



JACIE

Science Applications of High Resolution Imagery at the USGS EROS Data Center

November 8-10, 2004

**U.S. Department of the Interior
U.S. Geological Survey**

Michael Coan, SAIC
USGS EROS Data Center
coan@usgs.gov

USGS EROS Data Center Science Directorate is composed of many High-Resolution users-

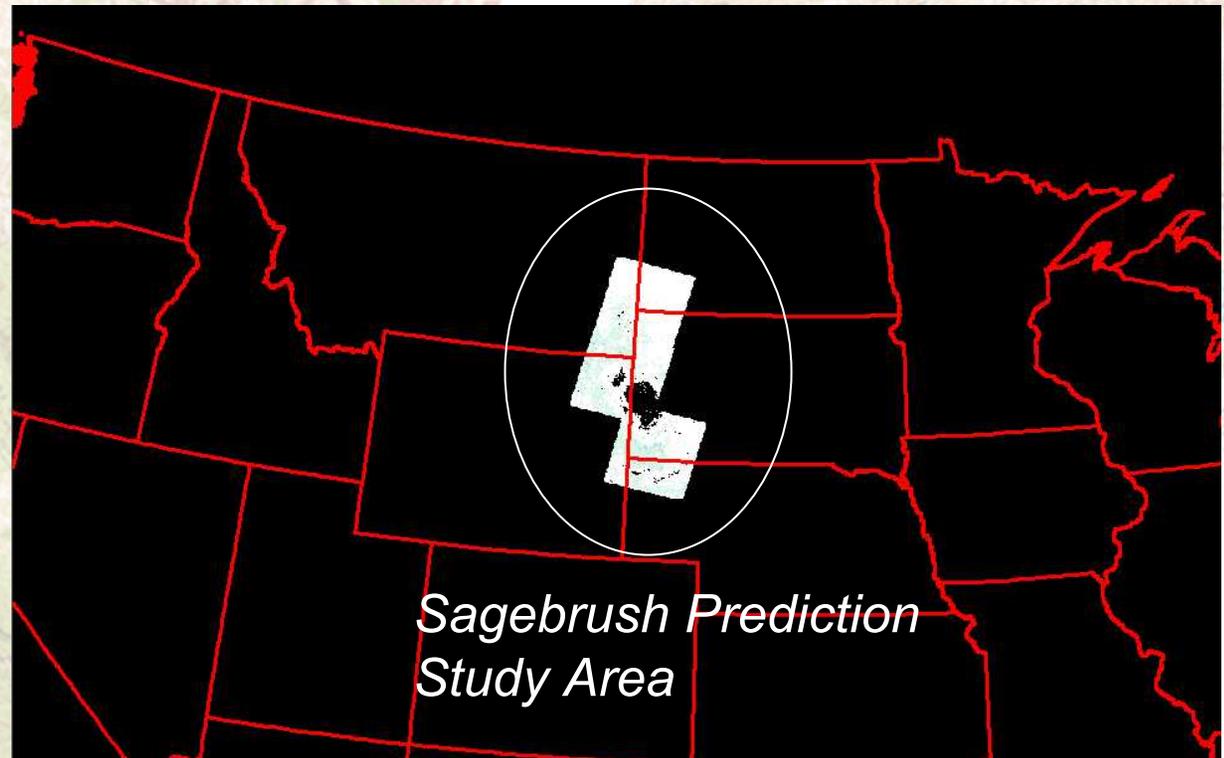
- **Land Cover Trends Project uses NHAP and NAPP (1:40K, 1:20K) along with DOQQs to interpret Landsat imagery, aiding in classifications**
- **Native American Project uses aerial photo products for forest inventory, new road and structure locations, range management, prairie dog town delineations (annual basis)**
- **Amphibian Habitat Project uses DOQQs to supplement fieldwork, to verify locations, identify potential habitat, verify models, and help interpret Landsat imagery**
- **National Land Cover Project uses all available sources (aerial photos, DOQQs, IKONOS, QuickBird, etc.) for computations of nation-wide percent-impervious surface and percent tree canopy estimation layers.**

USGS EROS Data Center (more users)-

- LandFire Project is investigating methods developed by NLCD for computing shrub coverage and structure in Western US.
- International Program's Sahel Project uses 5m Spot panchromatic, 1m color photomosaics, and 1960's era Corona film (pan, ~2 to 3m) in Senegal for community based forest management. The forty year span helps determine how much was lost or protected, as well as the amount of soil erosion, and the condition and density of the trees.
- Disaster Response Task Group works with FEMA, NASA, USGS, NOAA, ACE and other Federal, State, and local agencies. They use a variety of imagery, depending on type of disaster, the extent of damage, location, availability, and price. Currently there is no coordinated effort to collect consistent event based coverages for archives.

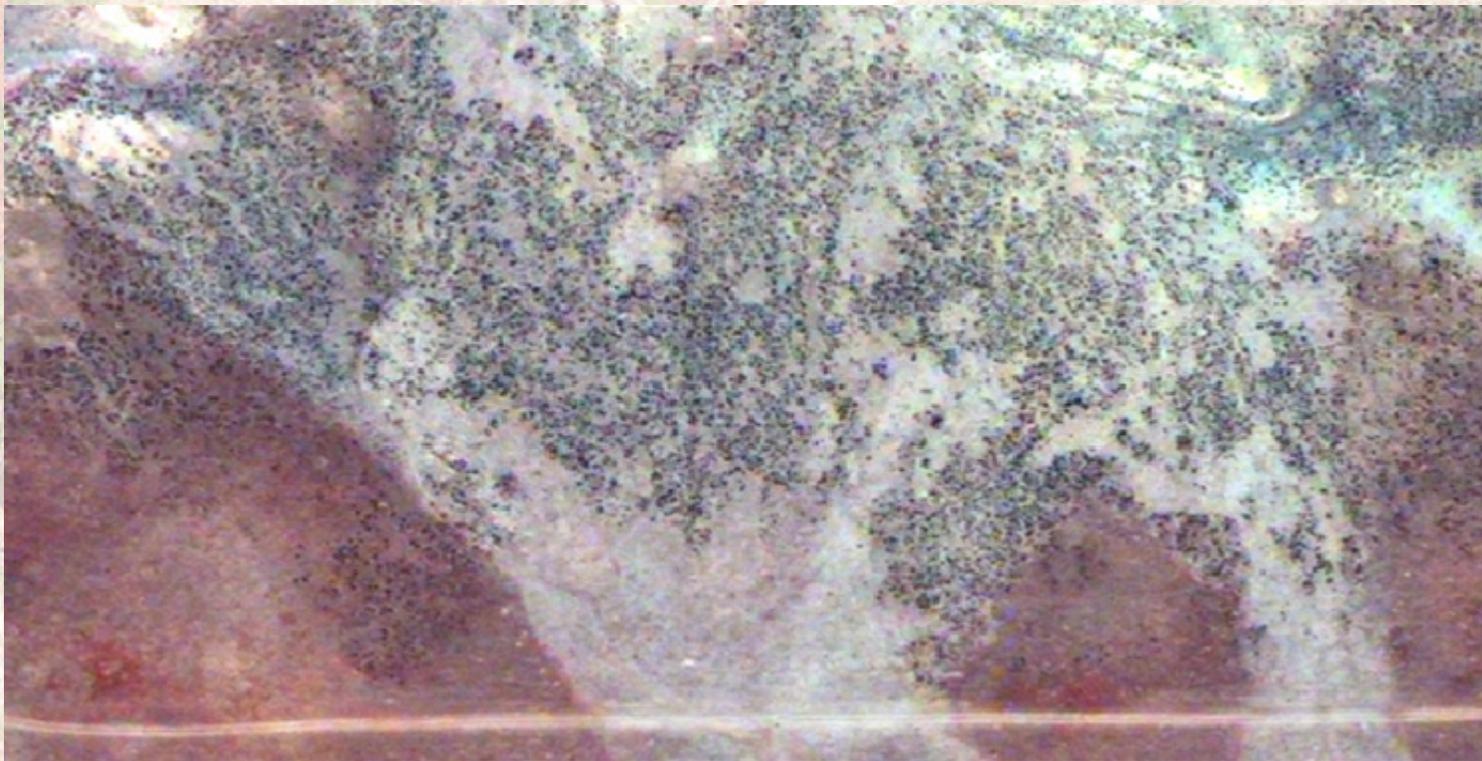
NLCD/LandFire - Sagebrush Research Example

- Western US contains large areas of sagebrush steppe
- Critical habitat for sage grouse
- Pilot area in Western Dakotas, Eastern Wyoming and Montana



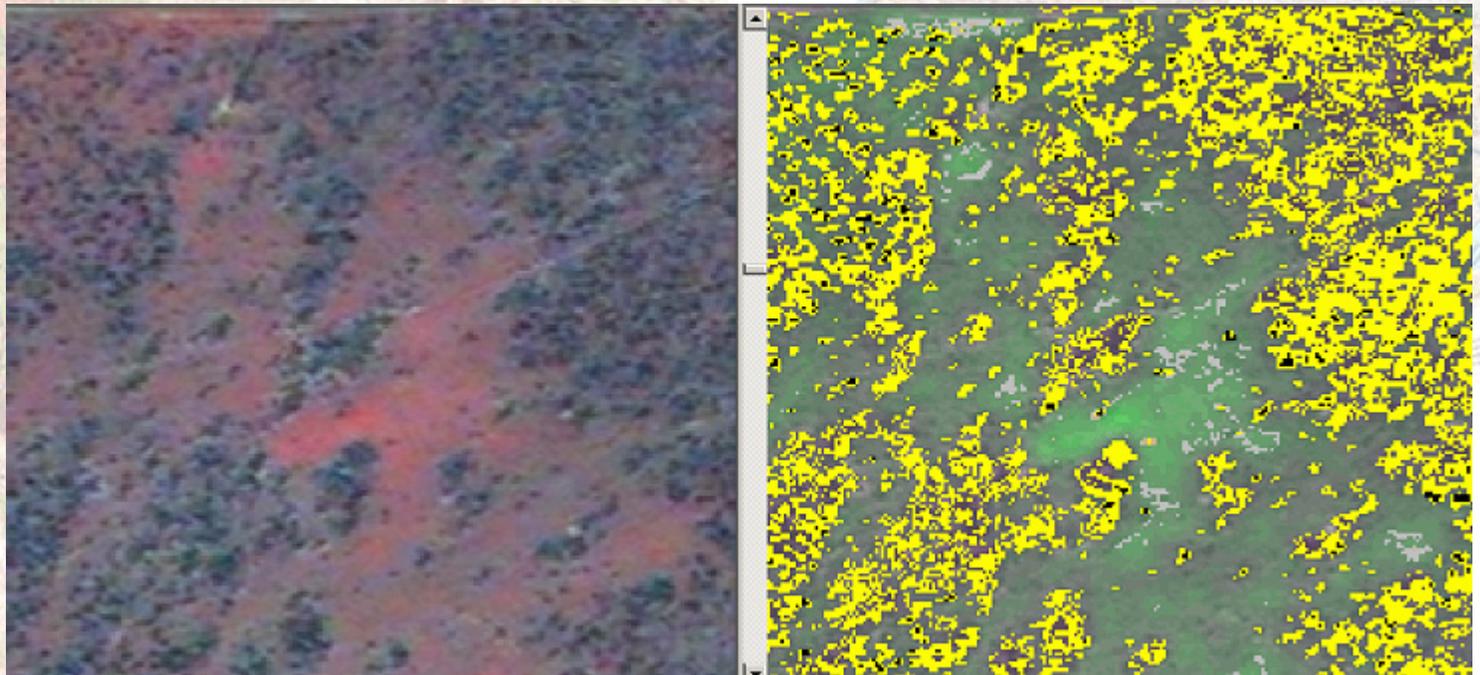
Sagebrush – QuickBird Pan-sharpened Multispectral Data

- Training data developed on 3 QuickBird scenes
- Pan-sharpened multispectral data allows sagebrush shrub clusters to be identified.



Sagebrush - Classifying at high resolution

- Supervised classification of imagery into sagebrush/not sagebrush (on right, sagebrush is yellow)
- Note- Could possibly be extended to herbaceous and barren classifications, too.



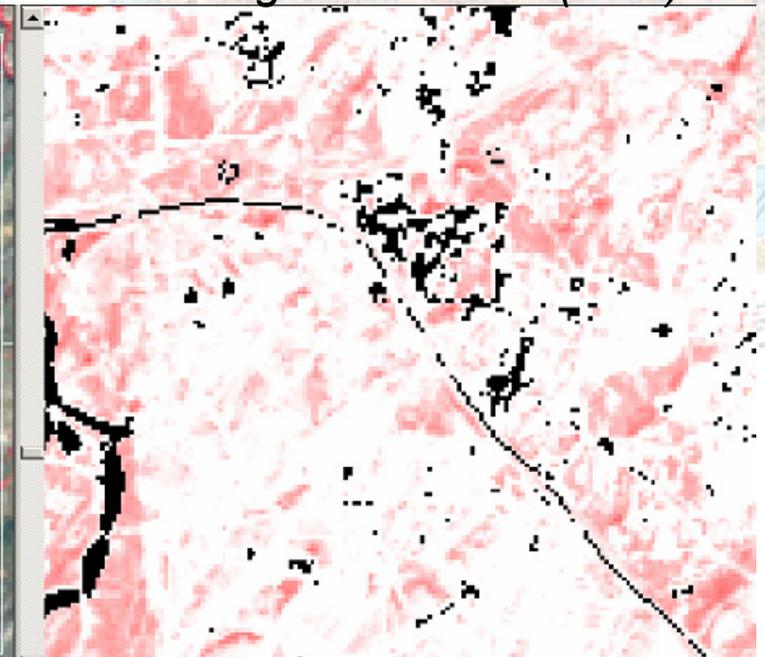
Sagebrush – Estimate Percentage at 30m resolution

- Classified high-resolution image is rescaled to 30m, to match the Landsat imagery.
- Values are determined by counting numbers of individual sagebrush-classified pixels in higher resolution in a 900m^2 neighborhood, and averaging those values for each 30m pixel.

LandSat (30m)



%Sage Estimation (30m)

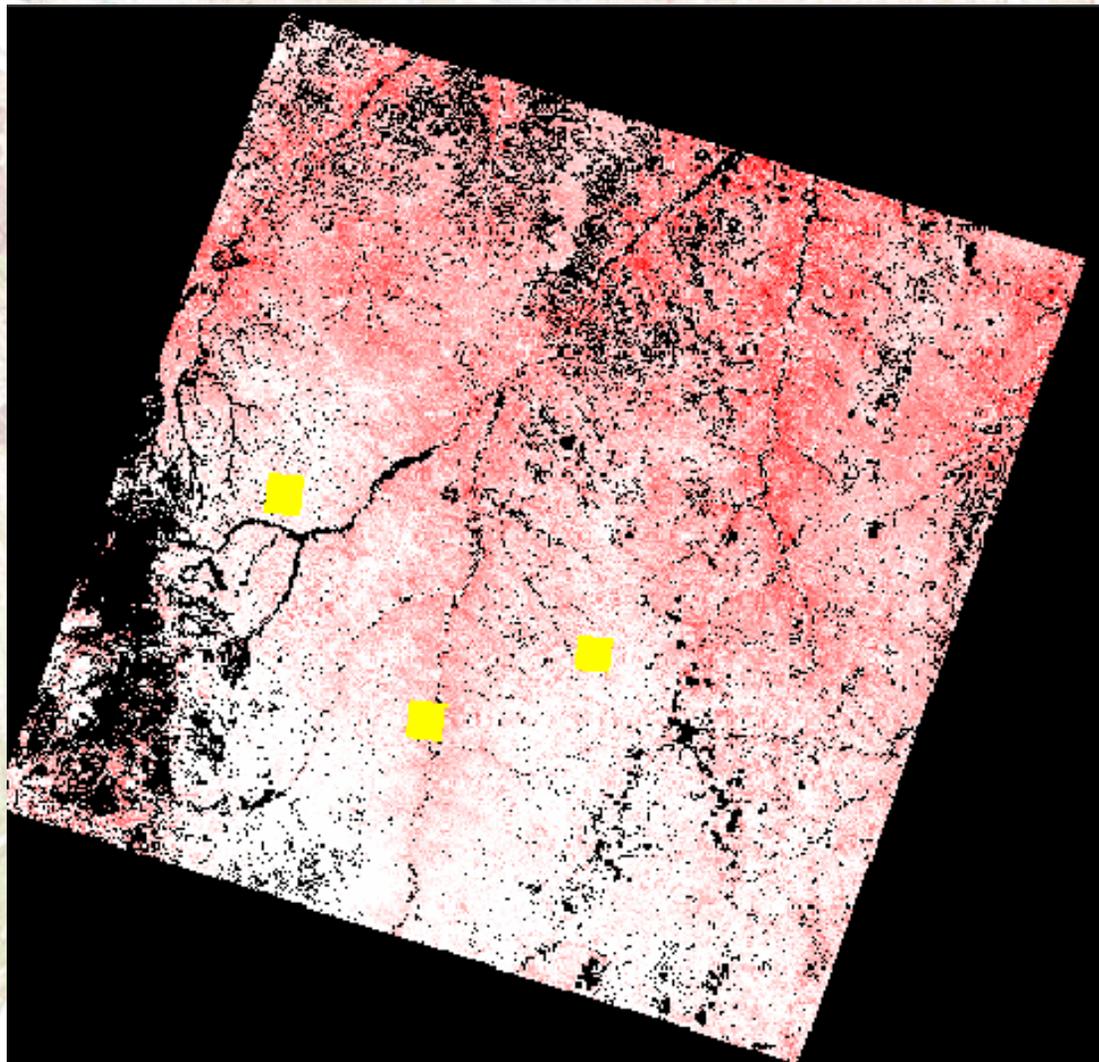


Sagebrush Estimation – Output at Landsat Image Scale

Estimations applied to
one Landsat scene
(~110 mi²)

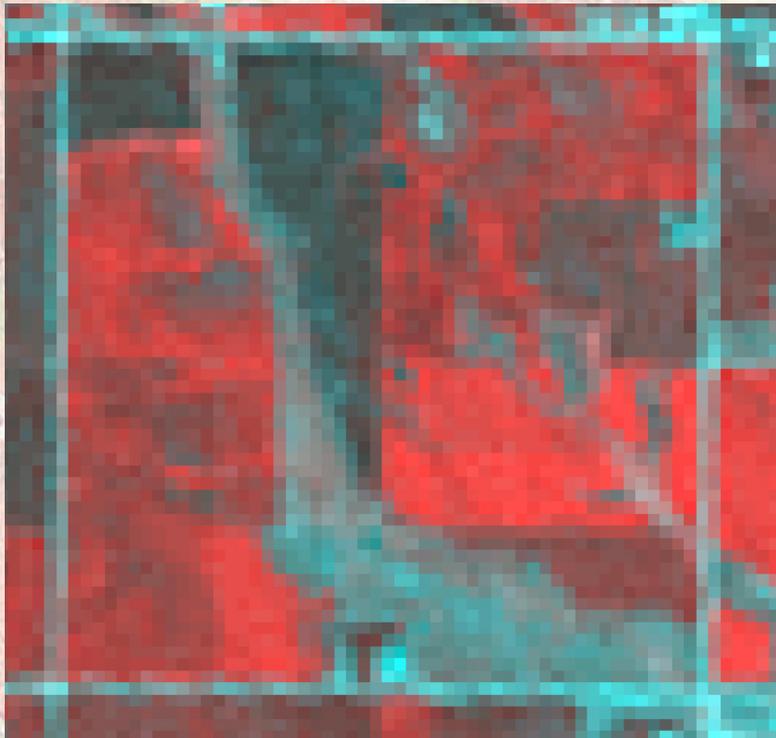
Pink to red are variations
in sagebrush density
(darker is more).

Three yellow chips are
the original QuickBird
training areas.

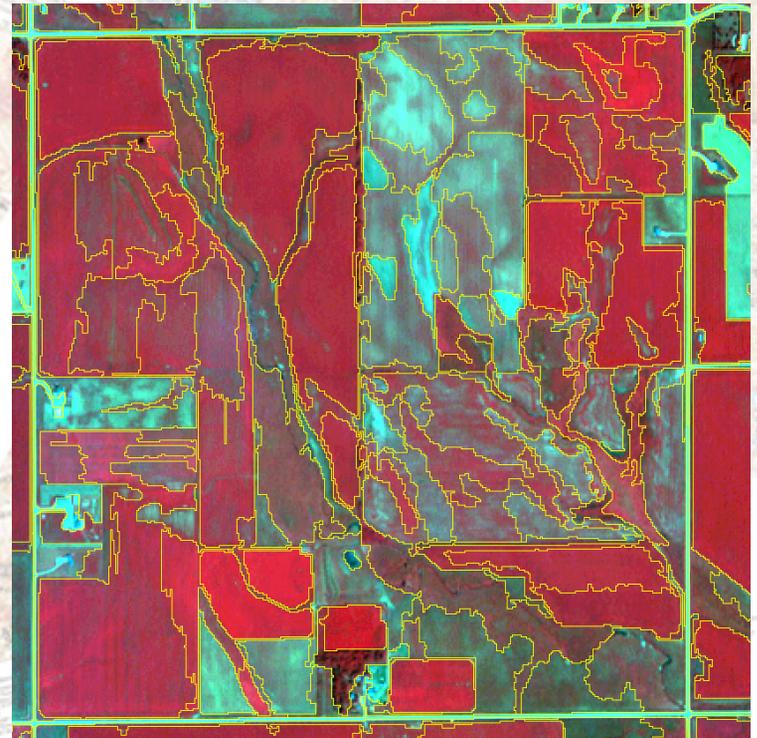


Comparison of 4m OrbView Multispectral to 30m Landsat

Segmented OrbView product displays obvious potential for riparian zone delineation, wildlife habitat characterization, soil type differentiation, cropland quality assessment, environmental monitoring, ...

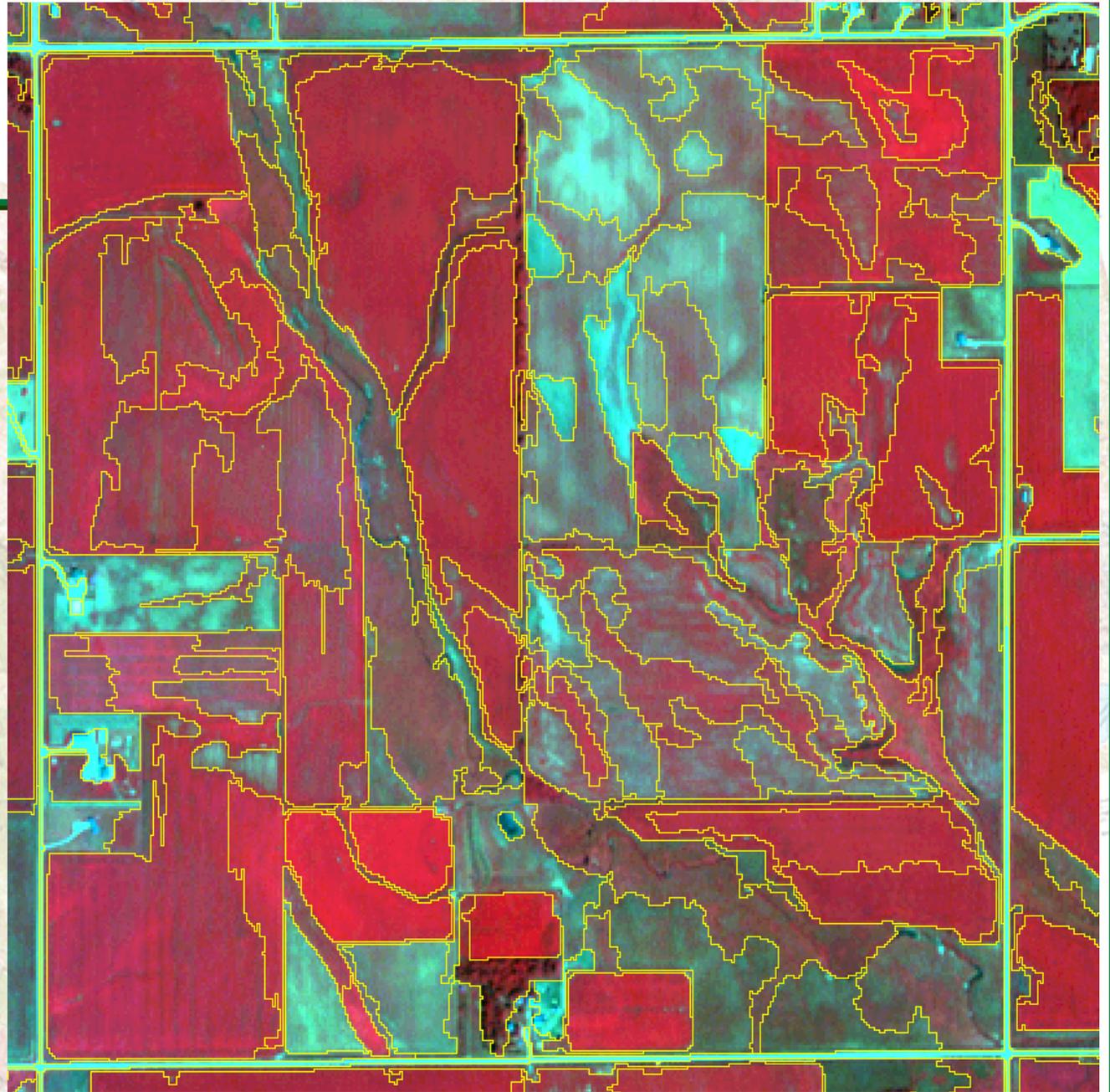


Landsat image (8/9/2000)



Orbview image (7/27/2004)

Segmented OrbView MS

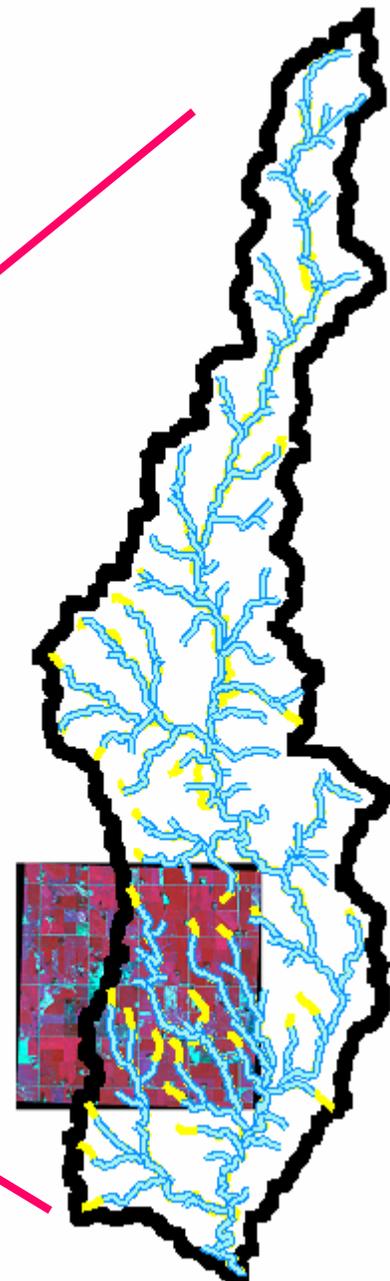
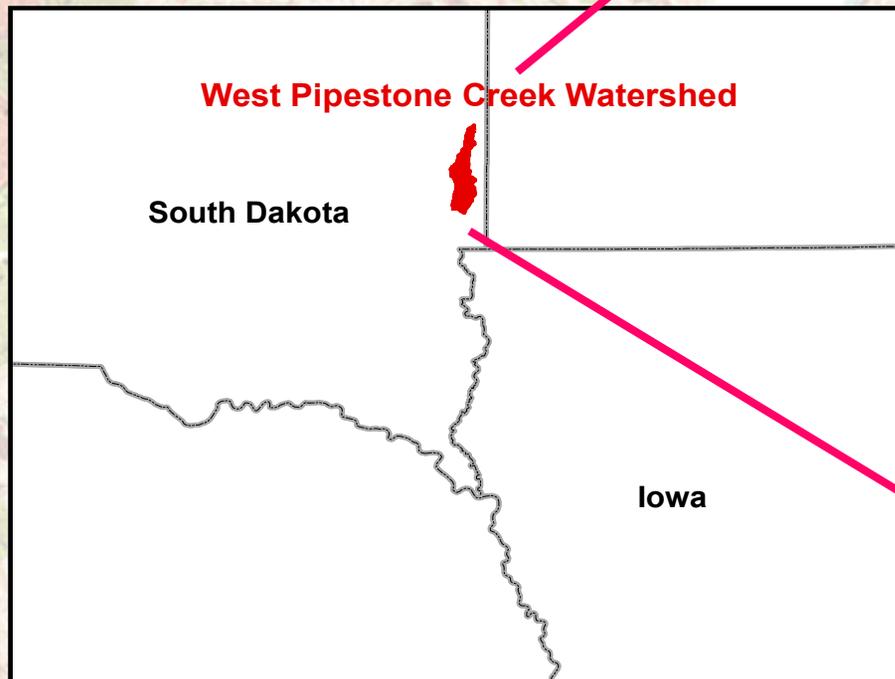


Topographic Program – Perennial/Intermittent Stream Classification Study

- **Regulations to protect water quality often depend on perennial and intermittent stream classifications shown on the USGS 1:24,000 (7.5 arc minute series) Quadrangle maps.**
- **Individual quadrangle maps may contain inconsistent stream classifications, or stream densities, from one quadrangle to another.**
- **The purpose of the Topographic Program's study is to predict where perennial and intermittent streams will occur. A consistent stream density is required for input to the modeling process.**
- **In this study, an OrbView 4m Multispectral image contributed to visual verification of a stream density modeling procedure.**

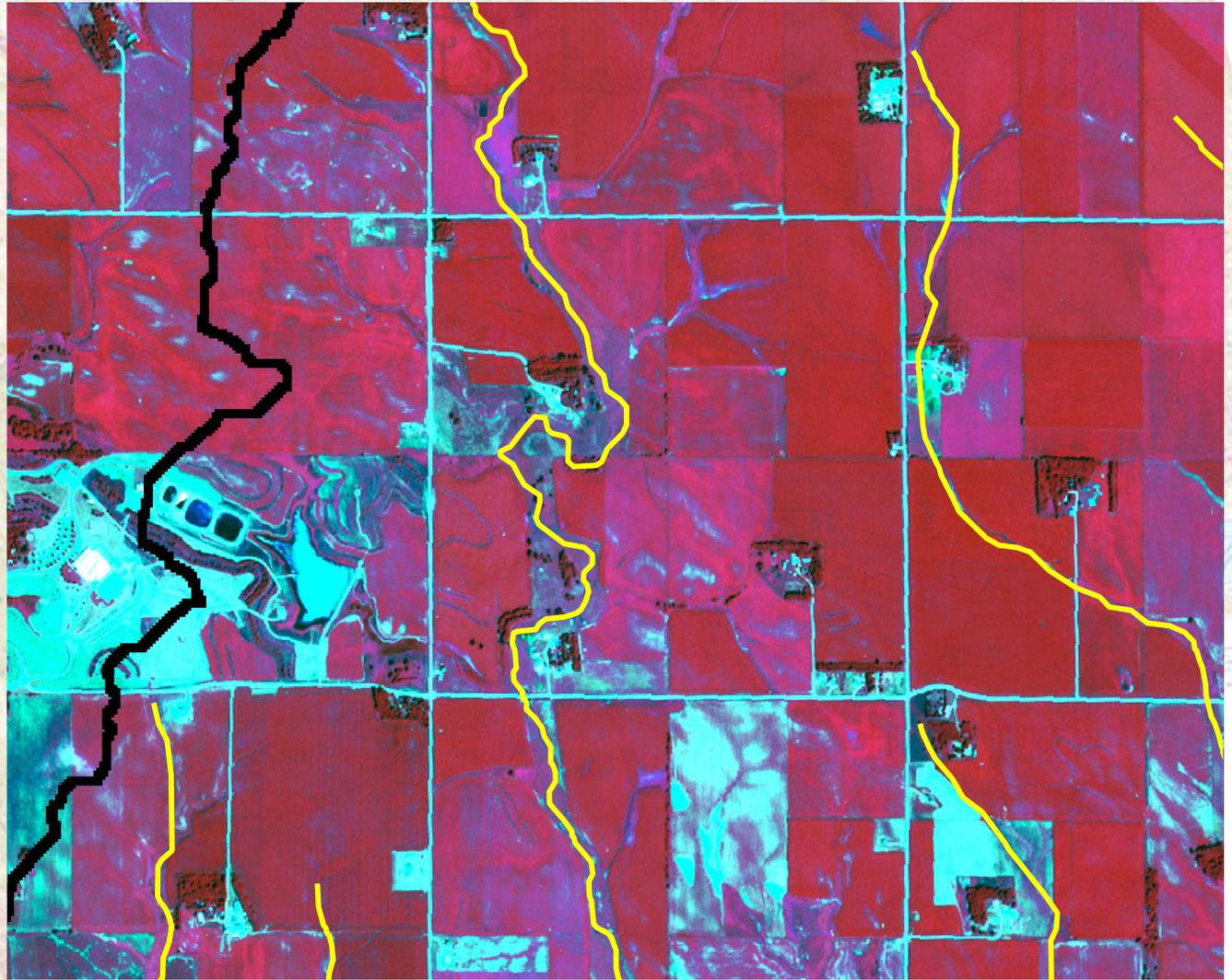
Topographic Program – Study Area

The study area is in a portion of the West Pipestone Creek Watershed, in Eastern South Dakota. This area was imaged by an OrbView MS product in July, 2004.



Topographic Program – Manually Digitized Streamlines

Manually digitized
1:24,000 USGS
stream lines
shown in yellow,
watershed
boundary in black.

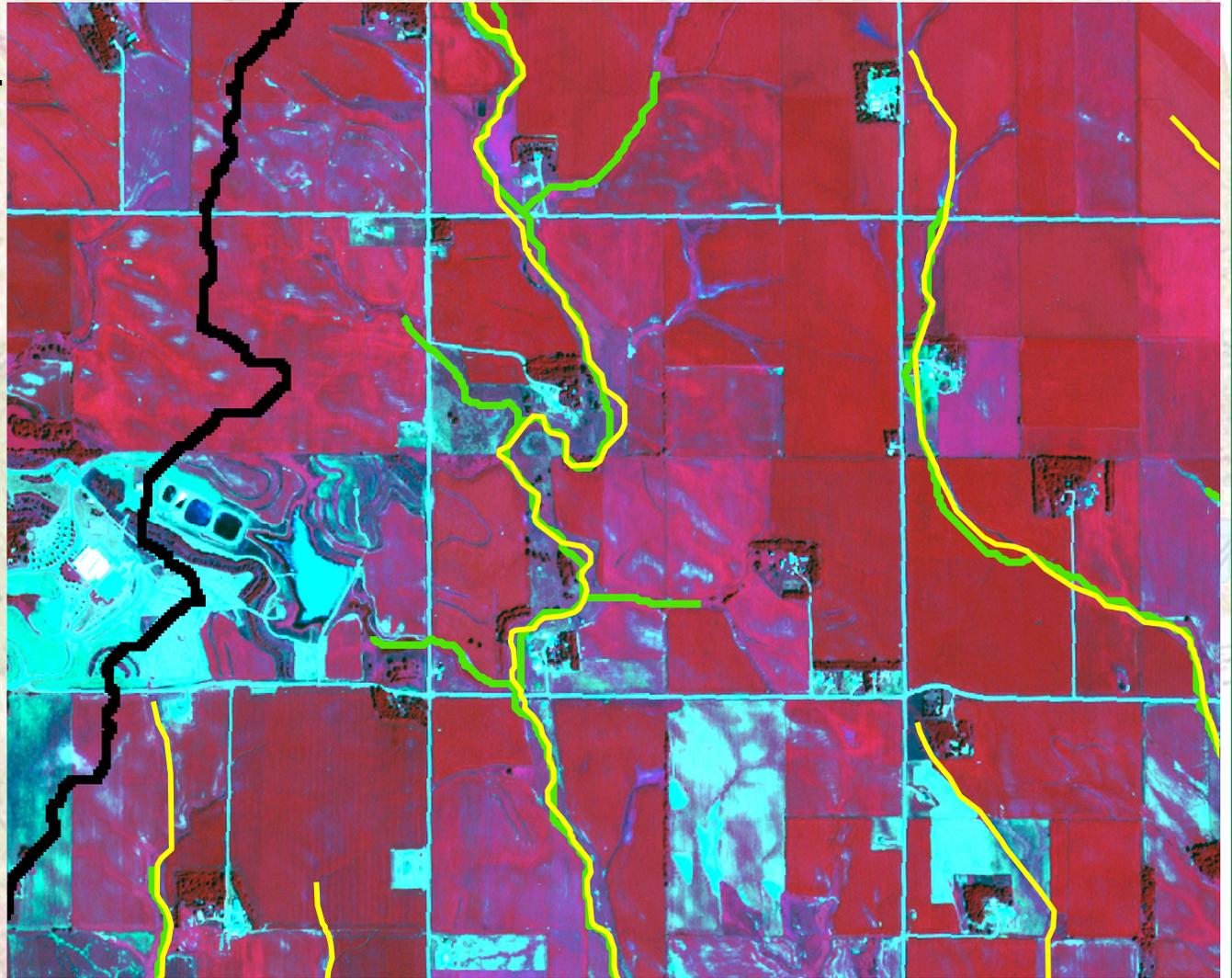


Topographic Program – Synthetic Streams

Synthetic flow lines, generated from a 10-meter Digital Elevation Model, are shown in green.

One of the settings used to generate synthetic streams is a basin threshold.

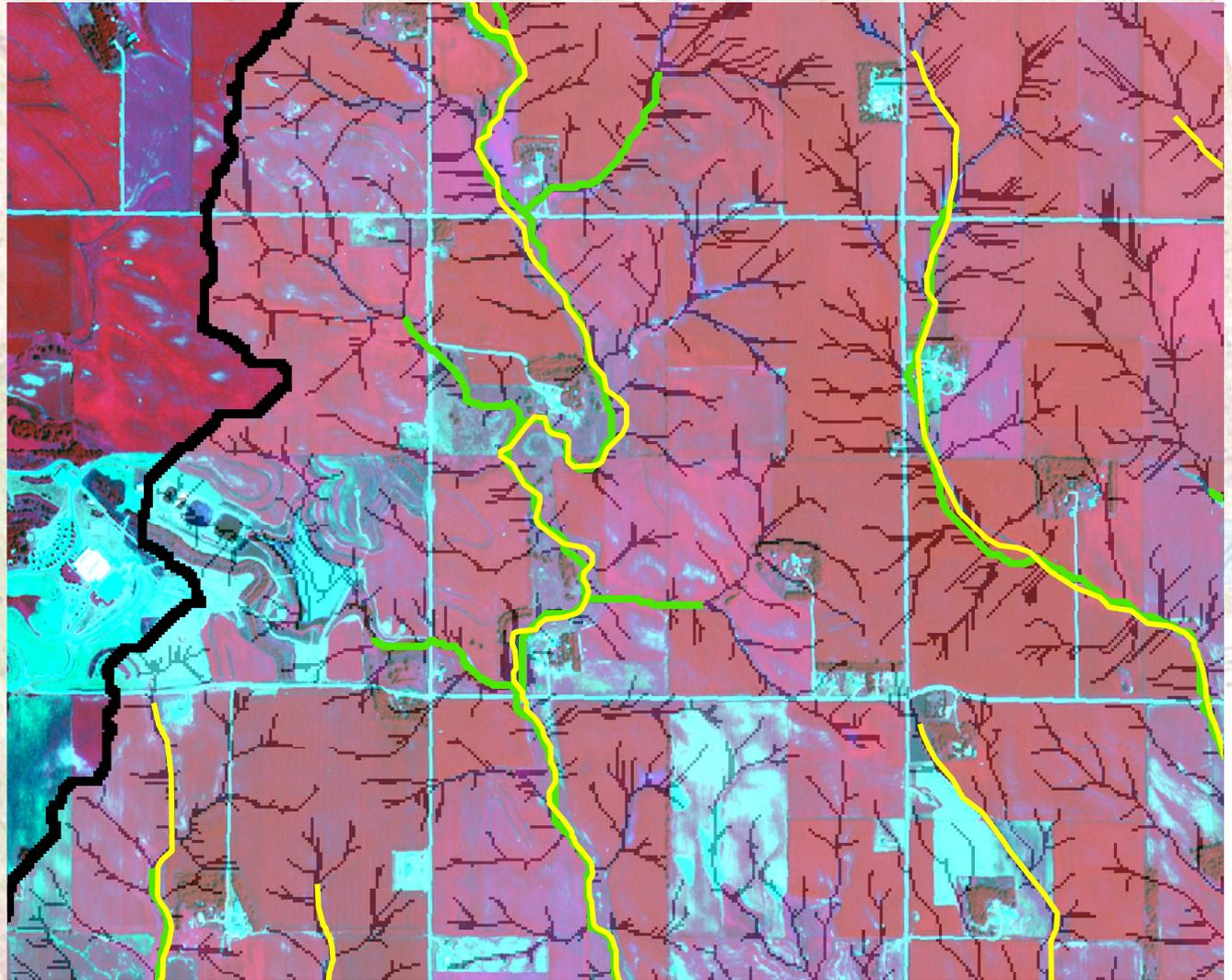
Here, a basin threshold of 2500 pixels was used.



Topographic Program – Varying the Stream Density

Model output with flow-accumulation set to 20 pixels.

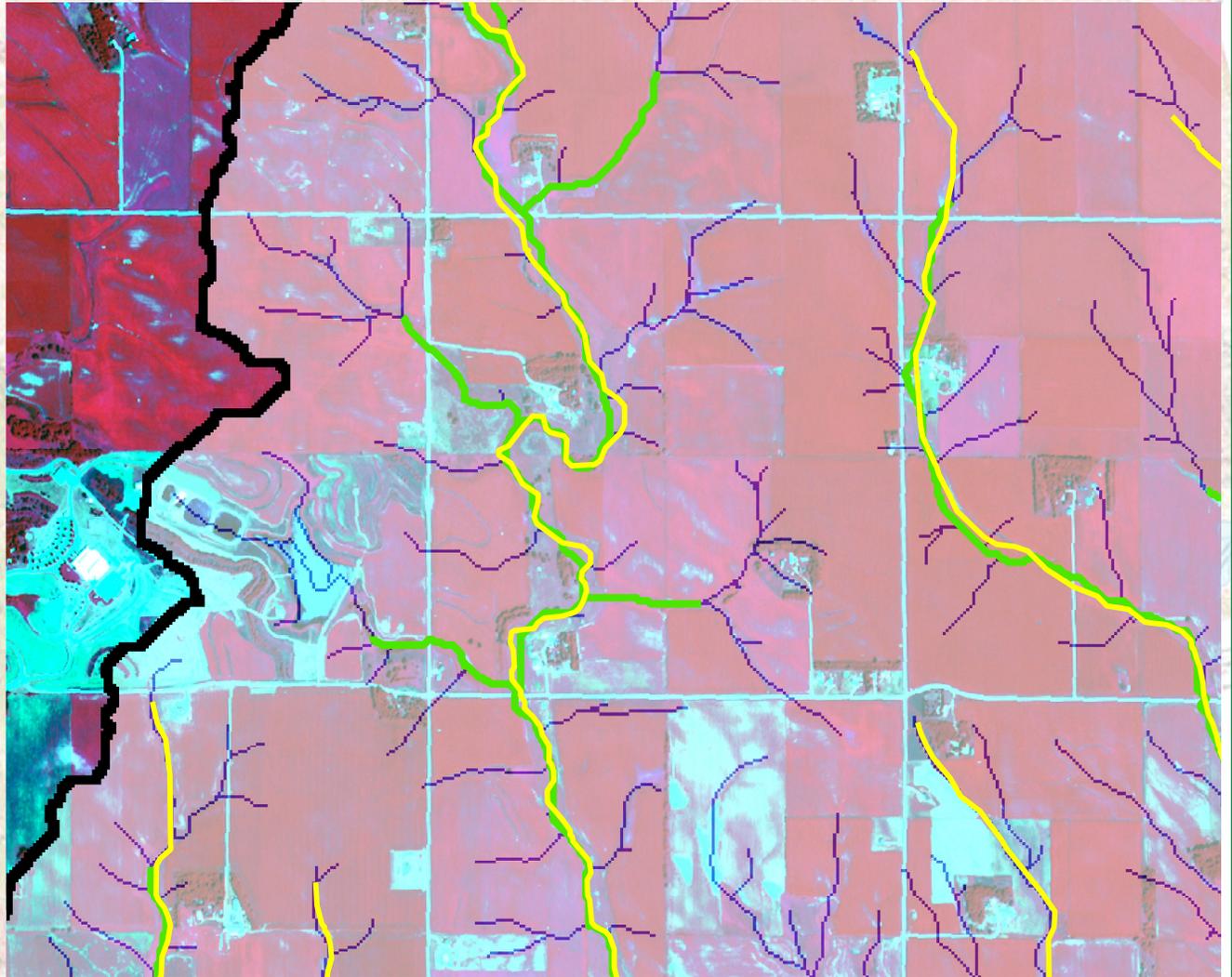
Resulting synthetic flow lines were too dense for this particular application.



Topographic Program – Another Stream Density

Here a threshold of 250 pixels was used.

The OrbView image helped validate that the synthetic streams were generated at a more appropriate density



USGS Science Links-

Land Cover Trends:

<http://landcover.usgs.gov/landcovertrends.asp>

Amphibian Habitat:

<http://edc2.usgs.gov/armi/nmd/>

National Land Cover:

<http://landcover.usgs.gov/nationallandcover.asp>

Fire Science:

<http://edc2.usgs.gov/fsp/index.asp>

International Program, Sahel Land Use:

<http://edcintl.cr.usgs.gov/sahel.html>

Topographic Research (Perennial/Intermittent/Ephemeral):

[http://gisdata.usgs.net/topographic/research/
Perennial intermittent ephemeral.pdf](http://gisdata.usgs.net/topographic/research/Perennial_intermittent_ephemeral.pdf)

Disaster Response:

[http://gisdata.usgs.net/website/Disaster Response/](http://gisdata.usgs.net/website/Disaster_Response/)