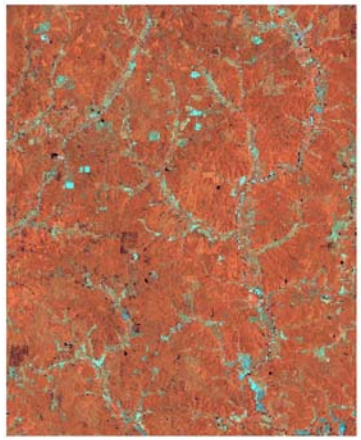
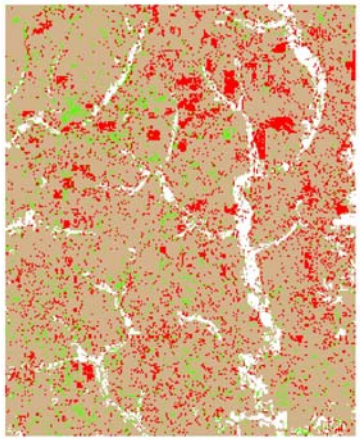
Using the Tasseled Cap Transformation to Identify Change in the Ozark, Boston, and Ouachita Mountain Forests





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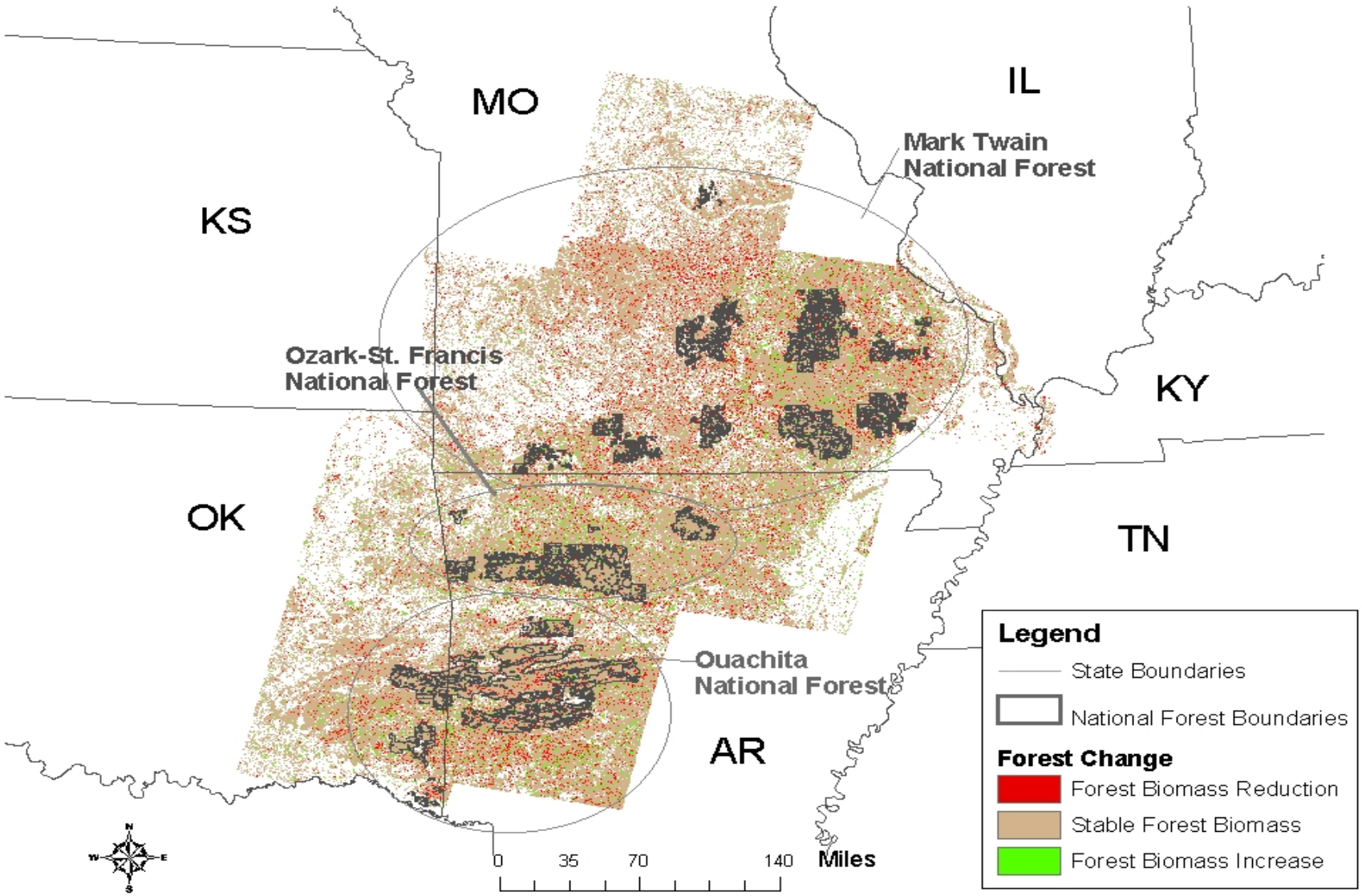
University of Missouri
Columbia, MO

[2]USDA Forest Service
Mark Twain National Forest
Rolla, Missouri

Forest Change Detection Using the Tasseled Cap Transformation

- **Goal**: To identify an easy and inexpensive technique to detect changes in forest biomass within the Ozark, Boston, and Ouachita Mountains.

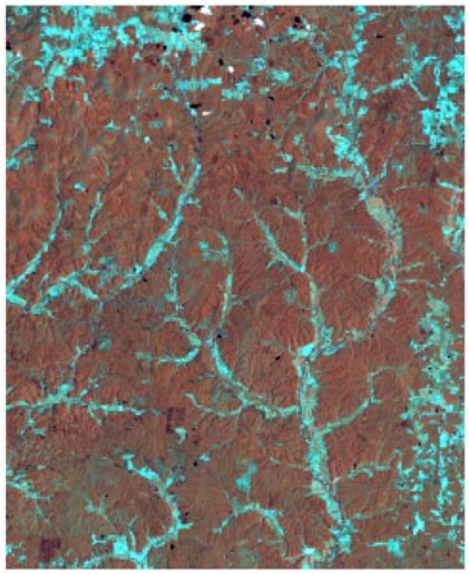
Study Area


MO
IL
KS
KY
OK
TN
AR
Mark Twain
National Forest
Ozark-St. Francis
National Forest
Ouachita
National Forest
0
35
70
140
Miles
Legend
State Boundaries
National Forest Boundaries
Forest Change
Forest Biomass Reduction
Stable Forest Biomass
Forest Biomass Increase

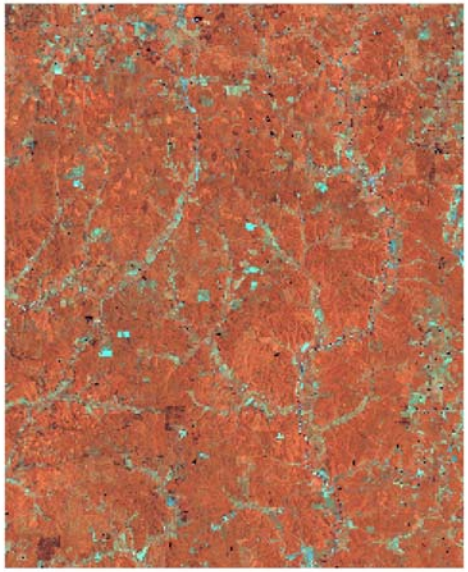
Technique

- Acquired Landsat TM data for three dates at a time step of approximately 2 years with similar anniversary dates (i.e. late August/early September 1996, 1998, 2000)

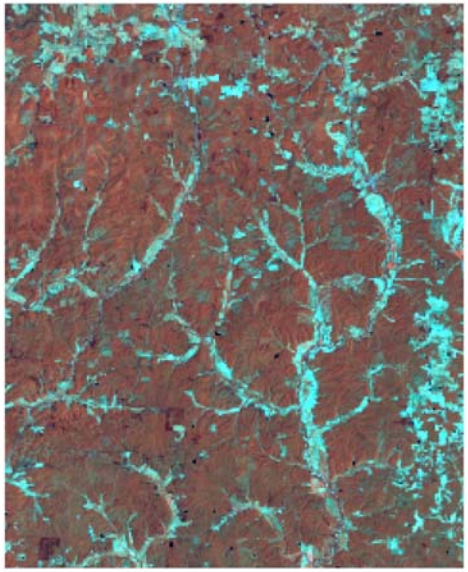
1996 TM Image



1998 TM Image



2000 TM Image



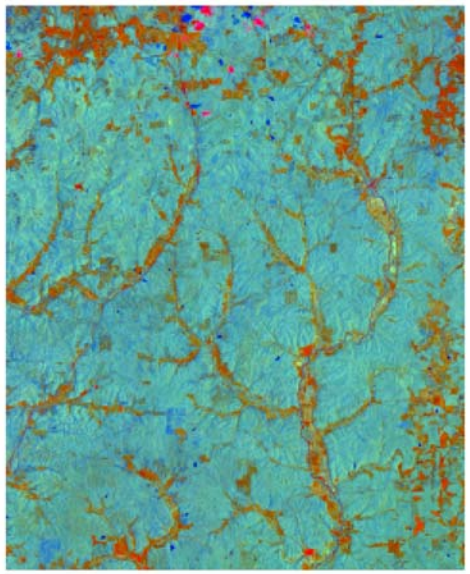
Technique

- Tasseled Cap (TC) transformation
  - Transforms 6 TM data channels to 3 data channels with known characteristics
    - Soil Brightness Channel
    - Vegetation Greenness Channel
    - Moisture Content of Soil/Vegetation (Wetness) Channel

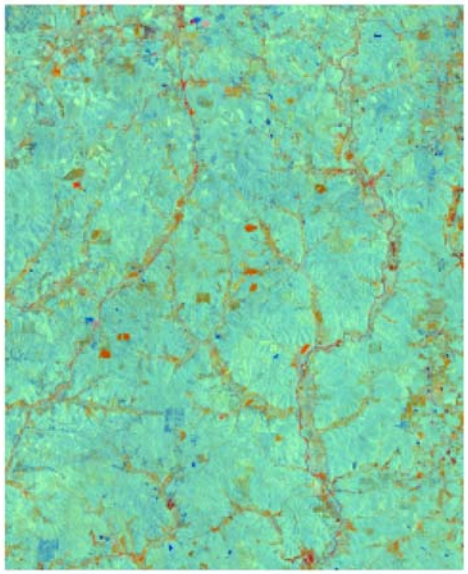
Technique

- Processed TM data using the Tasseled Cap transformation

1996 TC Image



1998 TC Image

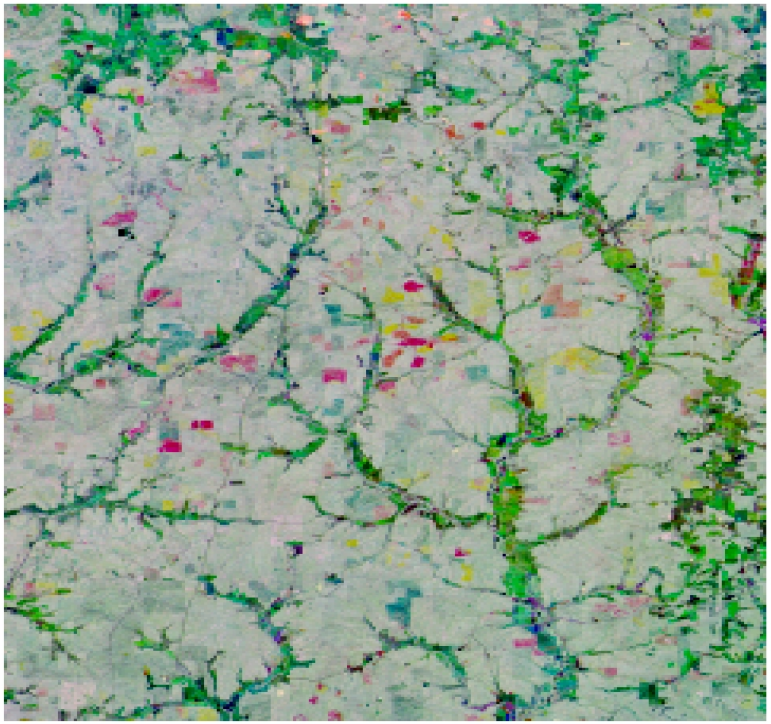


2000 TC Image

Technique

- Stacked all TC wetness bands to create a multitemporal "composite" wetness image

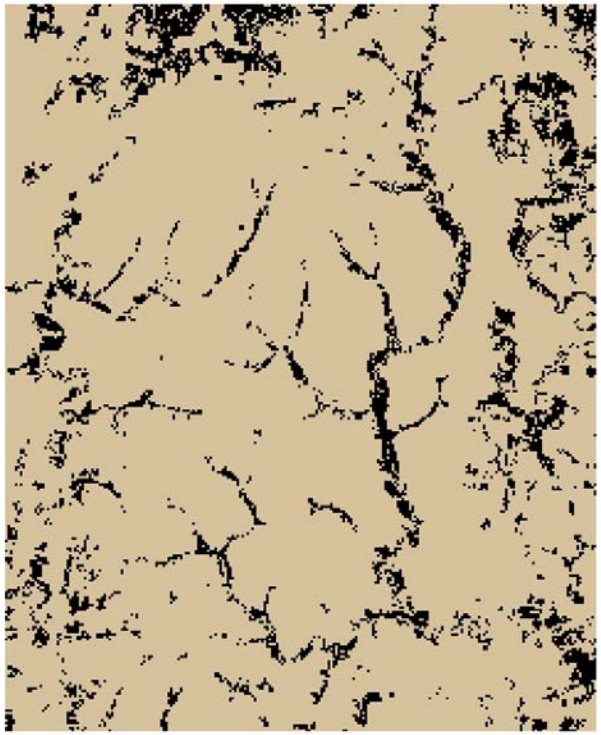
Tasseled Cap Wetness Composite



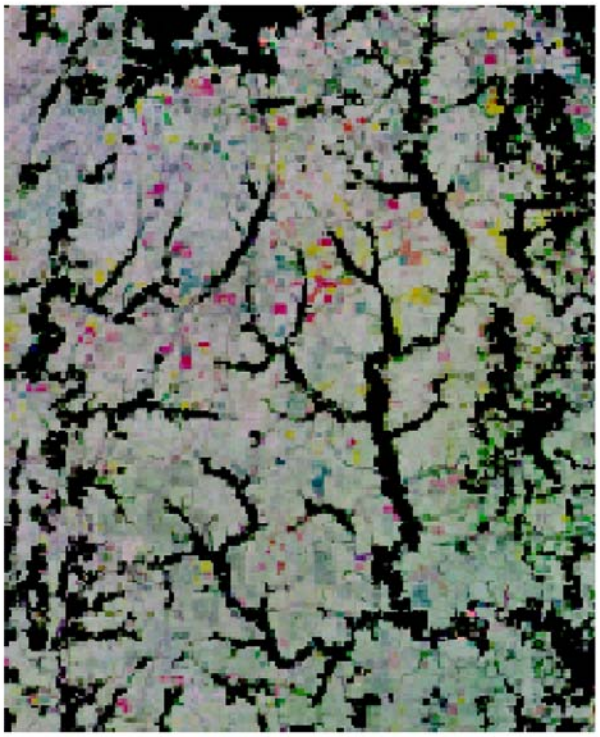
Technique

- Created forest only mask from multiple landcover datasets to include only forested areas

Forest Only Mask



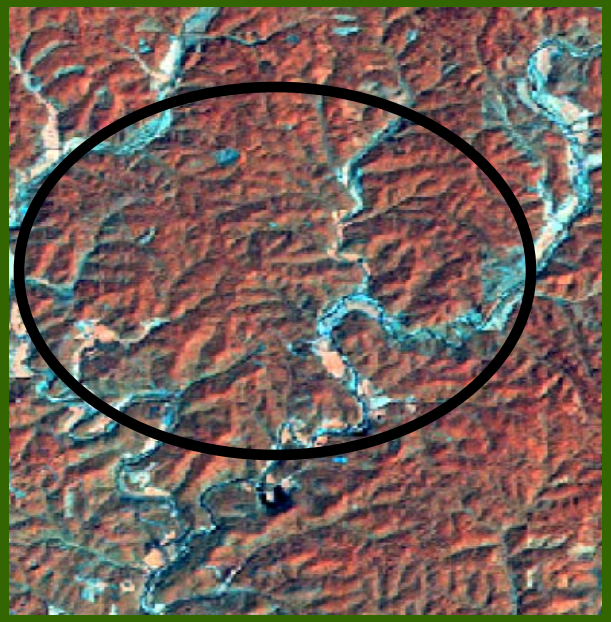
Masked Tasseled Cap Wetness Composite



Technique

- Unsupervised classification utilized to assign forest change classes on a scene by scene basis
  - Isodata clustering algorithm used to create 75 clusters
  - Visually assessed change (1996 to 2000)
  - Change Classes
    - **Forest Biomass Reduction**

1996

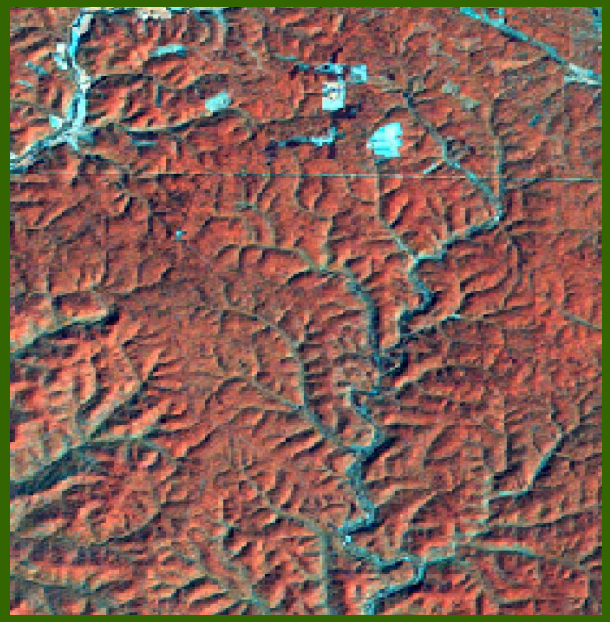


2000

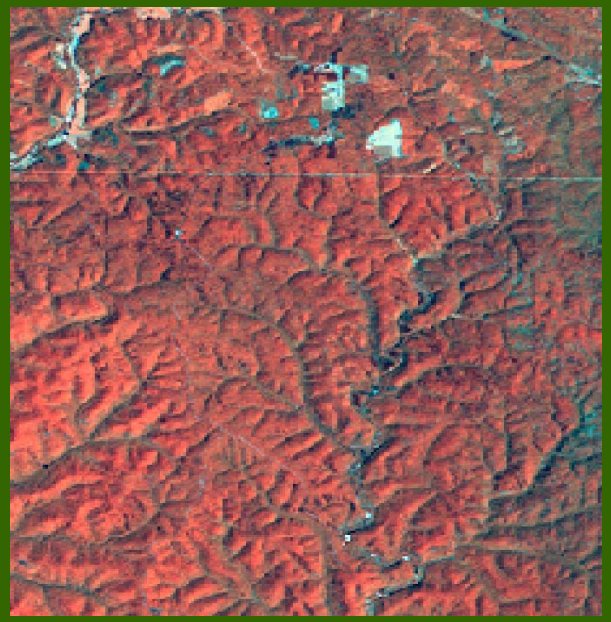
Technique

- Unsupervised classification utilized to assign forest change classes on a scene by scene basis
  - Isodata clustering algorithm used to create 75 clusters
  - Visually assessed change (1996 to 2000)
  - Change Classes
    - **Stable Forest Biomass**

1996



2000

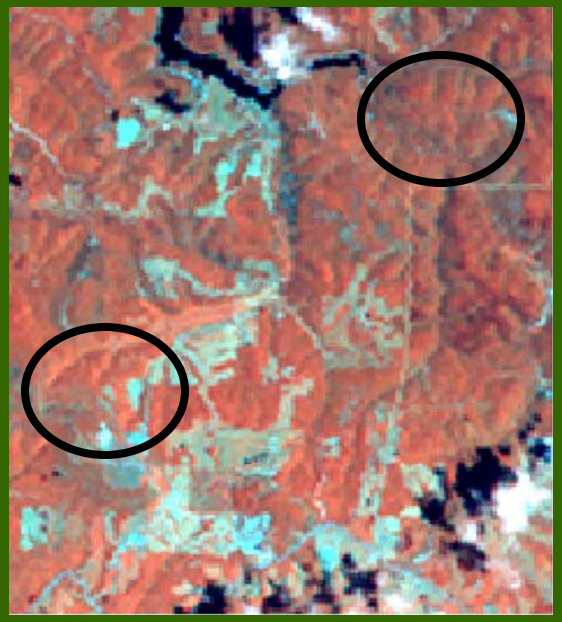


Technique

- Unsupervised classification utilized to assign forest change classes on a scene by scene basis
  - Isodata clustering algorithm used to create 75 clusters
  - Visually assessed change (1996 to 2000)
  - Change Classes
    - **Forest Biomass Increase**

1996

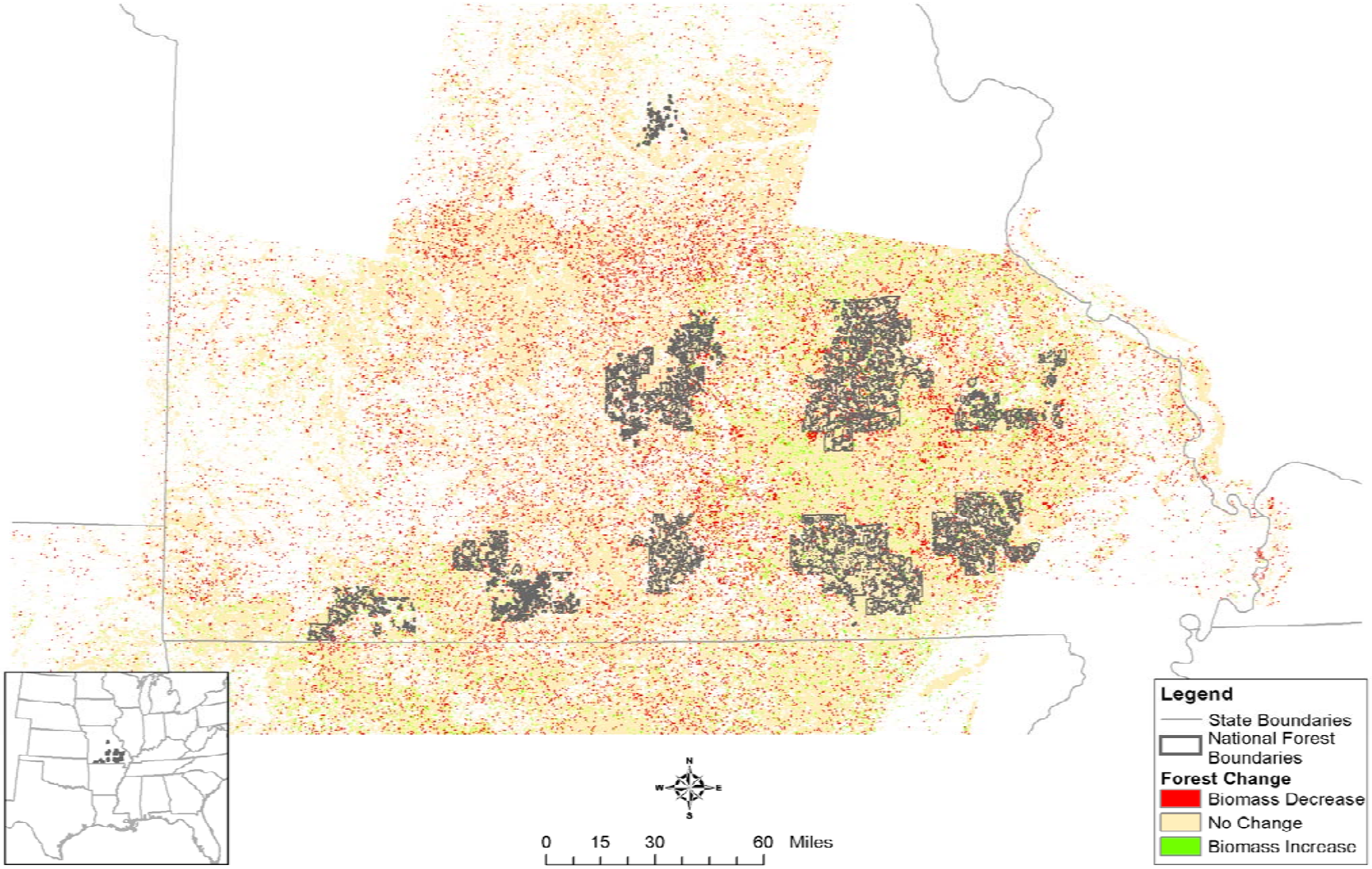
2000



Forest Change Validation

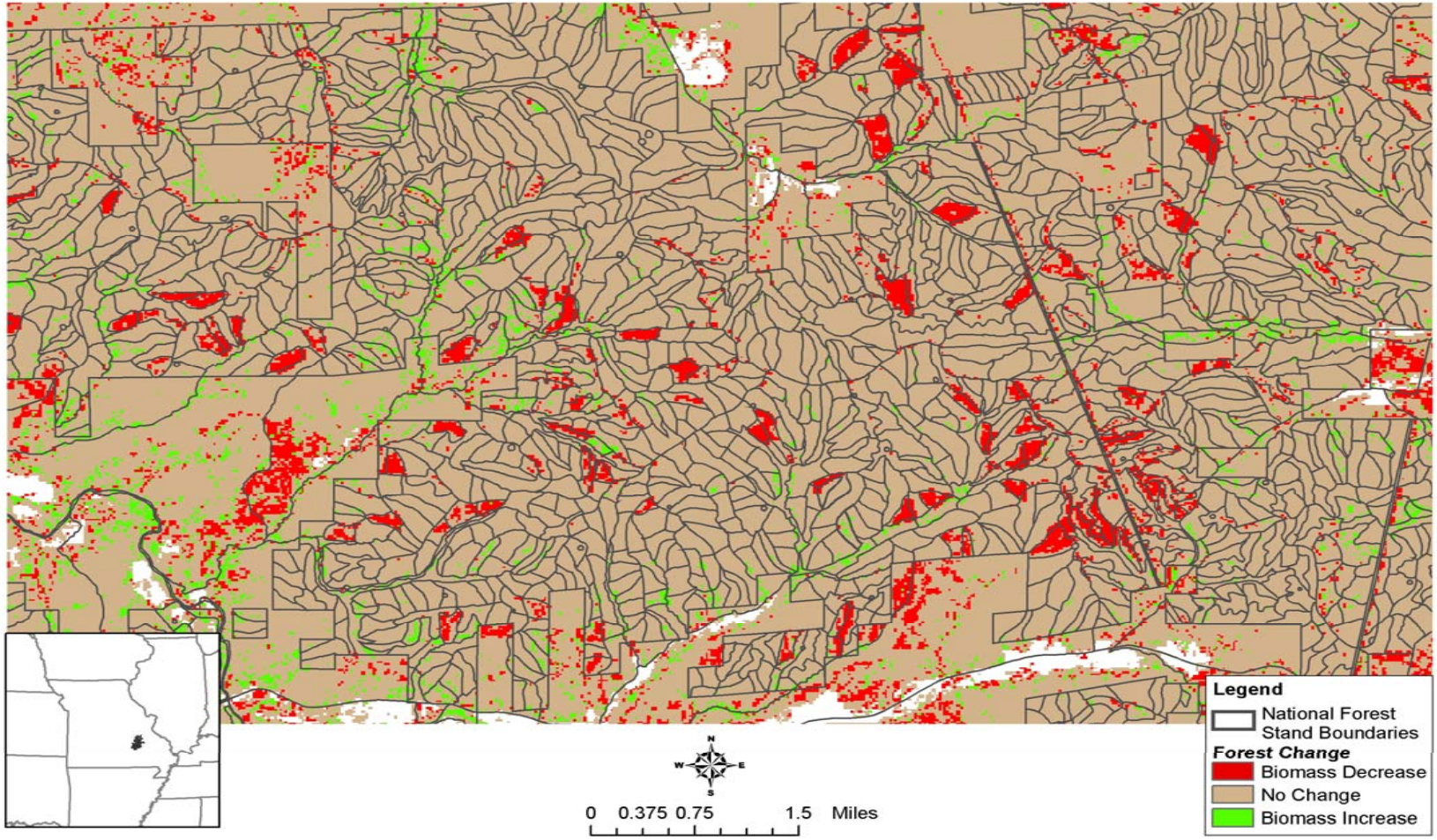
- Validation performed on MTNF stands only
- Mark Twain National Forest Stand Management database used to find % co-occurrence
- Stand management data divided into 3 classes based on nature and extent of activity
  - Regeneration Cuts
  - Intermediate Cuts
  - Salvage Cuts

Mark Twain
National Forest Service Lands



Forest Change Validation

- Stand management data intersected with change detection data

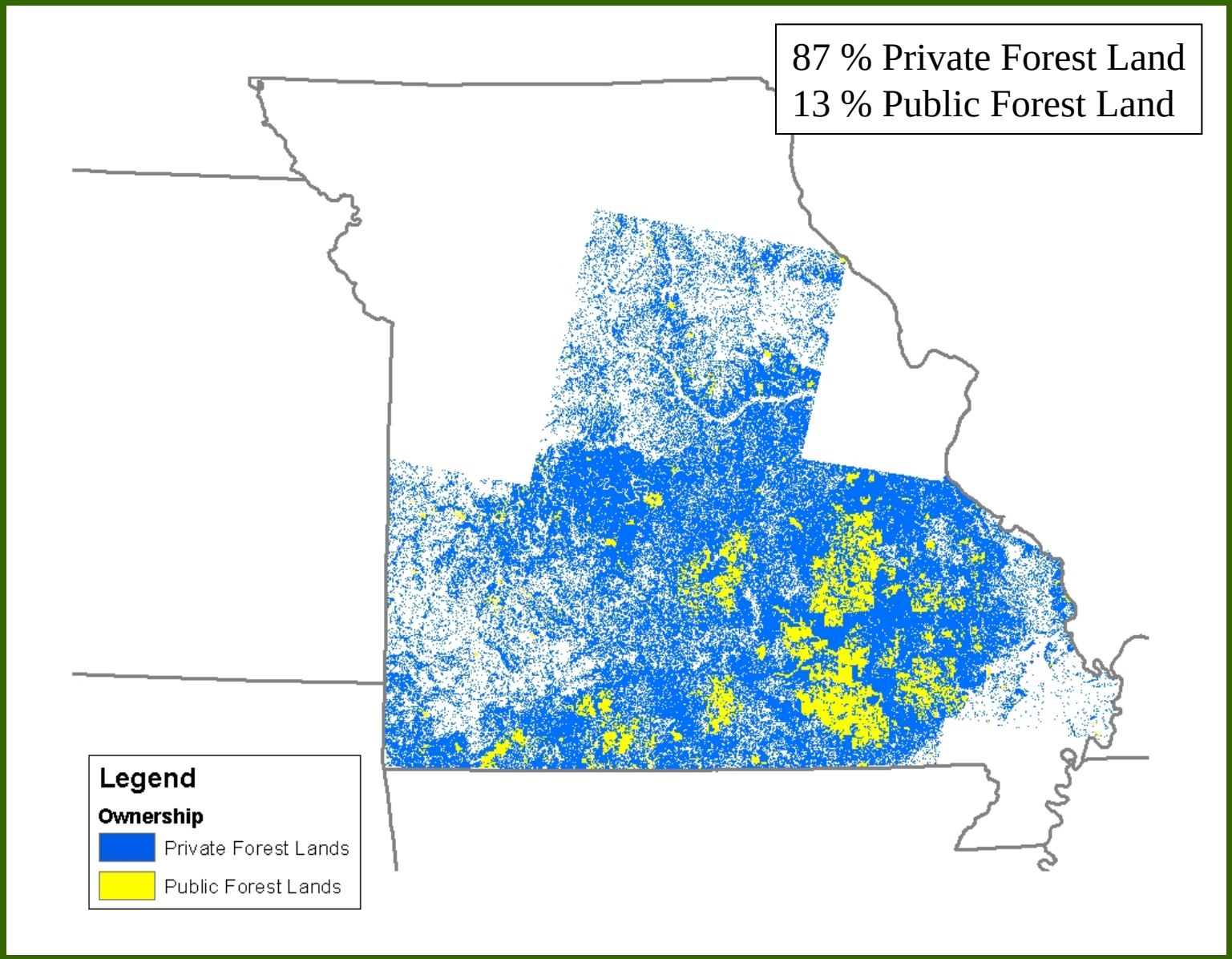


Co-occurrence Summary

- Co-occurrence of Forest Biomass change within MTNF between 1996-2000

	Biomass Reduction
Overall	75.3 %
Regeneration Cuts	90.3 %
Intermediate Cuts	75.0 %
Salvage Cuts	71.4 %

Private and Public Forest Lands In Missouri



Forest Change by Ownership Summary

- Annual Rate of Biomass Reduction 1996-2000 within Missouri
  - Private Forest Land 2.24 %/year 328,867 acres/year
  - Public Forest Land 0.99 %/year 21,722 acres/year

- Annual Rate of Biomass Increase 1996-2000 within Missouri
  - Private Forest Land .77 %/year 112,160 acres/year
  - Public Forest Land .77 %/year 16,919 acres/year

Conclusion

- This technique allowed for detection of forest change within the deciduous Oak/Hickory forest of Southern Missouri

- This technique was capable of detecting forest change at multiple spatial extents, including relatively fine scale changes (Salvage and Intermediate Cuts)

Continuing Assessment

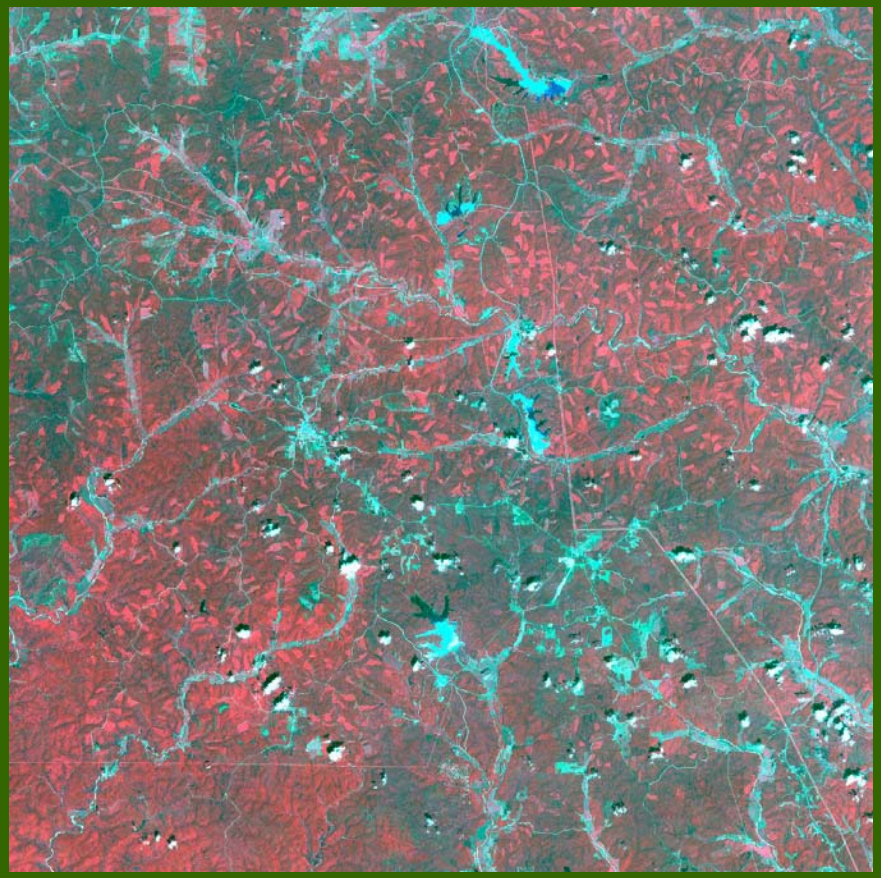
- Continuing to obtain imagery
  - Landsat ETM+ - 2002
  - Aster
- Compare change detection using different types of imagery
- Weigh potential of using Aster imagery for future forest change detection

Aster Tasseled Cap Forest Change Detection

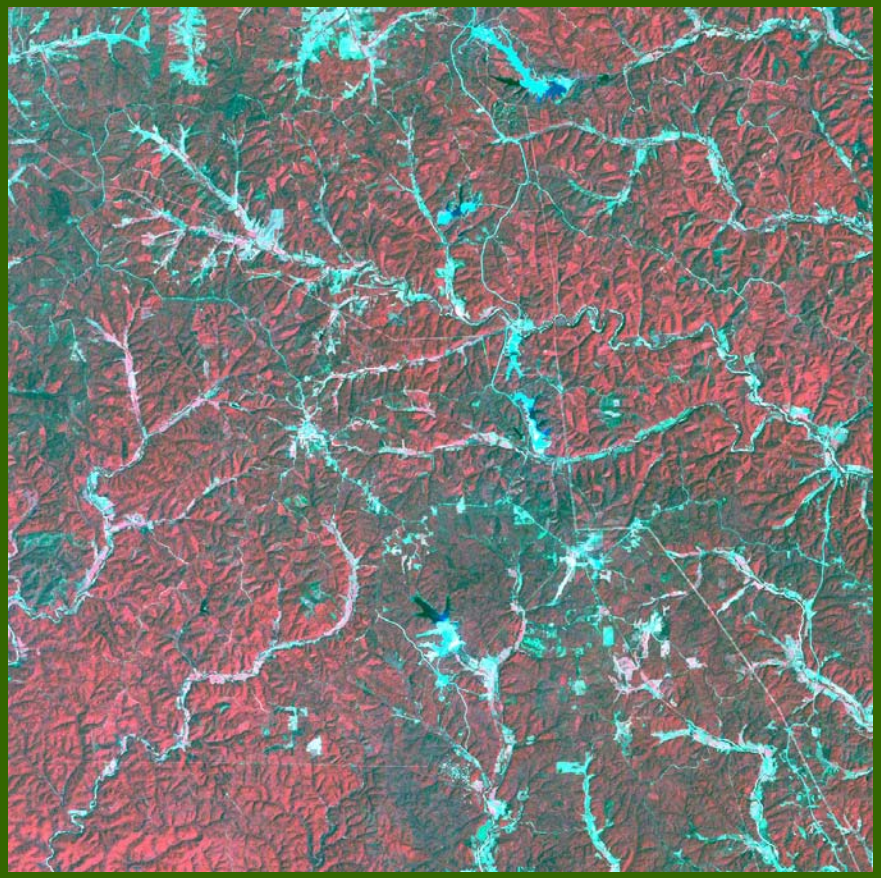
- Comparable alternative to Landsat during SLC-Off period
- Modified Aster spectral bands to fit Landsat TM Tasseled Cap coefficients
- Need modified Tasseled Cap coefficients to fit Aster spectral bands
  - Currently in progress at USDA Remote Sensing Applications Center in Salt Lake City, UT
  - Yarbrough, Easson, and Kuszmaul – University of Mississippi Geoinformatics Center

Aster vs. Landsat

Modified Aster 2000

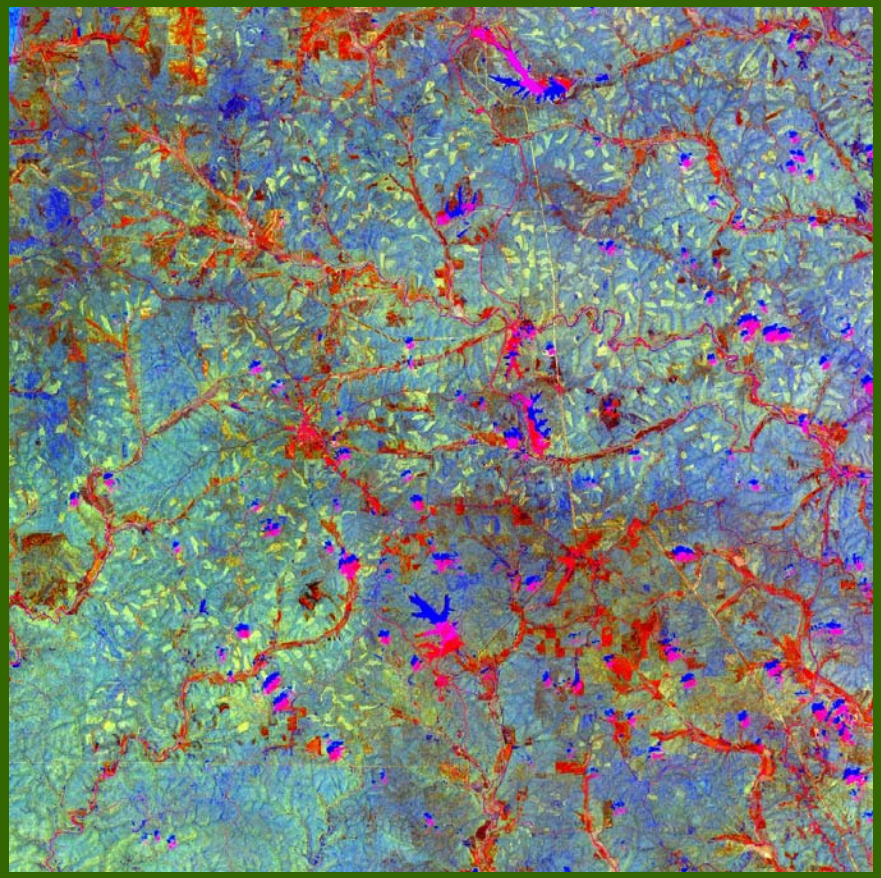


Landsat TM 2000

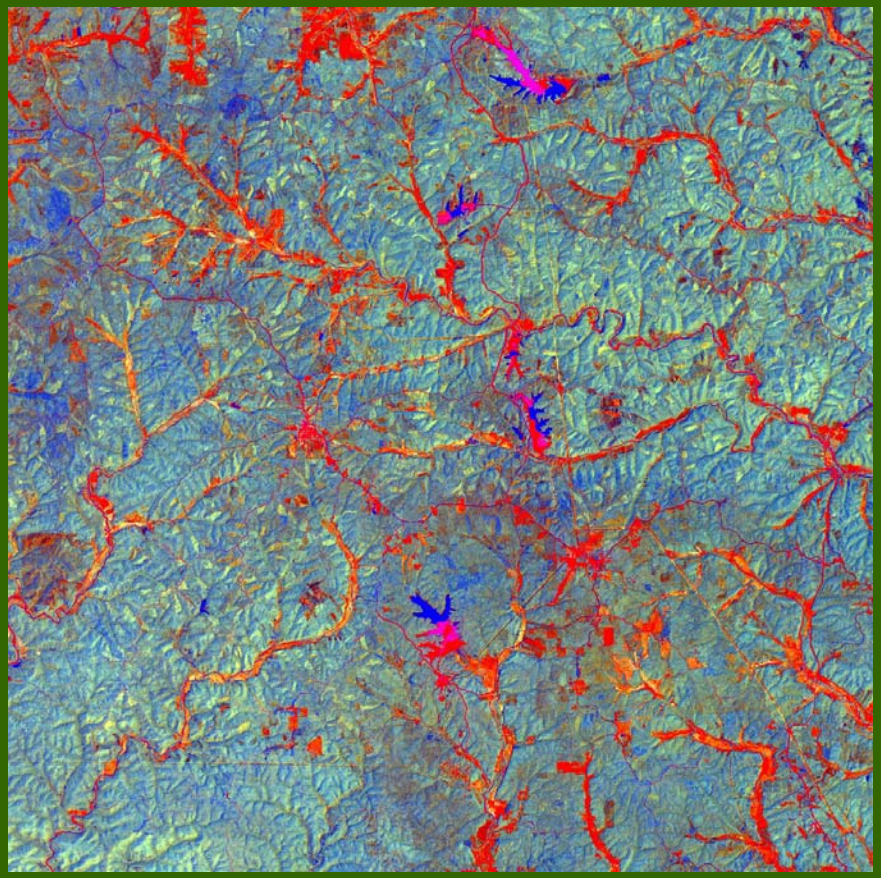


Aster vs. Landsat

Modified Aster TC 2000

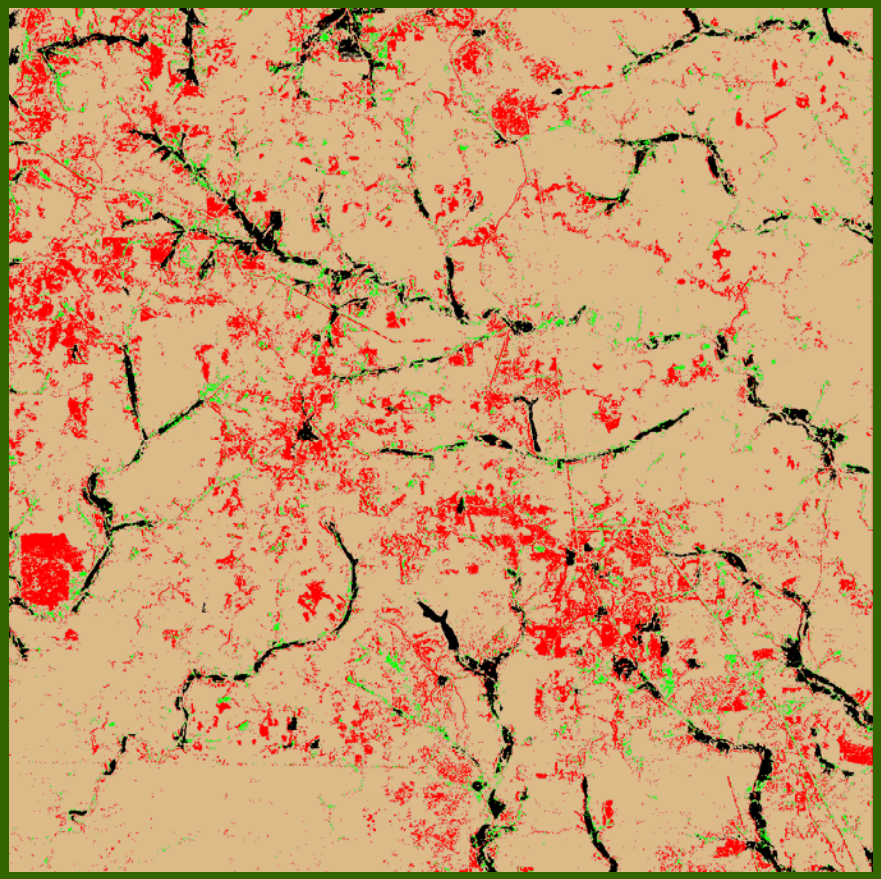


Landsat TM TC 2000

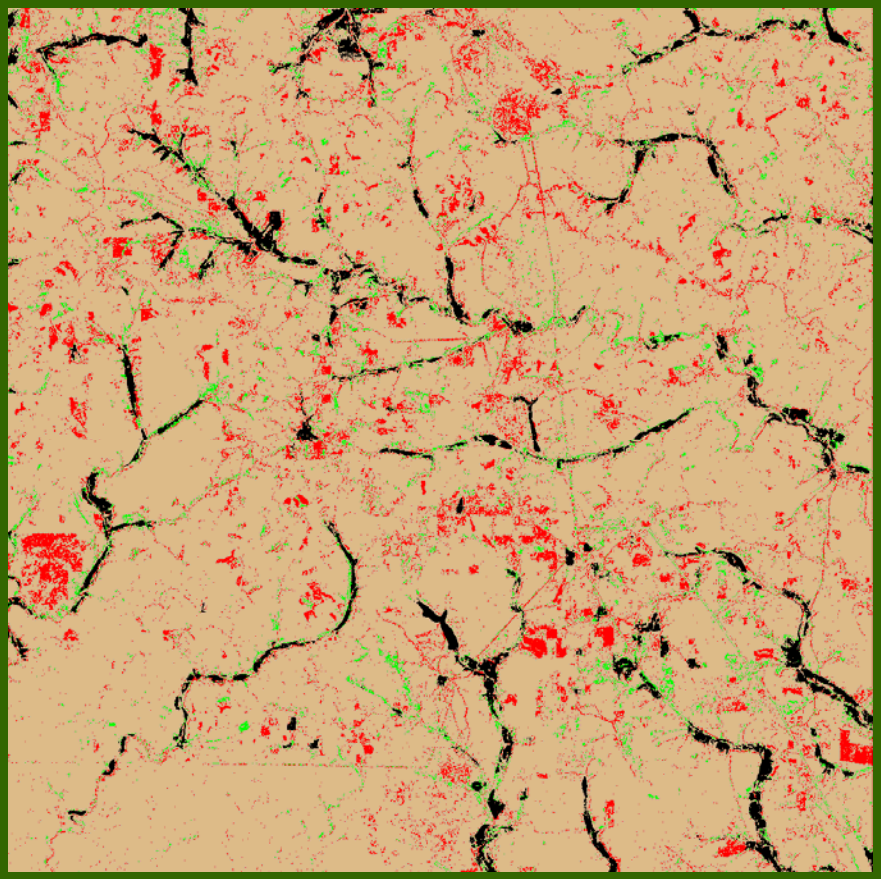


Aster vs. Landsat

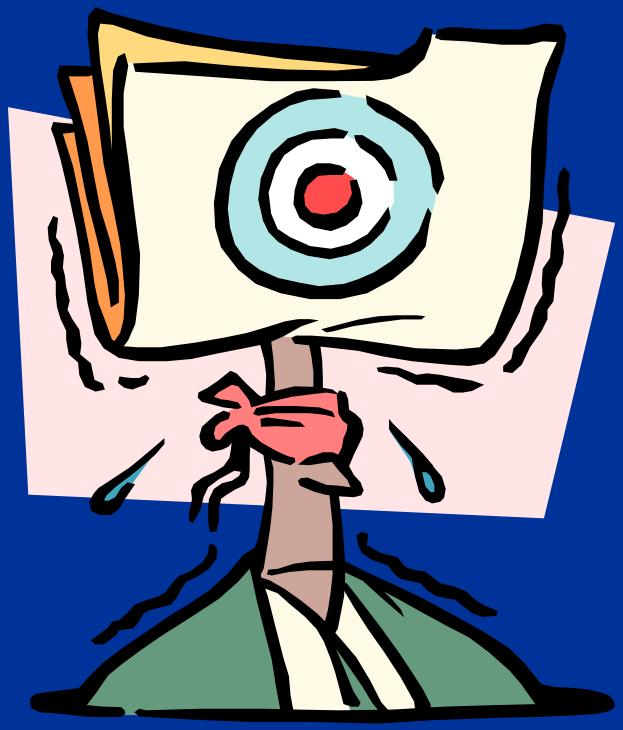
Forest Change with Aster 1996 - 2000



Forest Change with Landsat 1996 - 2000



LULC Update

- Currently reviewing all scenes because of the availability of 2003 NAIP imagery
  - Classes change significantly
  - Draft portions state previously delivered have changed due to use of NAIP imagery
- Anticipate entire state to be in draft form by December 31, 2004

Questions?