

# The Eastern Forest Environmental Threat Assessment Center



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Appalachian Mountains Joint Venture  
Technical Committee Meeting  
August 7, 2012; Morgantown WV

# The Eastern Forest Environmental Threat Assessment Center



**EFETAC's mission** is to generate knowledge and tools needed to understand, predict and respond to environmental threats. EFETAC's challenge is to maintain a holistic and integrated research program to tackle these complex cross-scale issues by working with forest managers, agencies, scientists, and other organizations.

**MONITORING**

**ASSESSMENT**

**PREDICTION**

**COMMUNICATION**



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**MONITORING**

**ASSESSMENT**

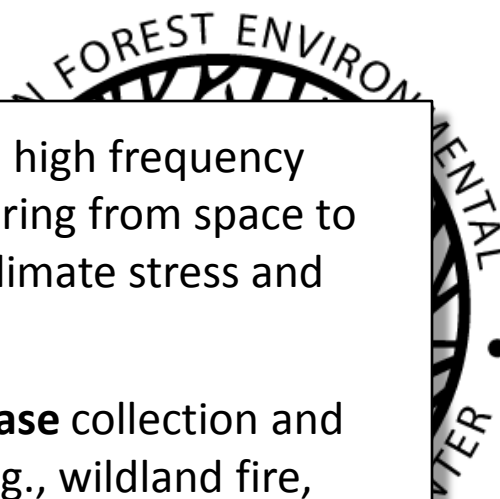
**PREDICTION**

**COMMUNICATION**



**ForWarn:** Systematic, high frequency forest change monitoring from space to detect disturbance, climate stress and recovery.

**Various threat database** collection and integration efforts (e.g., wildland fire, invasives, etc.)



Some highlights

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A diagram consisting of a large, thin-lined bracket shape on the left, with two lines extending from its top and bottom points to the left and right sides of a rectangular callout box. The box is positioned below the 'ASSESSMENT' header and contains text about landscape pattern analysis and two specific frameworks.

## **Landscape Pattern Analysis and Change**

**CRAFT:** Comparative Risk Assessment Framework and Tools

**TACCIMO:** Template for Assessing Climate Change Impacts and Management Options



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**Forecasts:** Forecasts of climate-associated shifts in tree species

**CRAFT:** Comparative Risk Assessment Framework and Tools

**WASSI:** Water Supply Stress Index Model

**Predicting spread** of non-native insects, plants, pathogens and diseases

Some highlights

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**MONITORING**

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**COMMUNICATION**



Direct collaboration with scientists  
and managers

Standard scientific venues  
(*i.e.*, publications, meetings, etc.)

Workshops, media outreach, website  
<http://www.forestthreats.org>

Some highlights

The  
Eastern Forest Environmental Threat Assessment Center

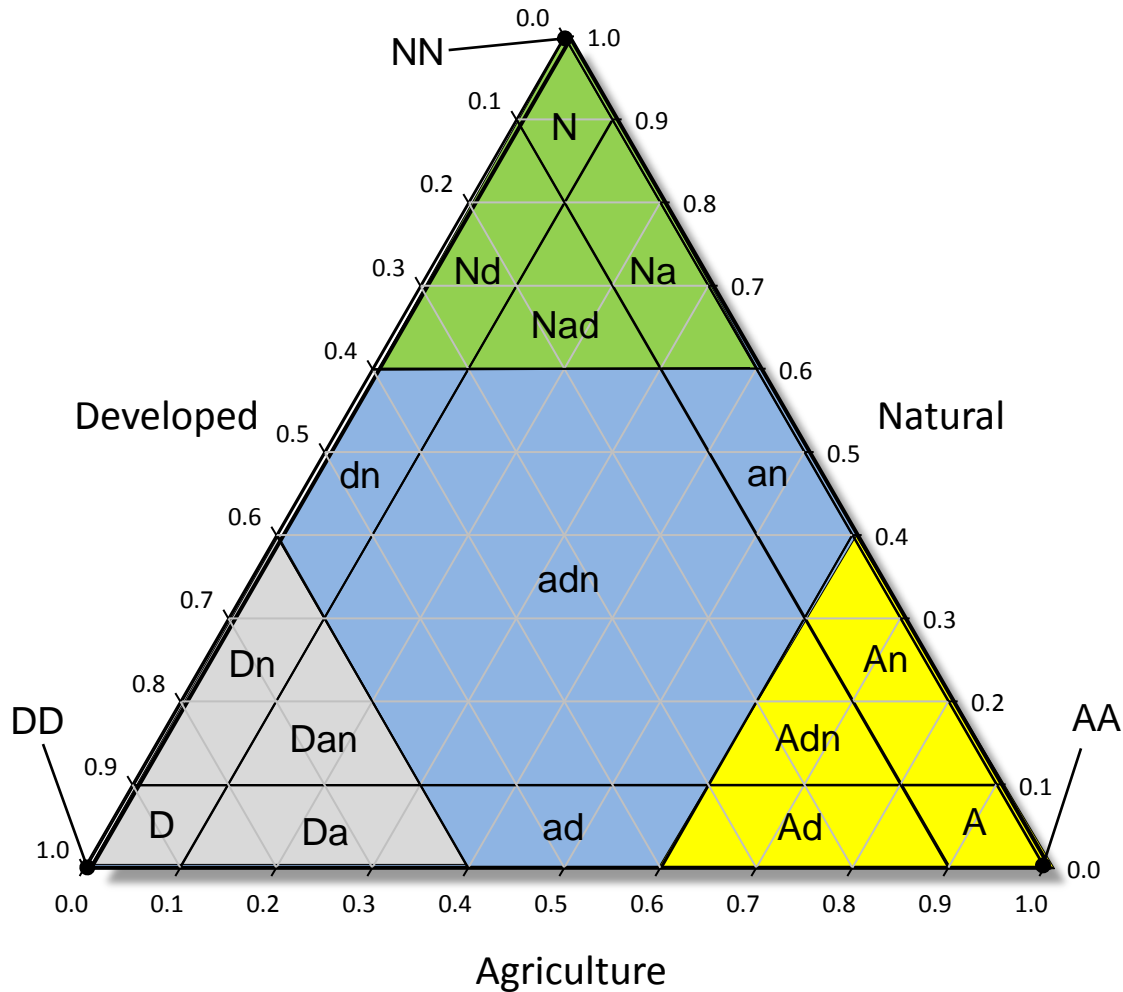


*A PRODUCT THAT CHARACTERIZES  
LAND COVER PATTERNS ACROSS SCALES*

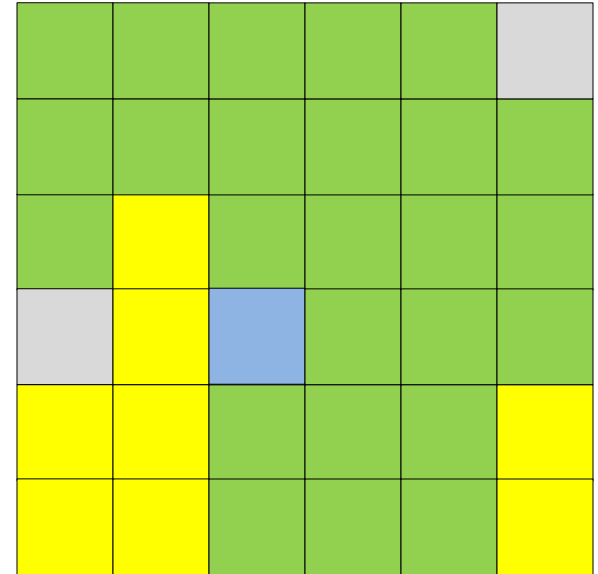


# Riitters' Multi-scale Pattern Types

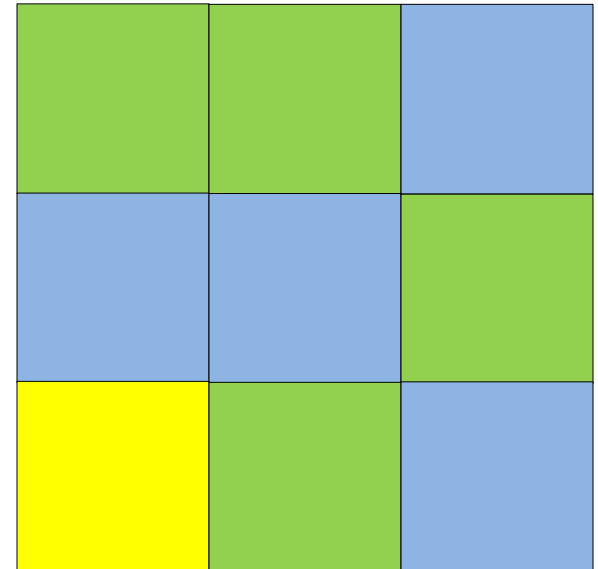
## Based on the National Land Cover Dataset



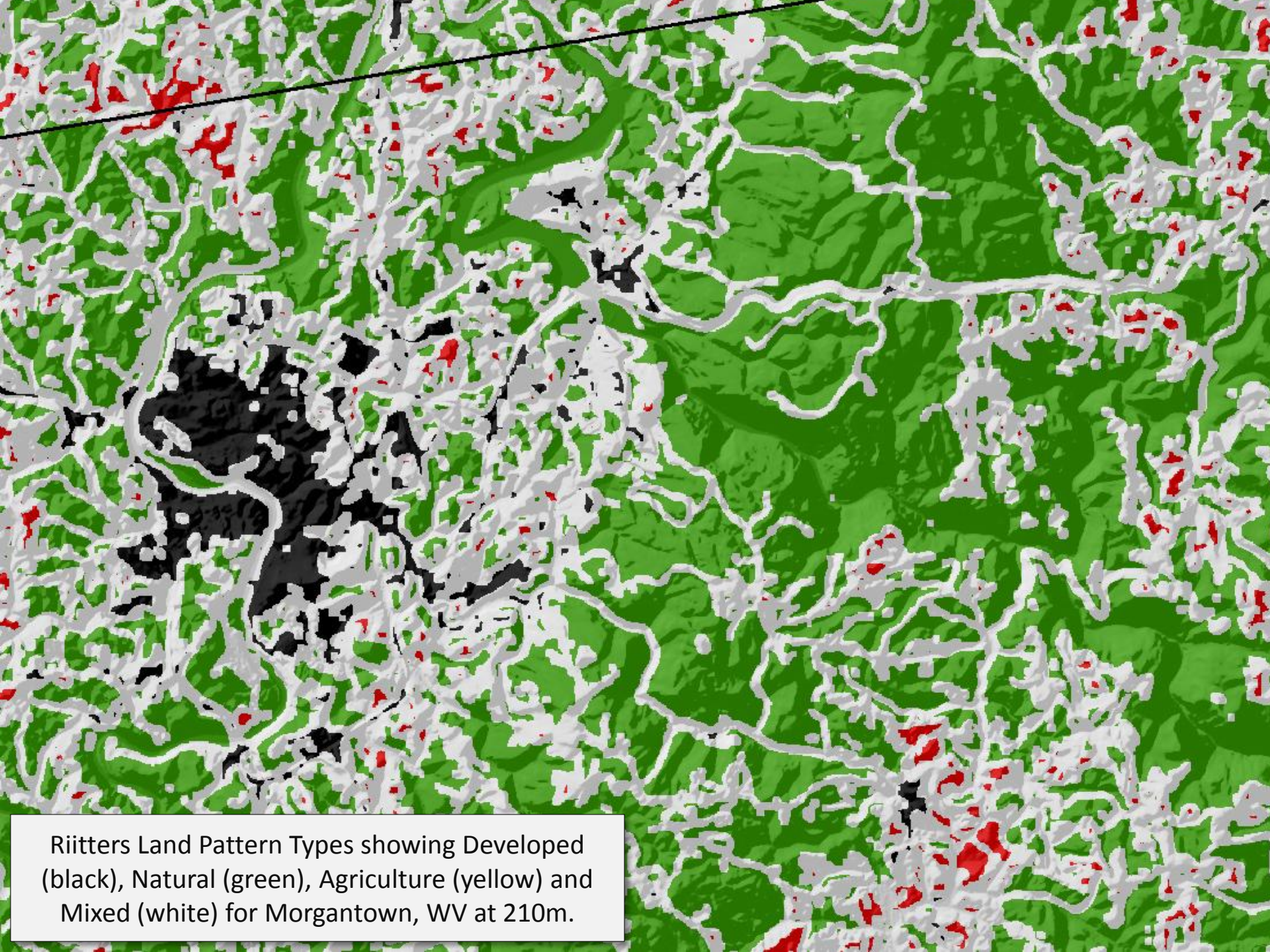
Finer scale



Coarser scale

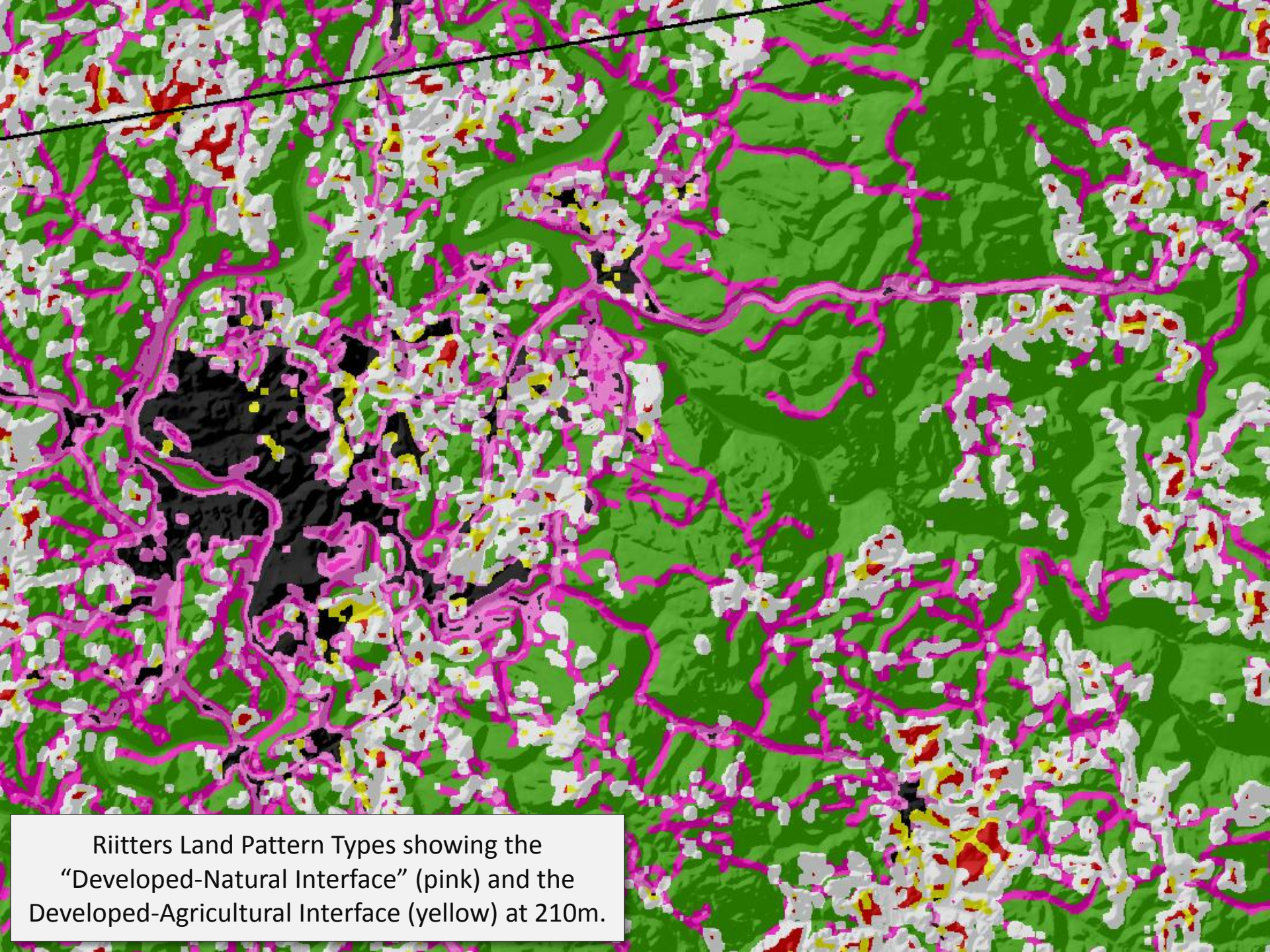






Riitters Land Pattern Types showing Developed (black), Natural (green), Agriculture (yellow) and Mixed (white) for Morgantown, WV at 210m.





Riitters Land Pattern Types showing the “Developed-Natural Interface” (pink) and the Developed-Agricultural Interface (yellow) at 210m.



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*A PRODUCT THAT PREDICTS  
LONG-TERM RISKS FROM CLIMATE CHANGE*











# The ForeCASTS Project

*Forecasts of Climate-Associated Shifts in Tree Species*

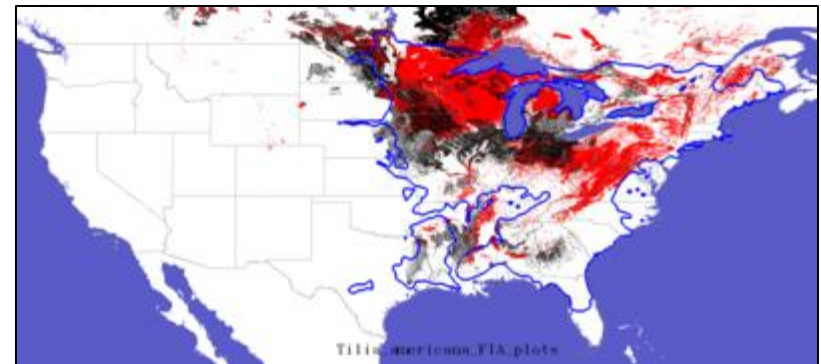
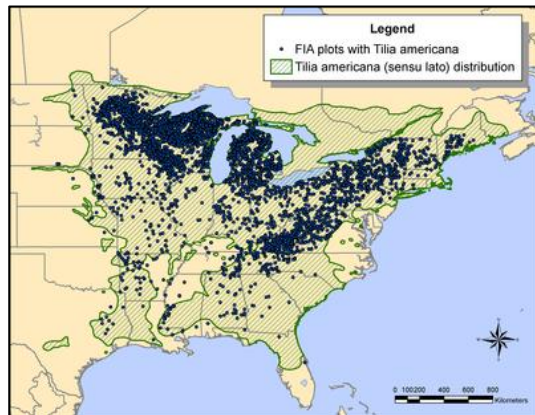
<http://www.forestthreats.org/research/tools/ForeCASTS>

Predicts changes in tree habitat stress under two climate change scenarios and minimum required movement using multivariate spatio-temporal clustering at 4km resolution.

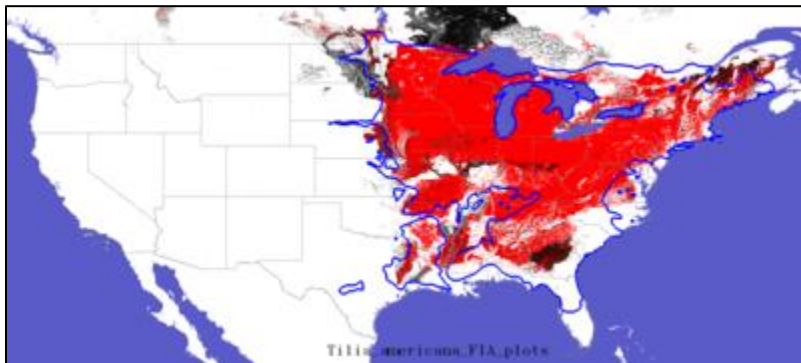
***Tilia americana* (American basswood):** FIA plots = 5,002

*Hadley Model B1 for 2050 (top), 2100 (bottom):*

*Present  
conditions:*



% change in area of suitable range (Hadley B1 2050): -56.3





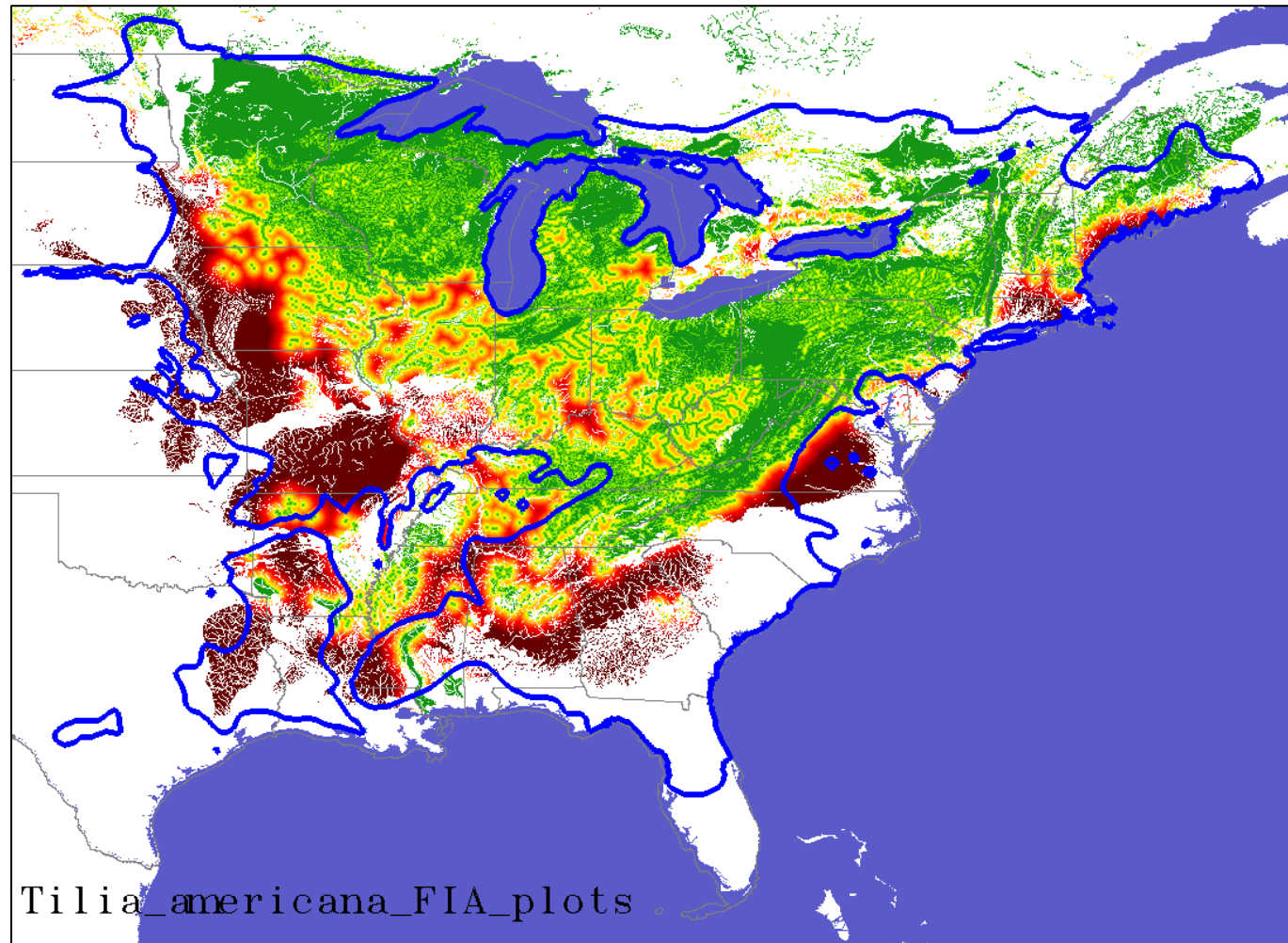
# The ForeCASTS Project

*Forecasts of Climate-Associated Shifts in Tree Species*

<http://www.forestthreats.org/research/tools/ForeCASTS>

## ***Tilia americana* (American basswood)**

*Minimum distance map  
Hadley B1 2050:*



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*A PRODUCT THAT MONITORS DISTURBANCE  
AND CLIMATE STRESS IN NEAR REAL TIME*









<http://forwarn.forestthreats.org>


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# ForWarn

Satellite-Based Change Recognition and Tracking



[Home](#)[Overview](#)[News](#)[Highlights](#)[Data](#)[Support](#)



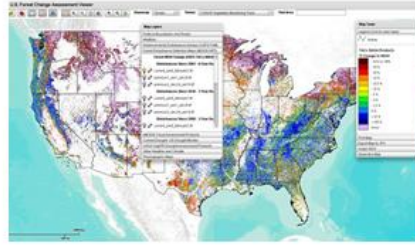
## Development cuts forests near Raleigh

Substantial forest area has fallen to development in the periphery of many urban areas over the last decade. The image below shows deforestation in the periphery of Raleigh, NC as yellow to red anomalies. Blue areas have not changed during the...

[read more »](#)

### What is ForWarn?


ForWarn is a satellite-based forest disturbance monitoring system for the conterminous United States. It delivers new forest change products every eight days and provides tools for attributing abnormalities to insects, disease, wildfire, storms, human development or unusual weather. Archived data provide disturbance tracking across all lands since 2000. Interactive maps are accessible via the [Forest Change Assessment Viewer](#). Read more about ForWarn [here](#).



### Recent News

#### [Official ForWarn News Release Now Available](#)

03/21/2012 - 09:25 The official news release from the USDA Forest Service and NASA announcing ForWarn is now available for download!

 [USDA FS AND NASA JOINT PRESS RELEASE 03 15 12.DOC](#)

#### [Introducing the Pest Proximity Database](#)

02/17/2012 - 10:40 The new Pest Proximity Database, now built into the Forest Change Assessment Viewer, helps determine which insects and disease agents are most likely to have been responsible for new forest...

[more news »](#)

USDA Forest Service

EFETAC

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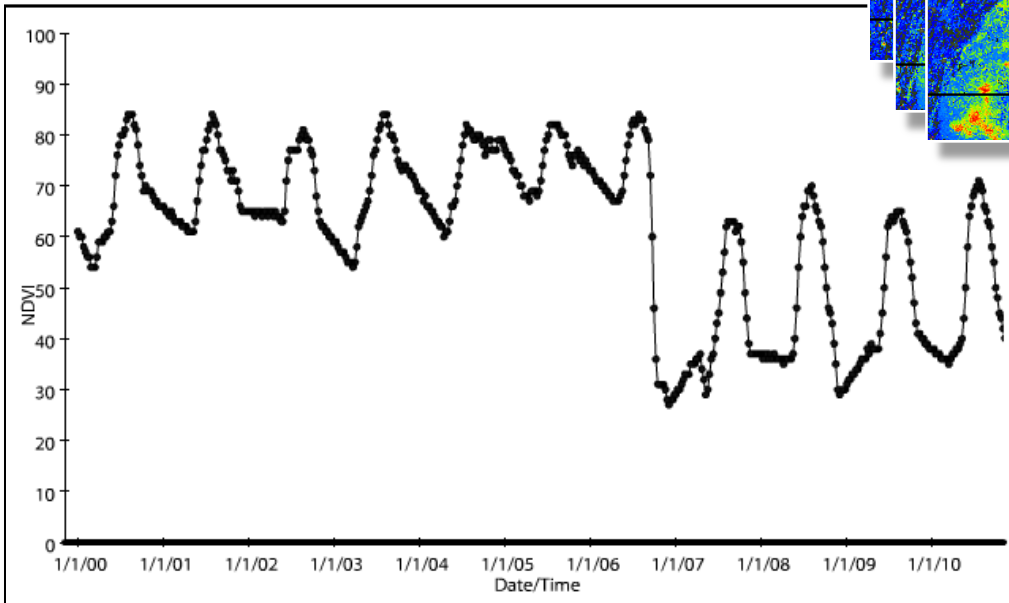
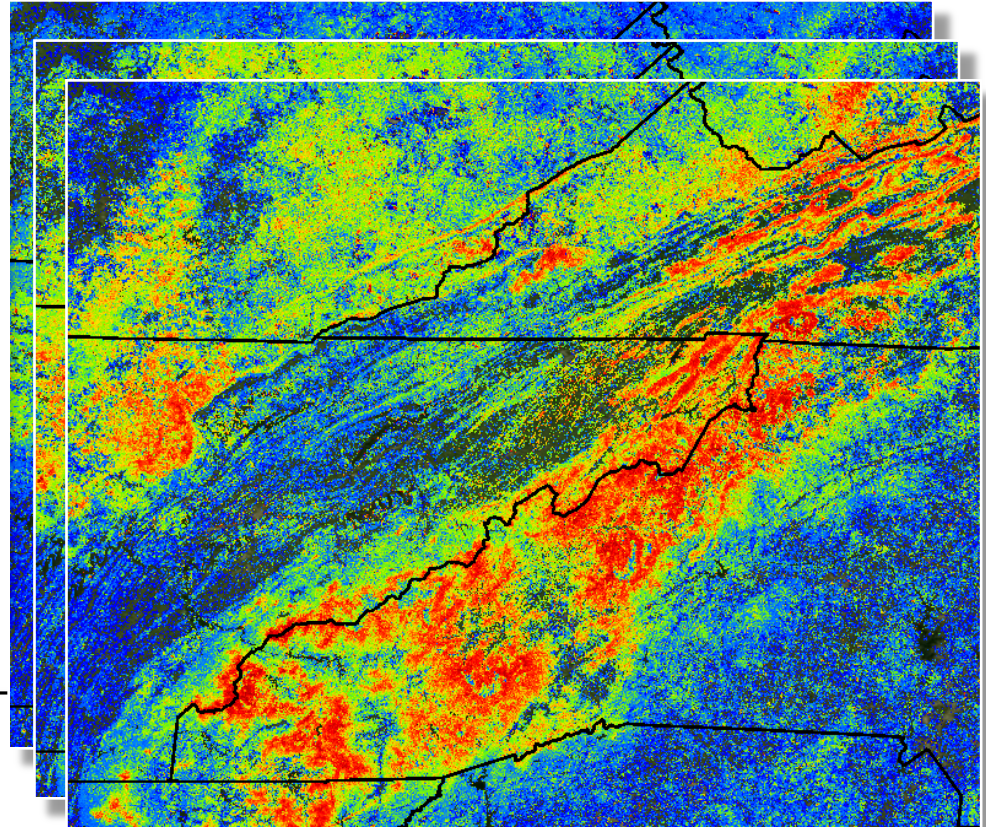
White House

usa.gov



# ForWarn

- MODIS-based
- Moderate resolution (~240m; 14ac)
- 2000 – present
- Conterminous US
- 24-day window; 8-day steps
- Normalized Difference Vegetation Index (NDVI)
- Maps of change in NDVI from multiple baselines (1, 3, all year)

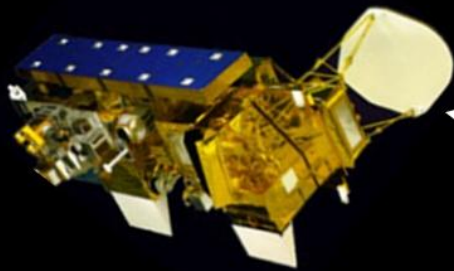


*An 11-year, 8 day NDVI time series for a portion of the Boundary Waters Wilderness, MN*

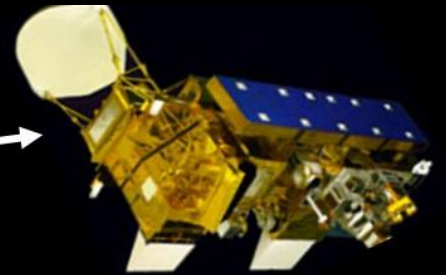


## **MODIS SENSOR:**

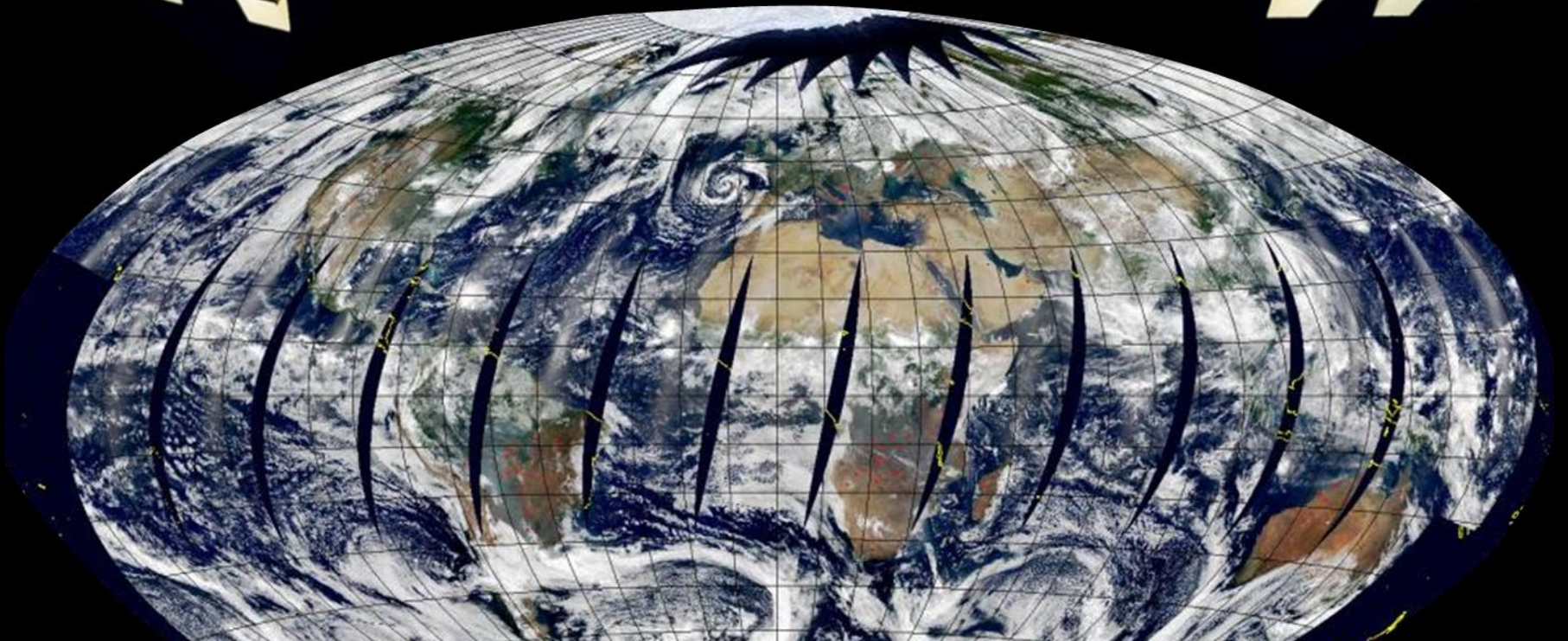
Moderate resolution imaging spectro-radiometer  
(36 spectral bands)



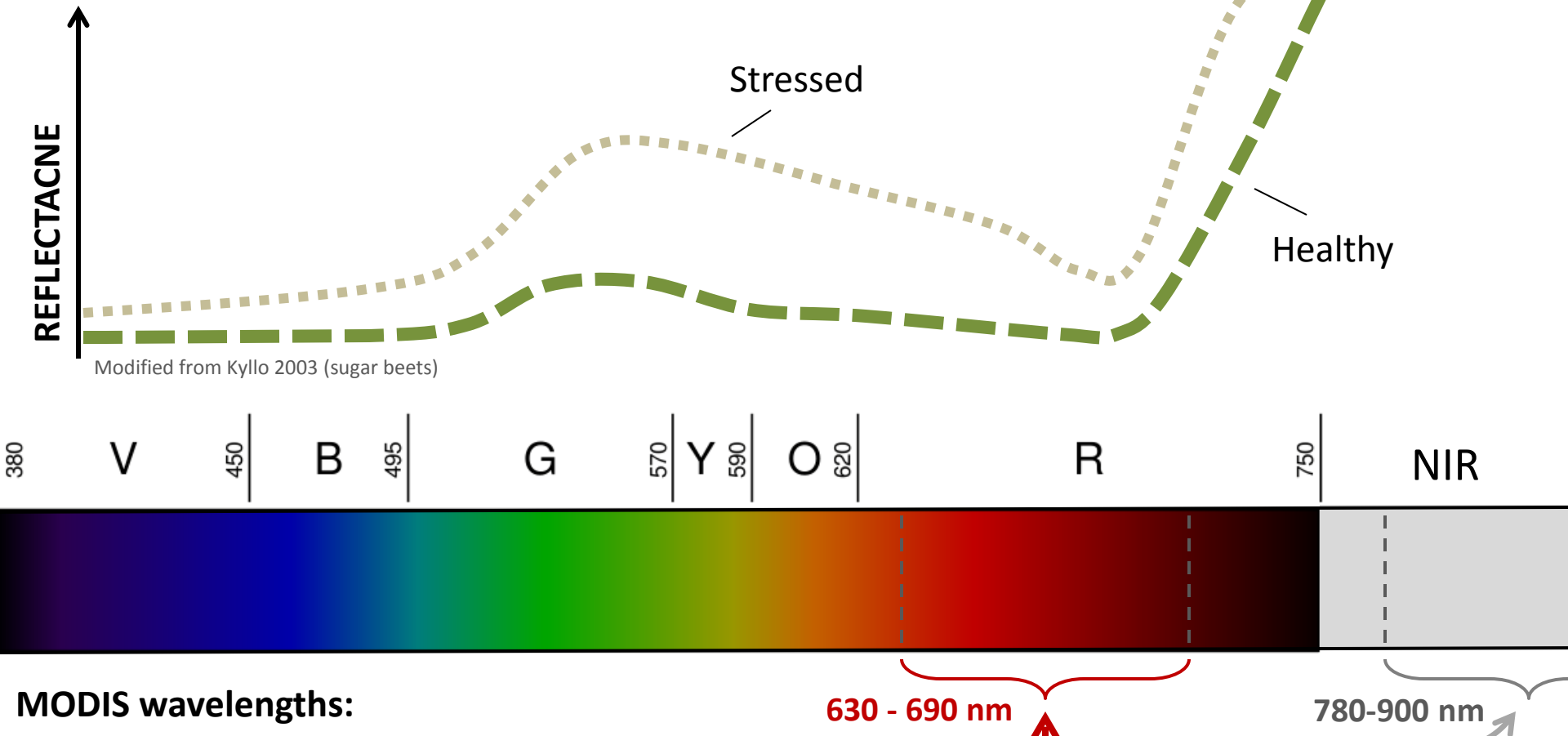
← Terra



Aqua →



# Normalized Difference Vegetation Index



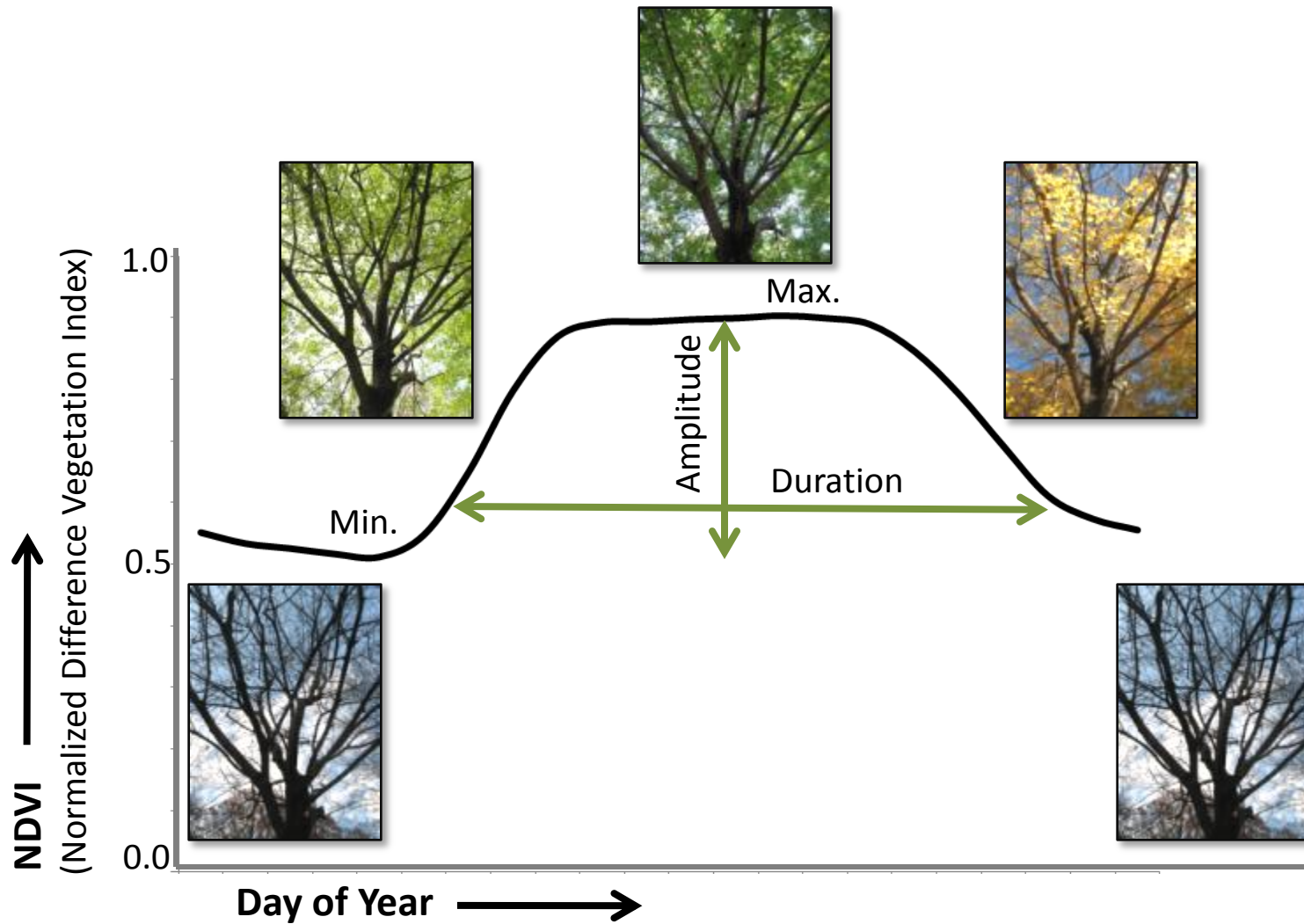
MODIS wavelengths:

630 - 690 nm

780-900 nm

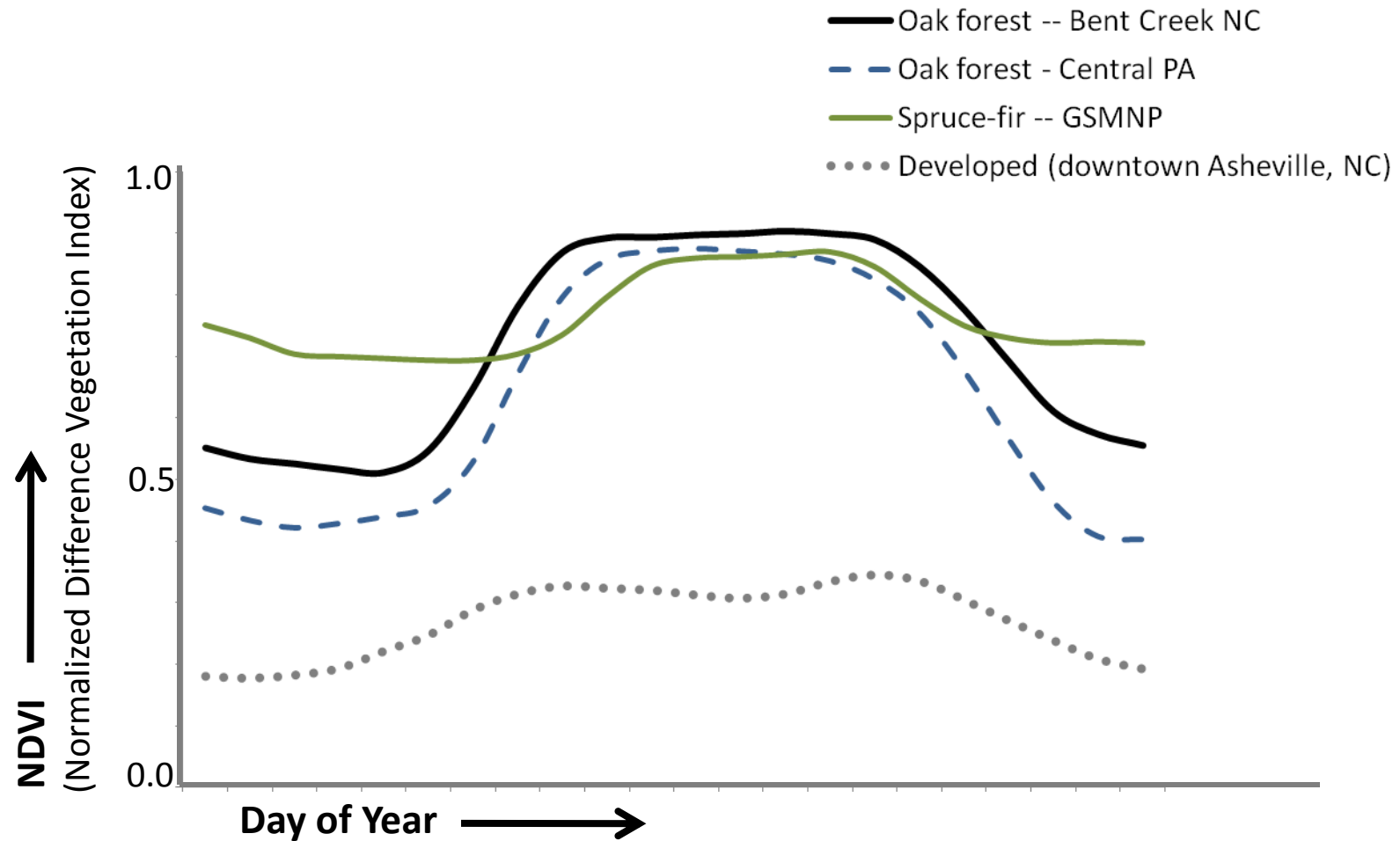
$$\text{NDVI} = \frac{(\text{Near Infrared}) - (\text{Red})}{(\text{Near Infrared}) + (\text{Red})}$$

# Land Surface Phenology of Eastern Deciduous Forest

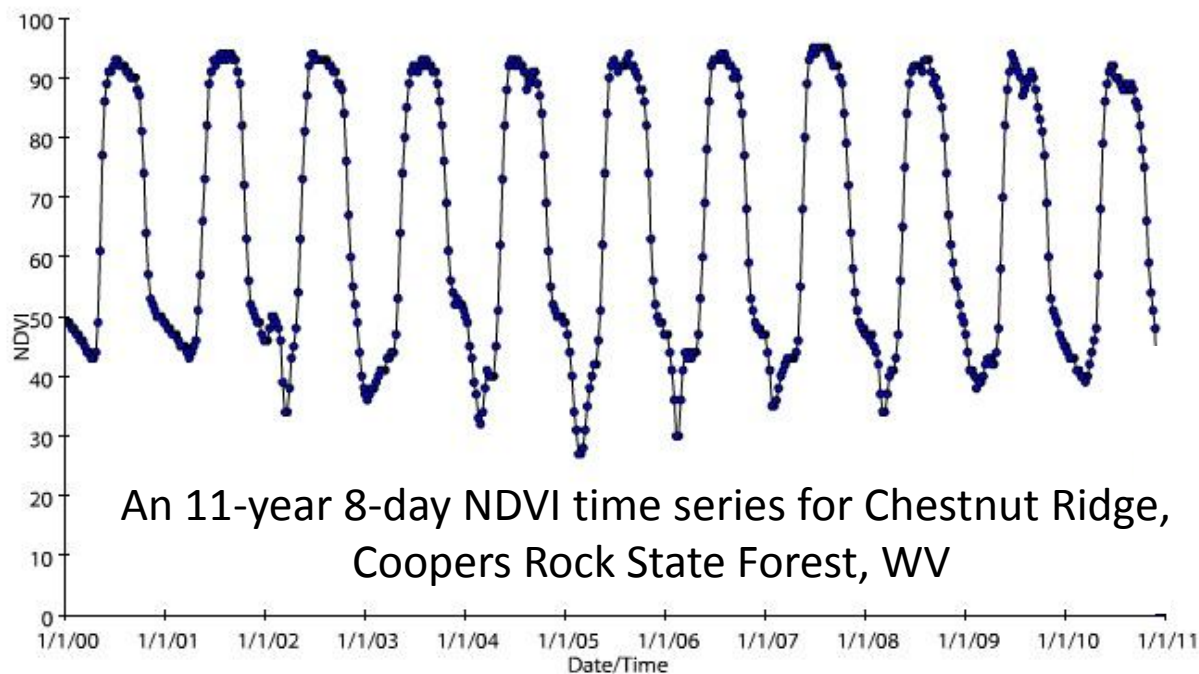




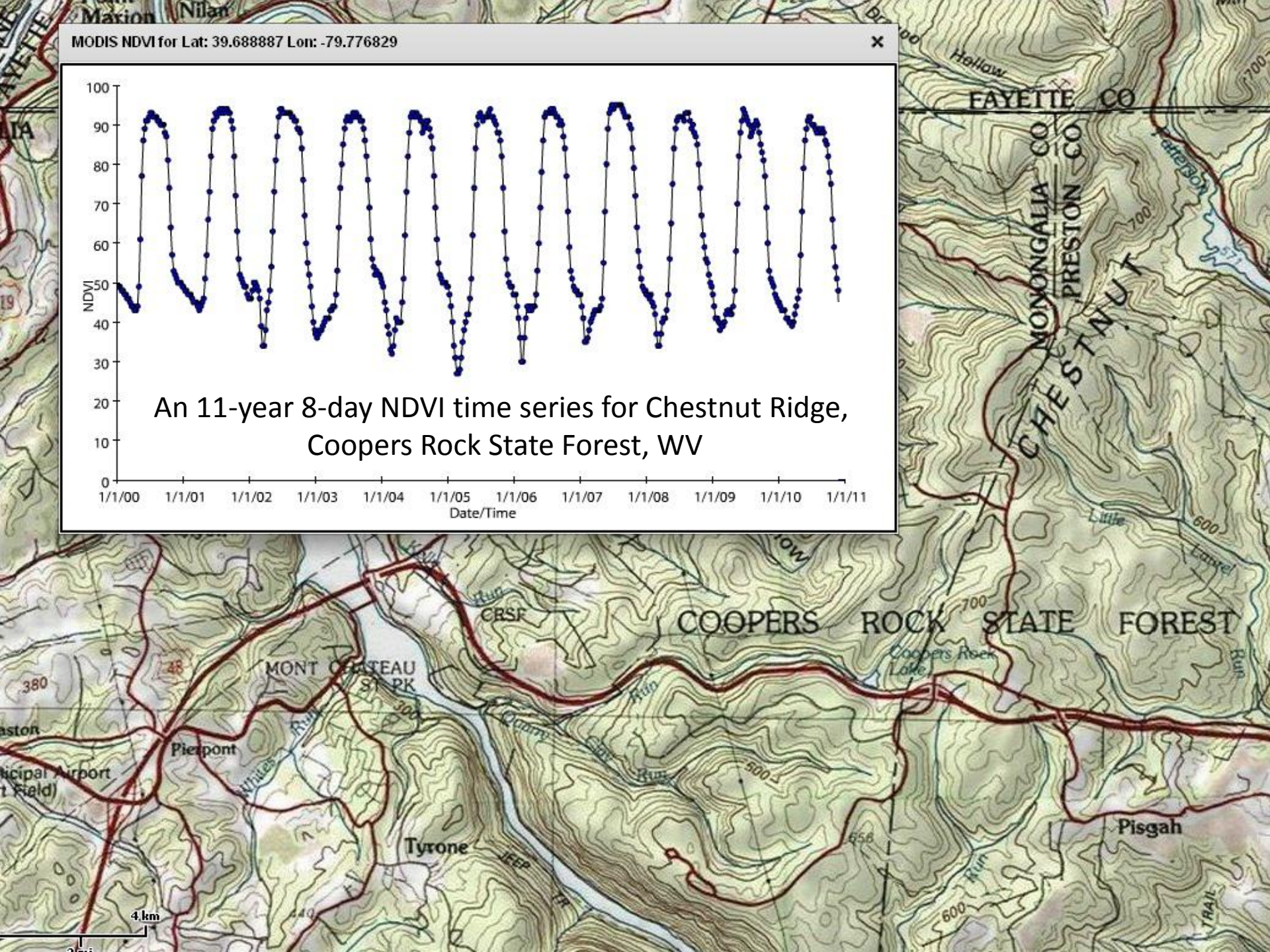
# Land Surface Phenology of Four Vegetation Types during 2008



MODIS NDVI for Lat: 39.688887 Lon: -79.776829



An 11-year 8-day NDVI time series for Chestnut Ridge,  
Coopers Rock State Forest, WV





**Scarlet oak**  
**Spring**  
**Greenup**

**2009** →

**2010**  
↘



**04-17**



**04-24**



**04-27**



**04-13**



**04-20**



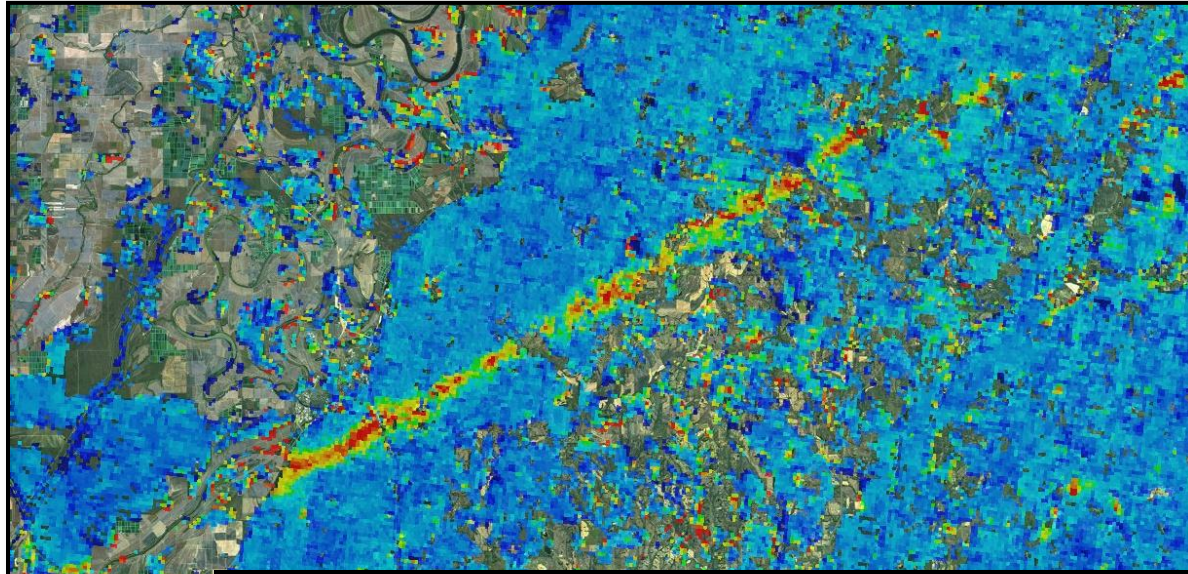
**04-22**



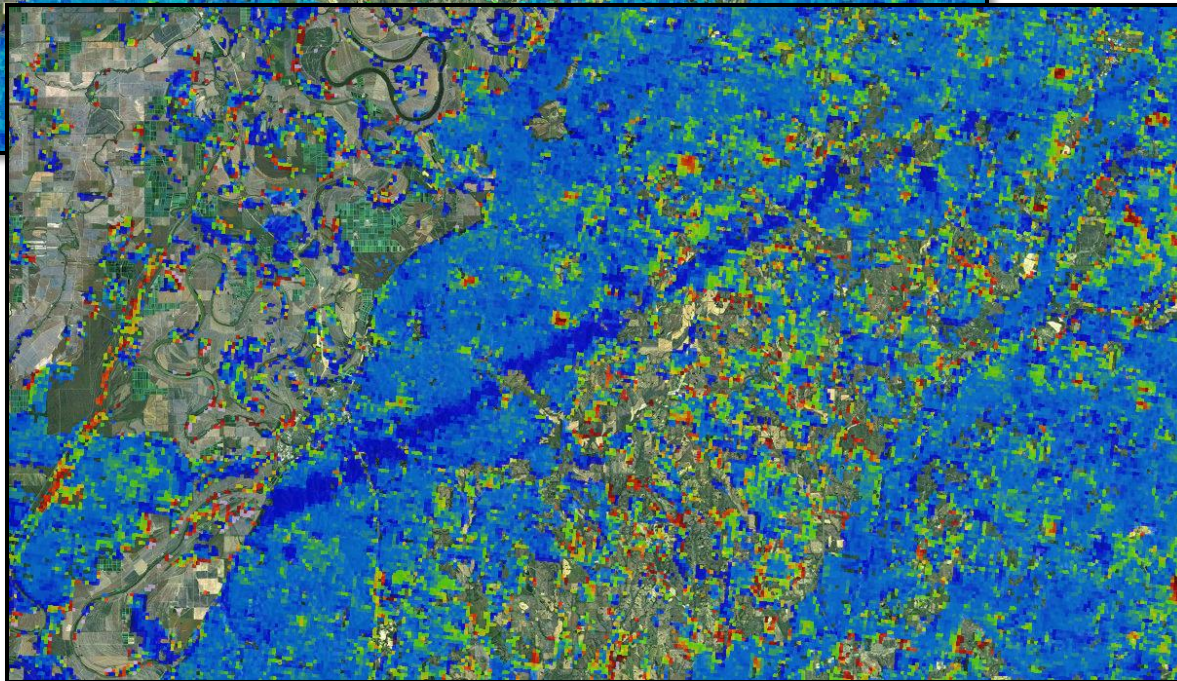
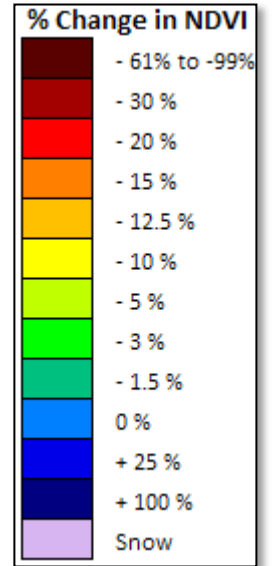
**04-26**



# Yazoo City, MS tornado recovery

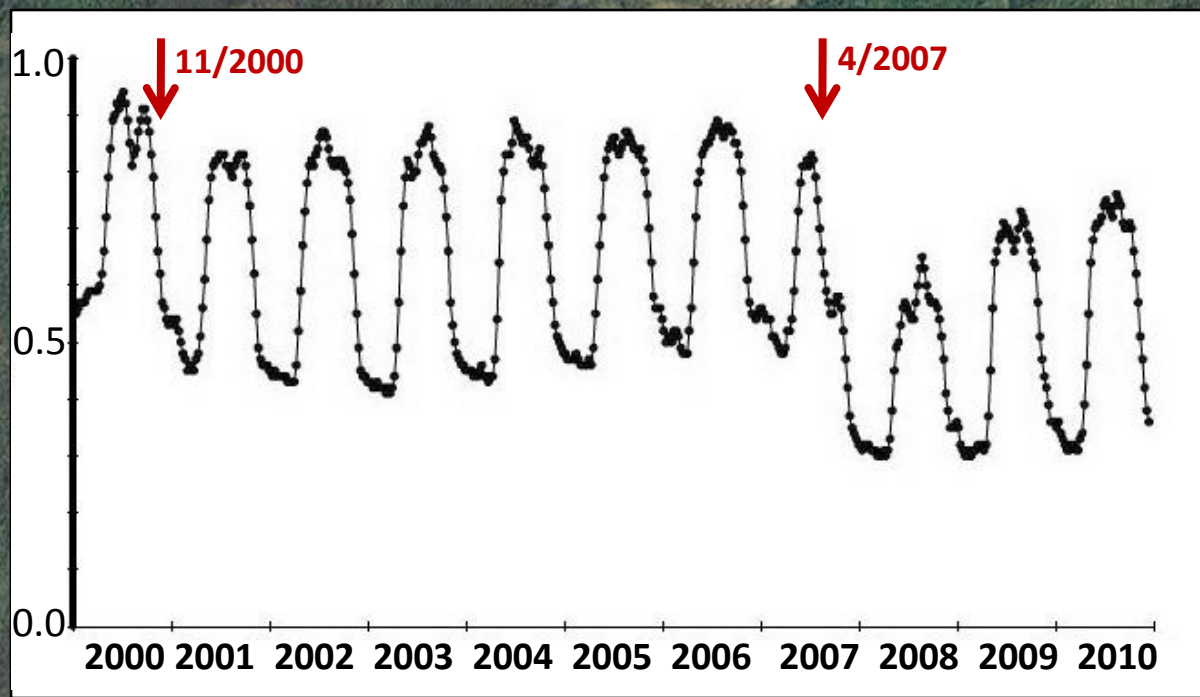


June 17, 2010  
compared to 2009



June 17, 2011  
compared to 2010



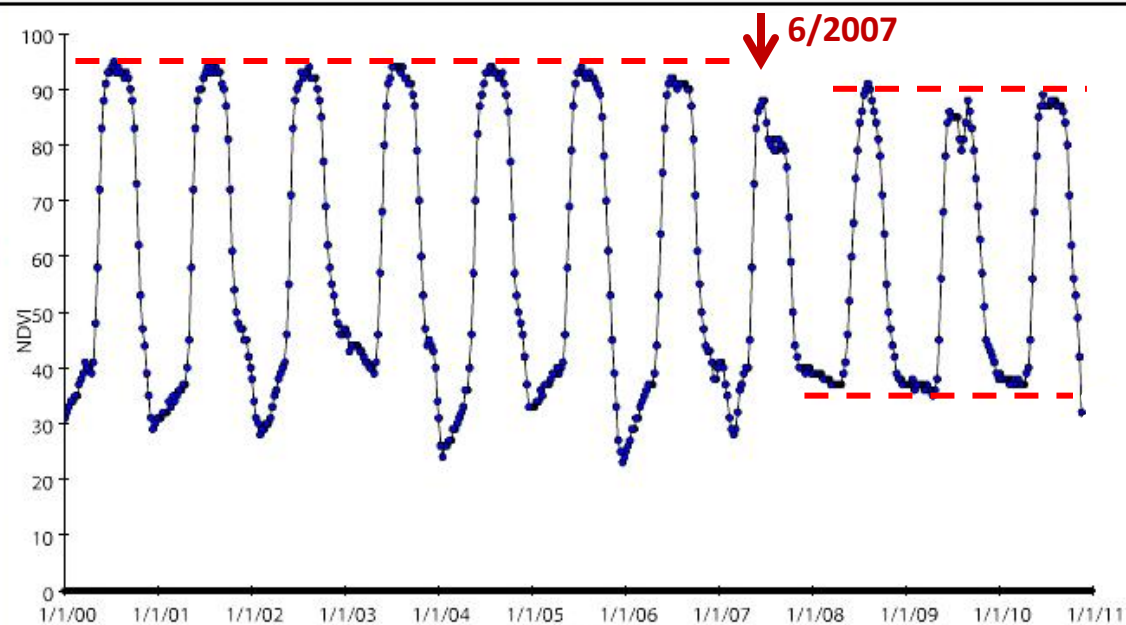


**Linville Gorge Fires**  
**Pisgah National Forest, North Carolina**



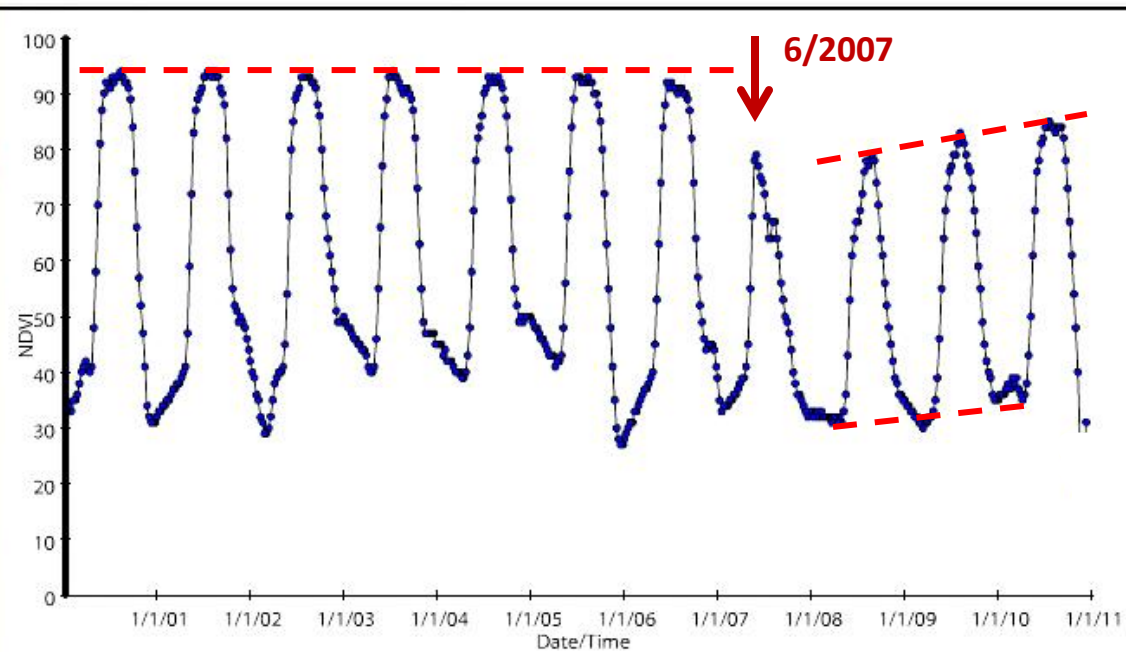
MODIS NDVI for Lat: 45.145366 Lon: -88.709501

x



MODIS NDVI for Lat: 45.147707 Lon: -88.702465

x



F3 Tornado  
June 7, 2007



# ForWarn: May 23, 2012

## Change since 2000

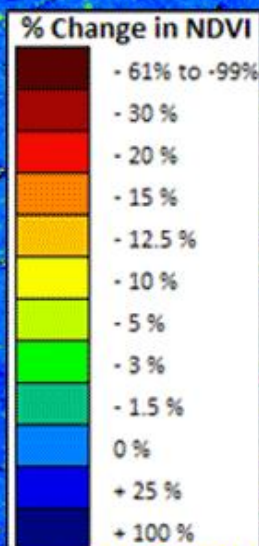
Twin tornado tracks  
from March 2, 2012

KY

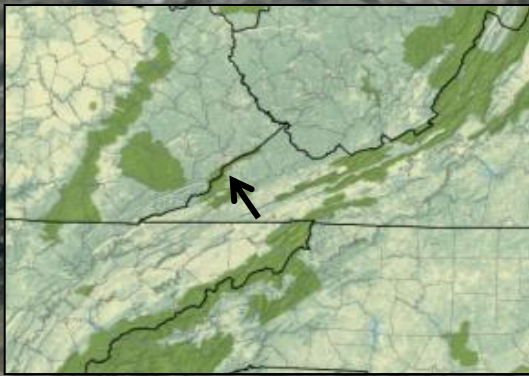
WV

VA

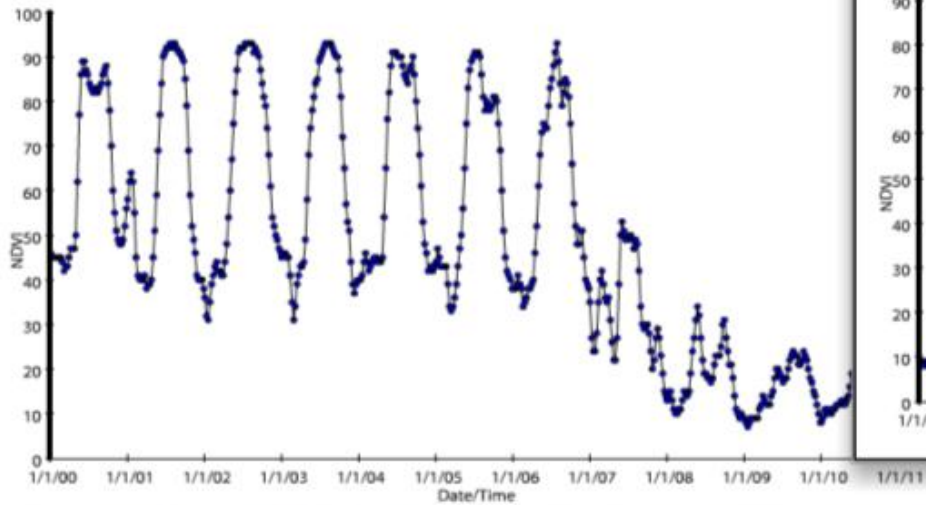
Strip  
mining



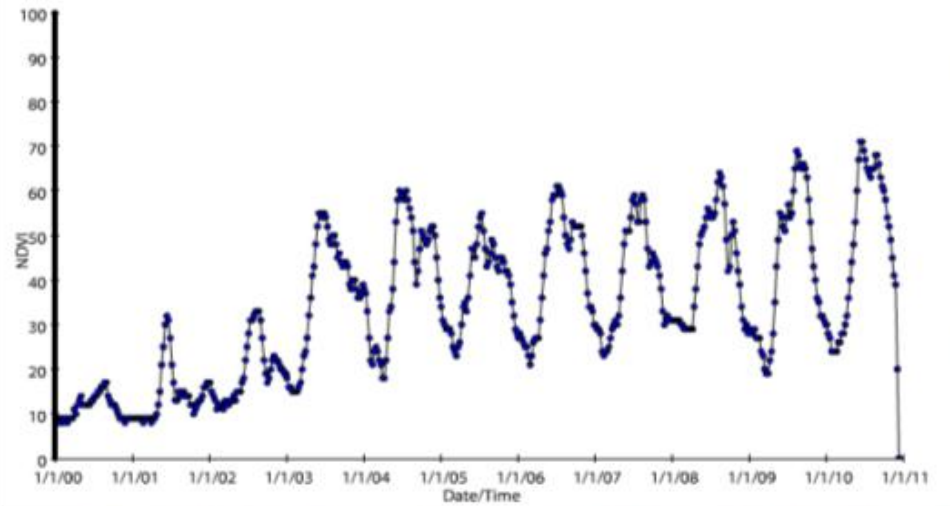




MODIS NDVI for Lat: 37.038195 Lon: -82.702823

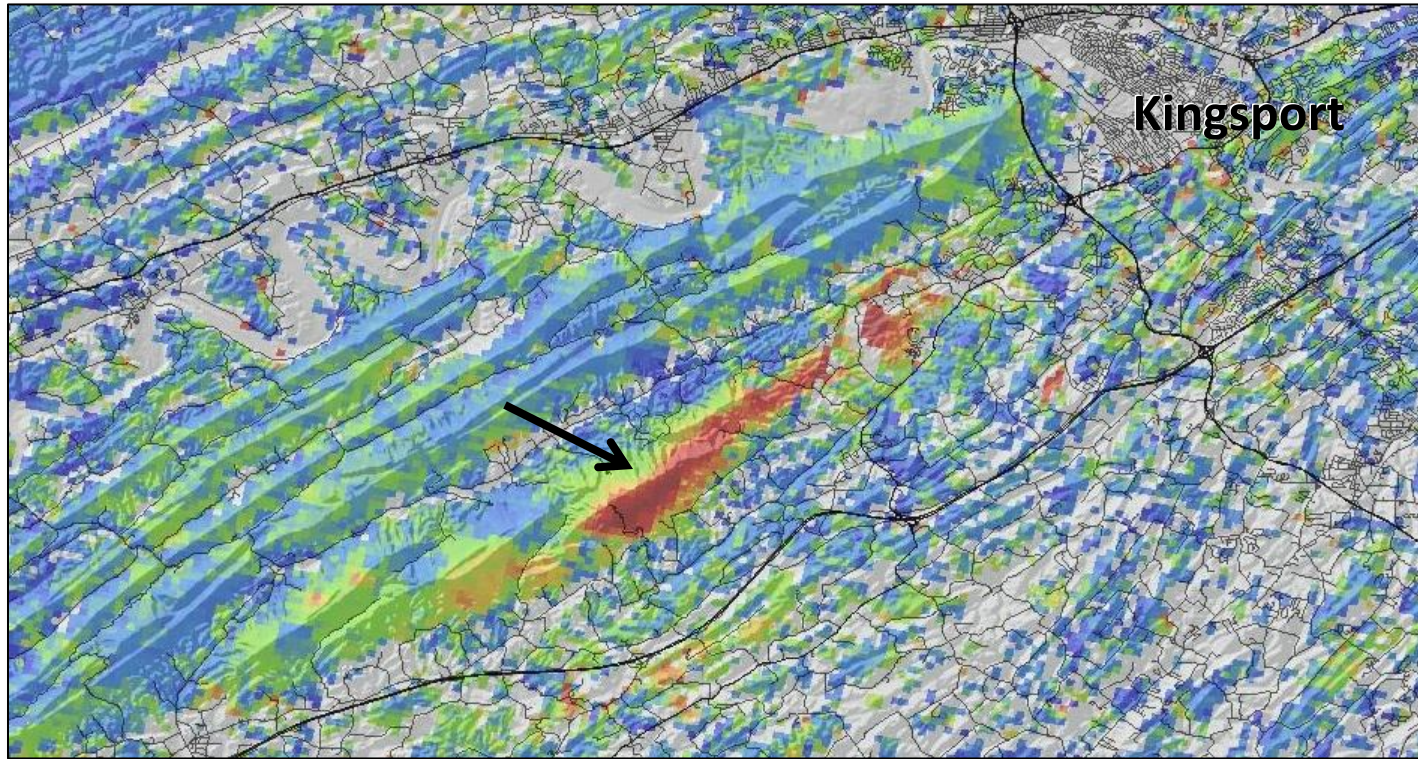


MODIS NDVI for Lat: 37.047855 Lon: -82.682910

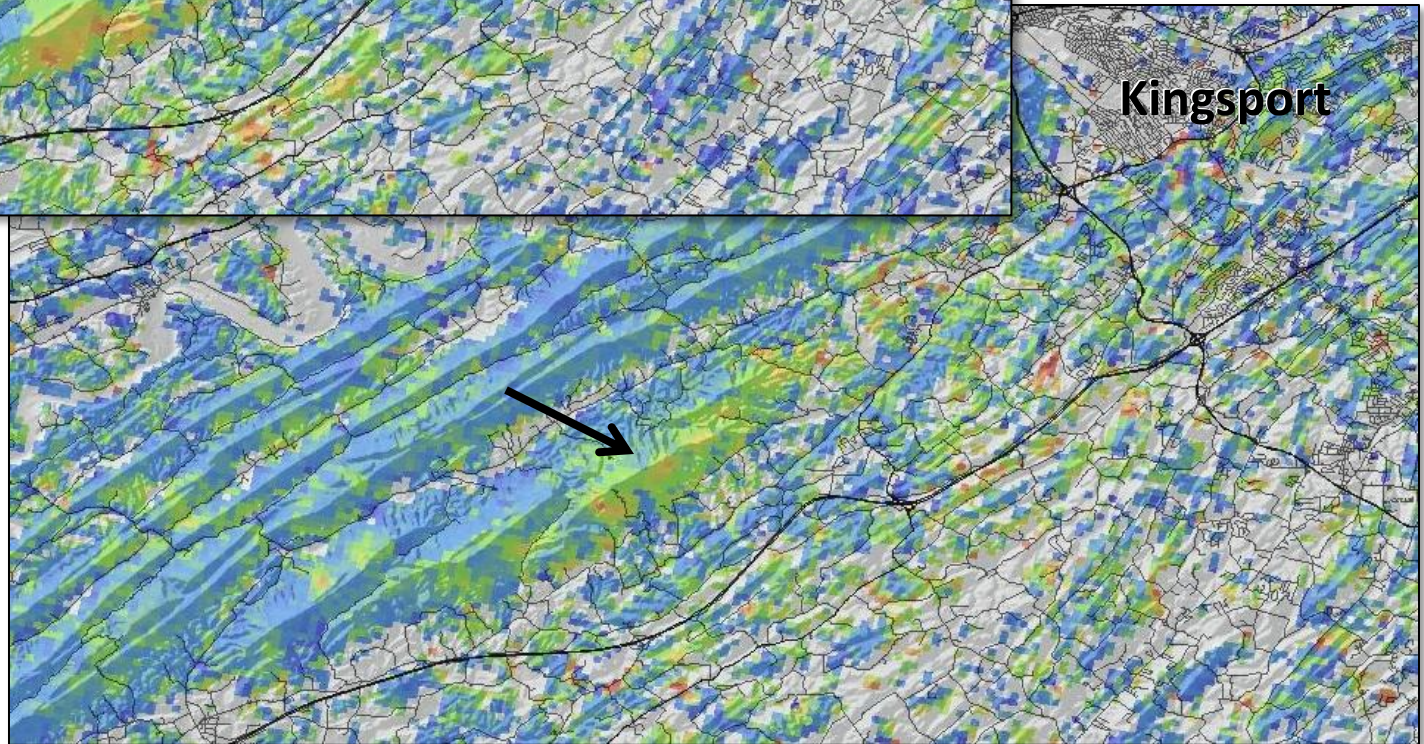




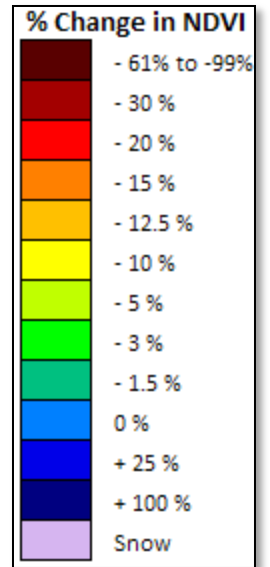
# Detecting ephemeral disturbances: Hail



June 1, 2011

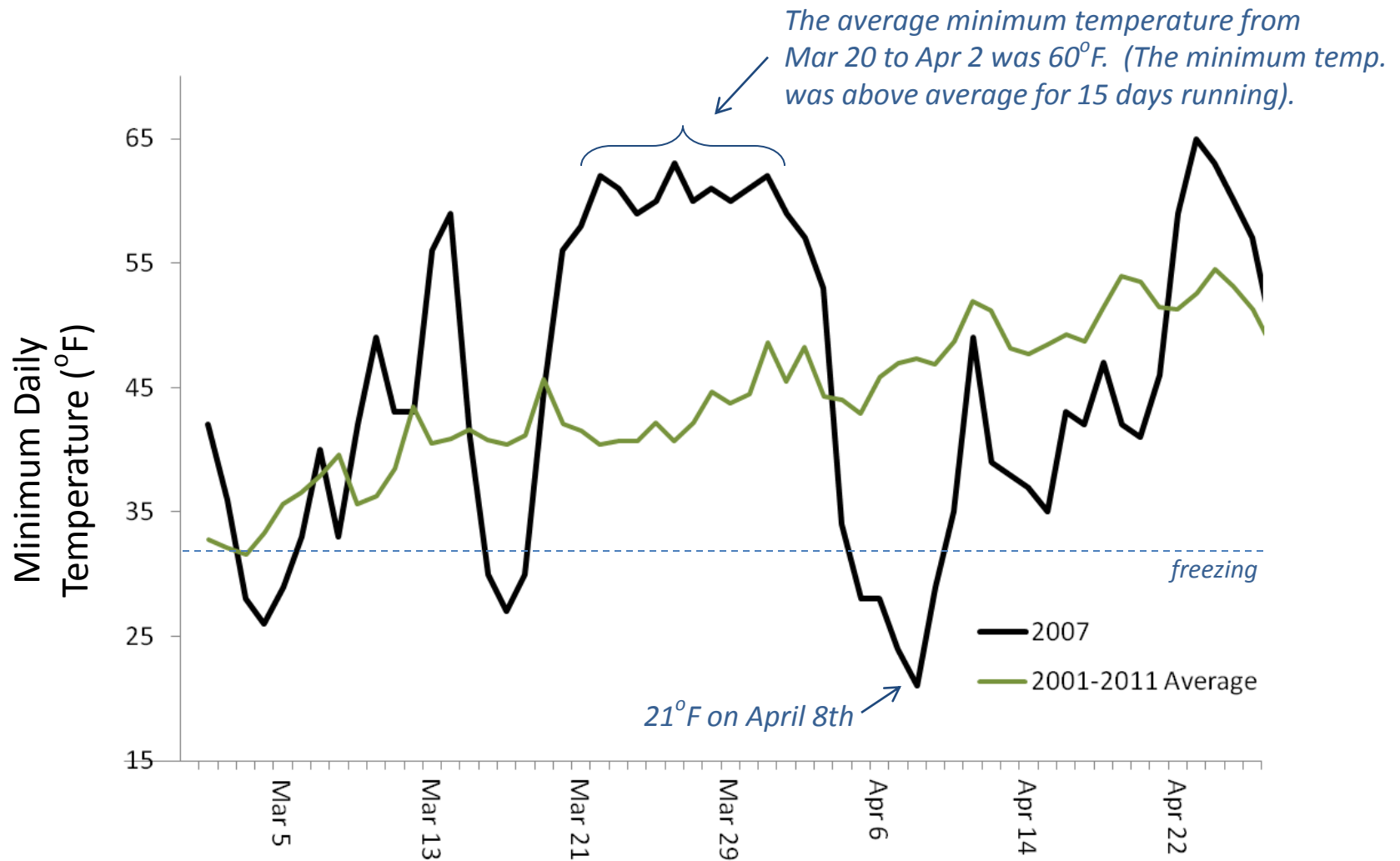


July 3, 2011

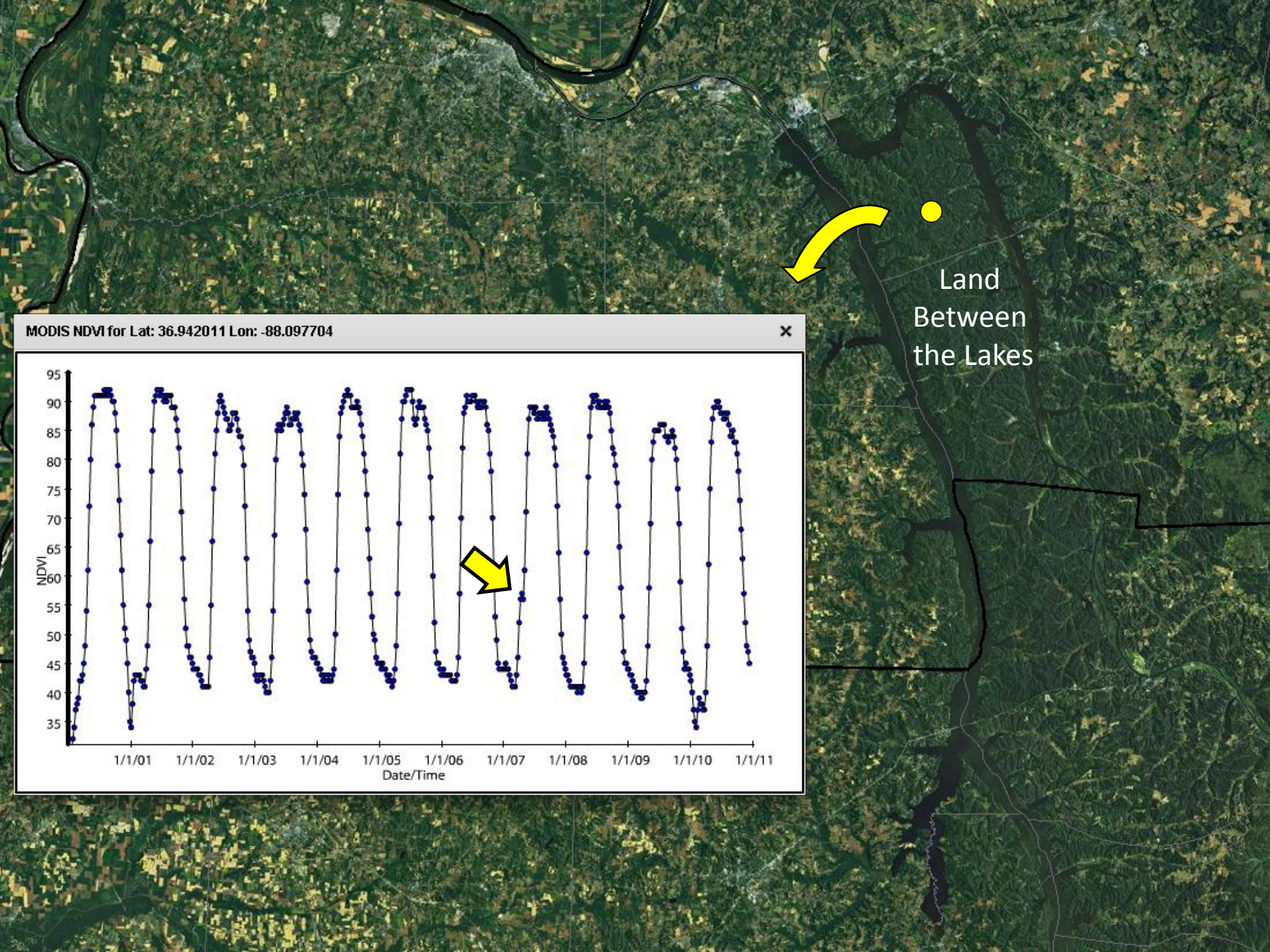




# Detecting ephemeral disturbances: A hard spring frost

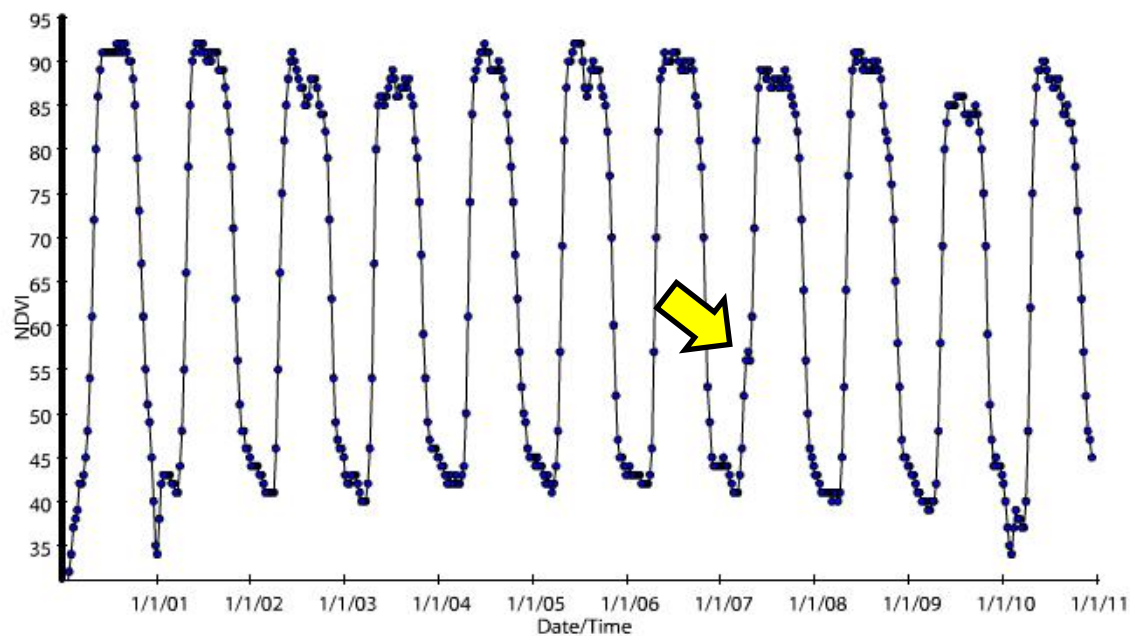


Kylbl, Kentucky (RAWS) Weather Station  
Land Between The Lakes



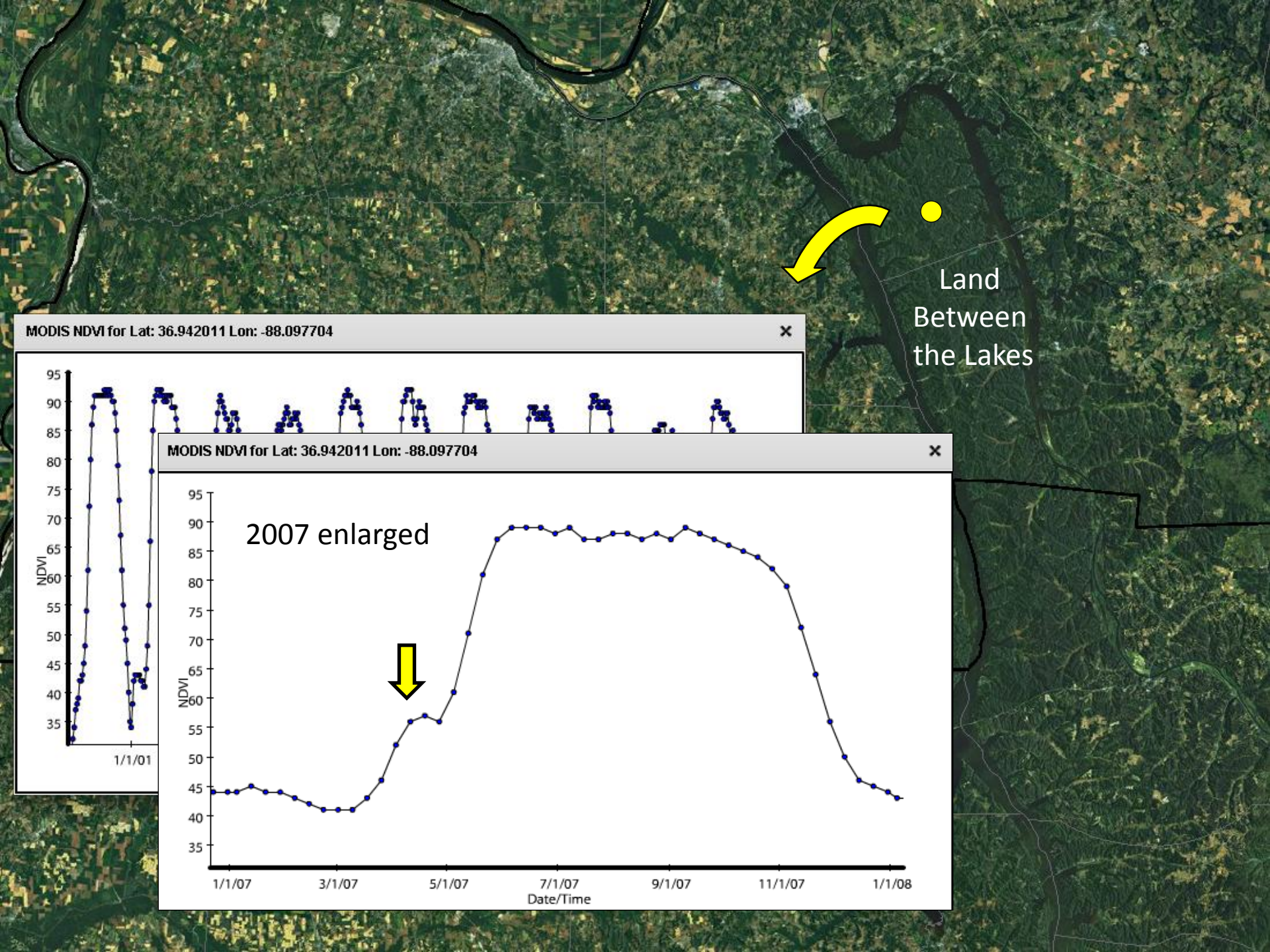
MODIS NDVI for Lat: 36.942011 Lon: -88.097704

x

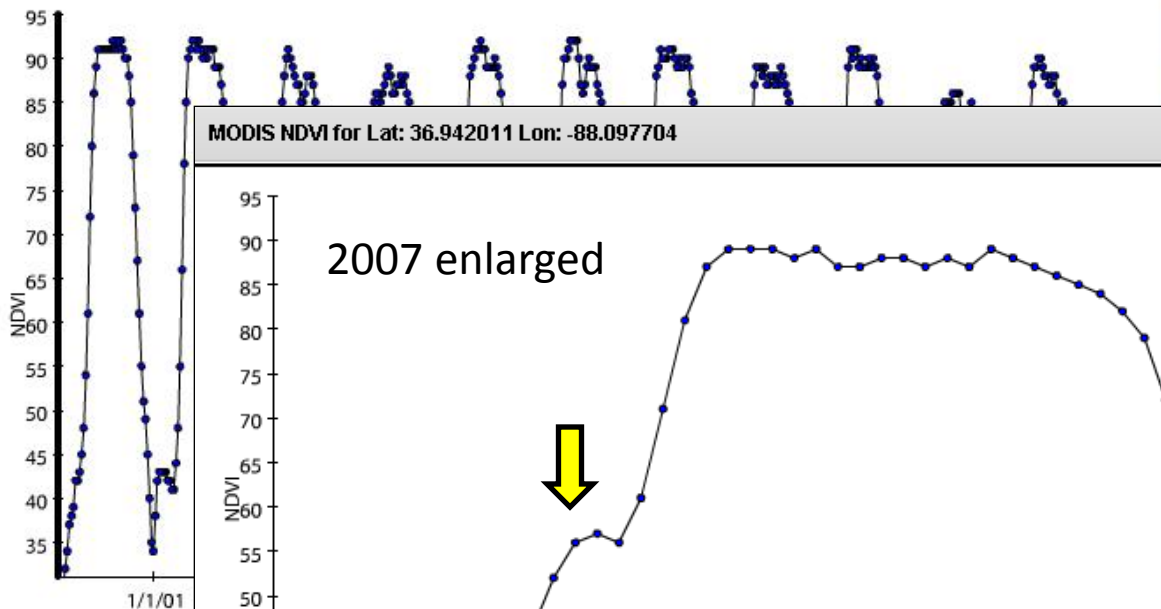


Land  
Between  
the Lakes





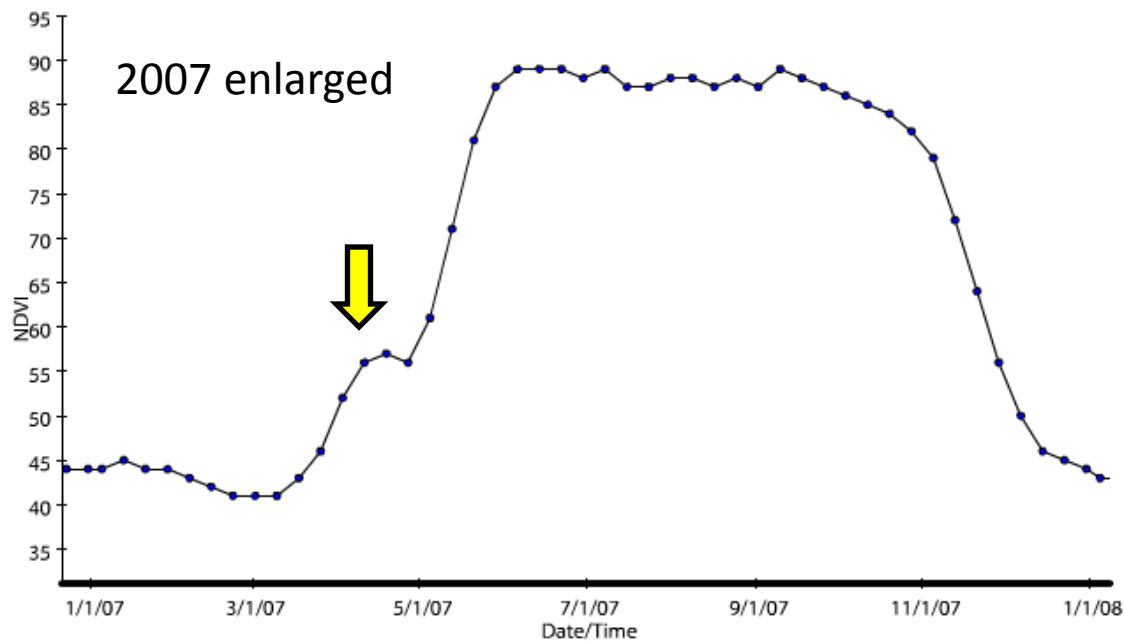
MODIS NDVI for Lat: 36.942011 Lon: -88.097704



MODIS NDVI for Lat: 36.942011 Lon: -88.097704



2007 enlarged



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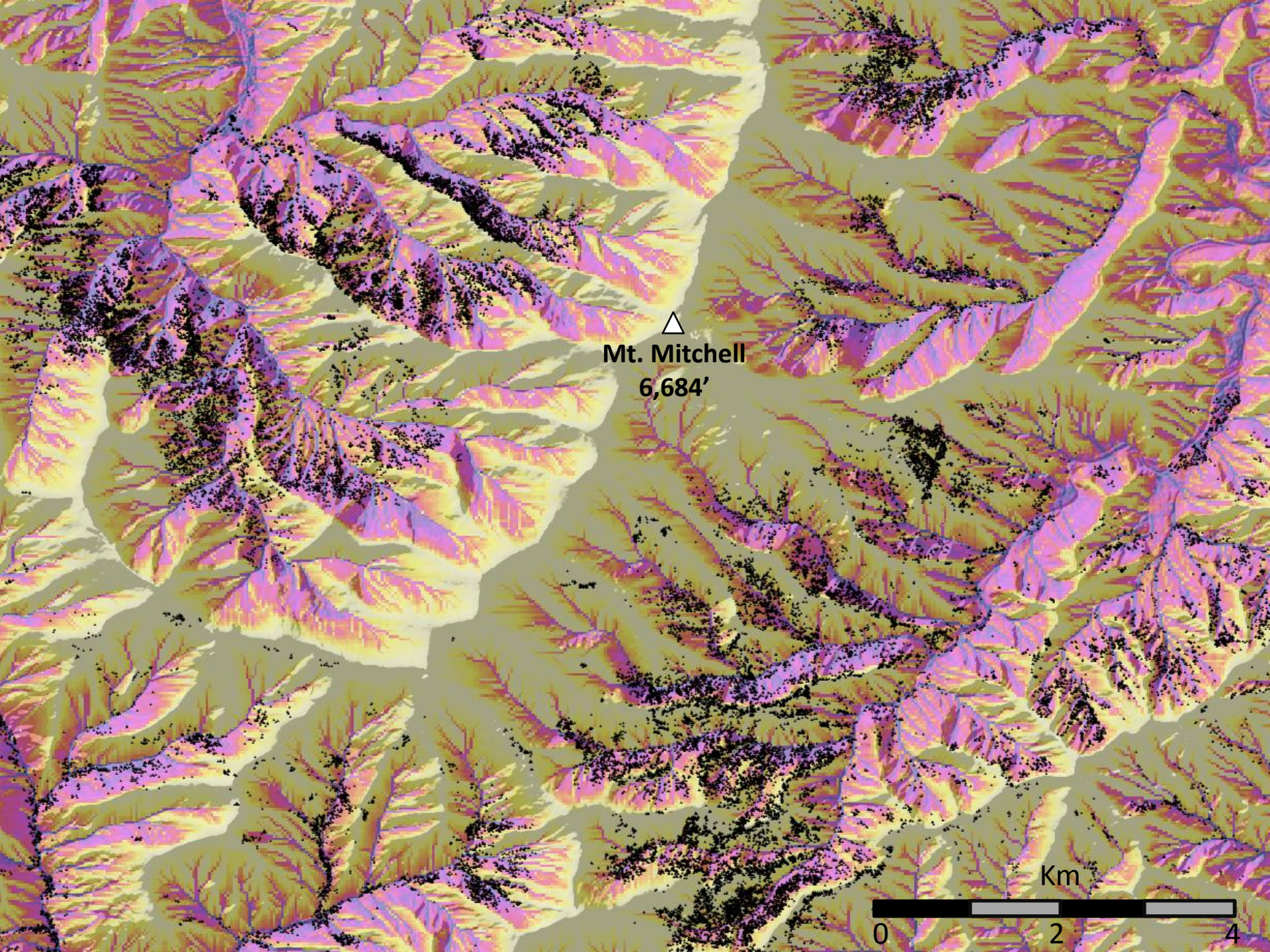
*MECHANISMS FOR ADDRESSING  
ECOLOGICAL NOVELTY AND RESILIENCE*



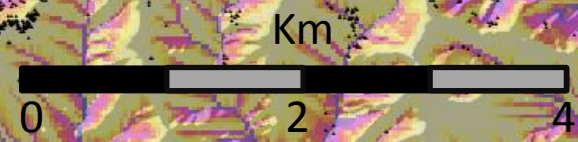




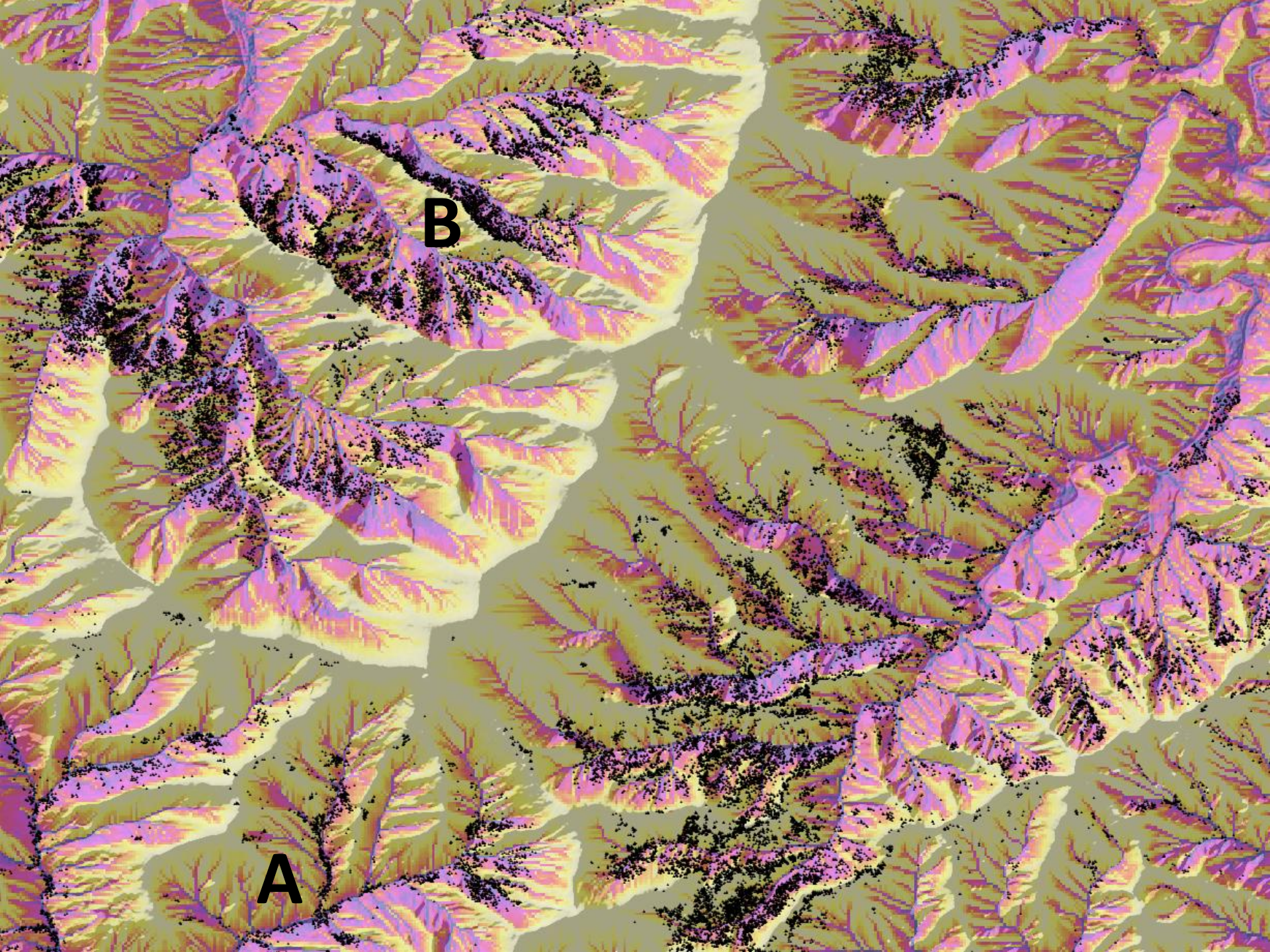




△  
Mt. Mitchell  
6,684'







**B**

**A**



A



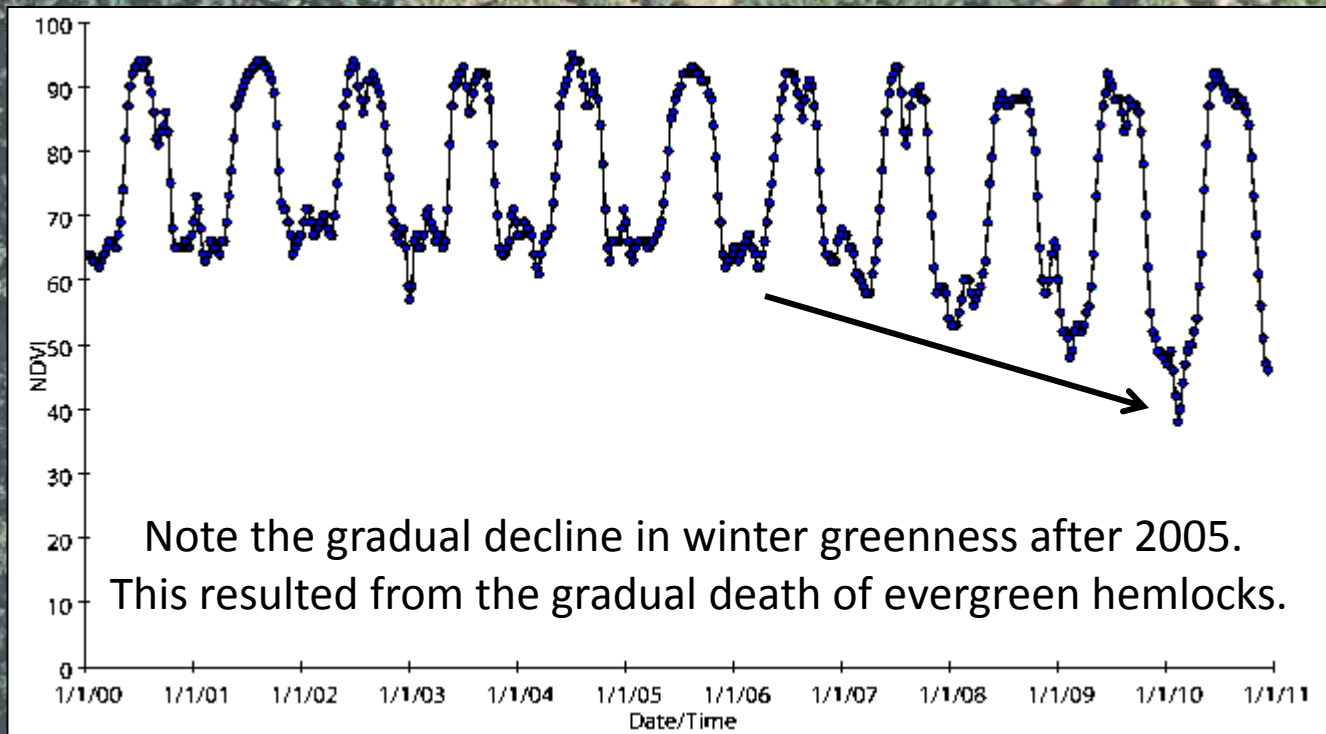


**B**





B





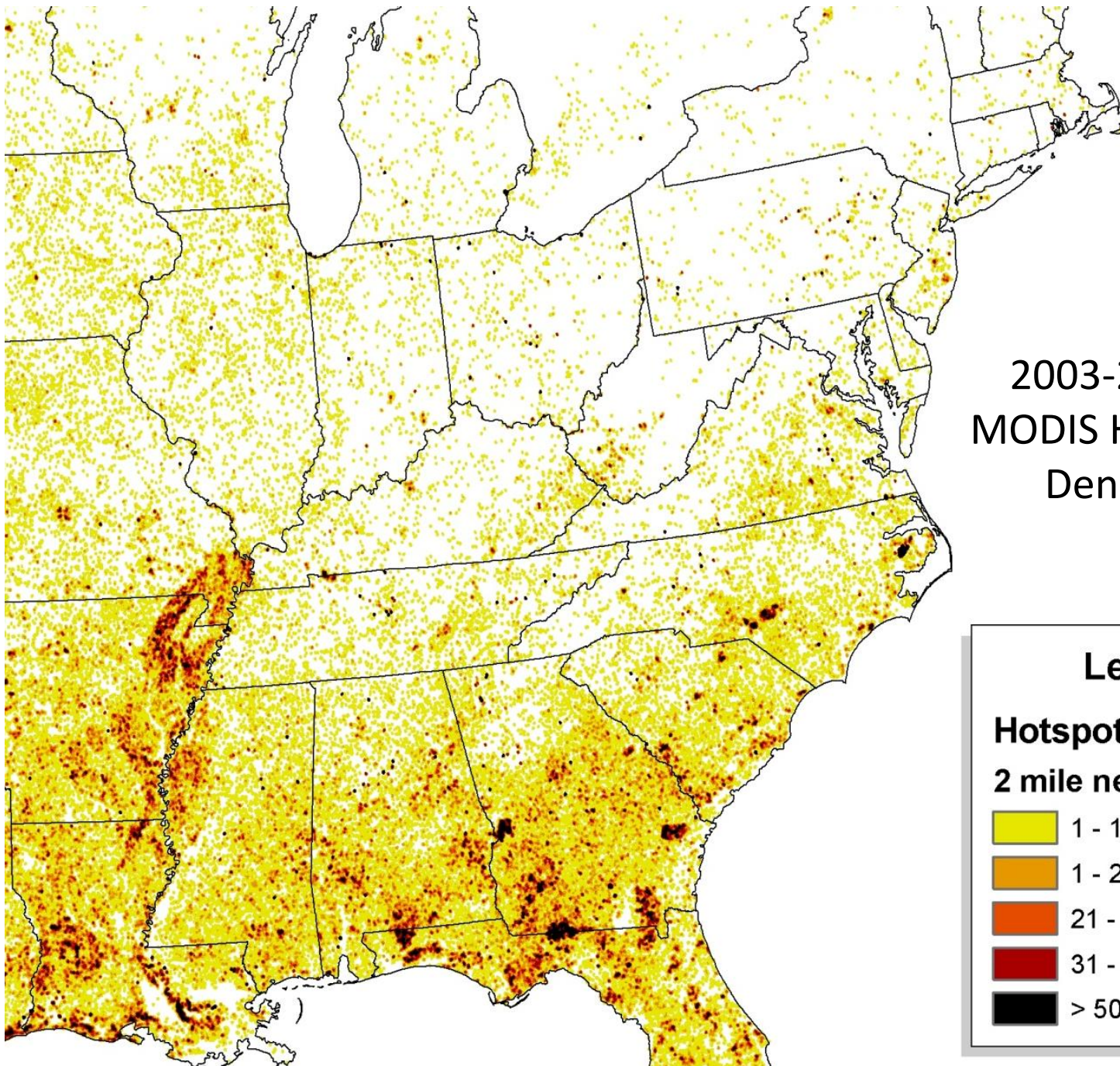
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*INTEGRATED DATASETS*

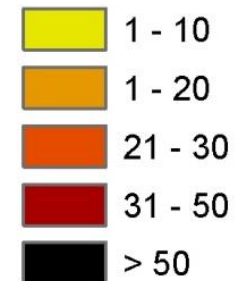


2003-2010  
MODIS Hotspot  
Density



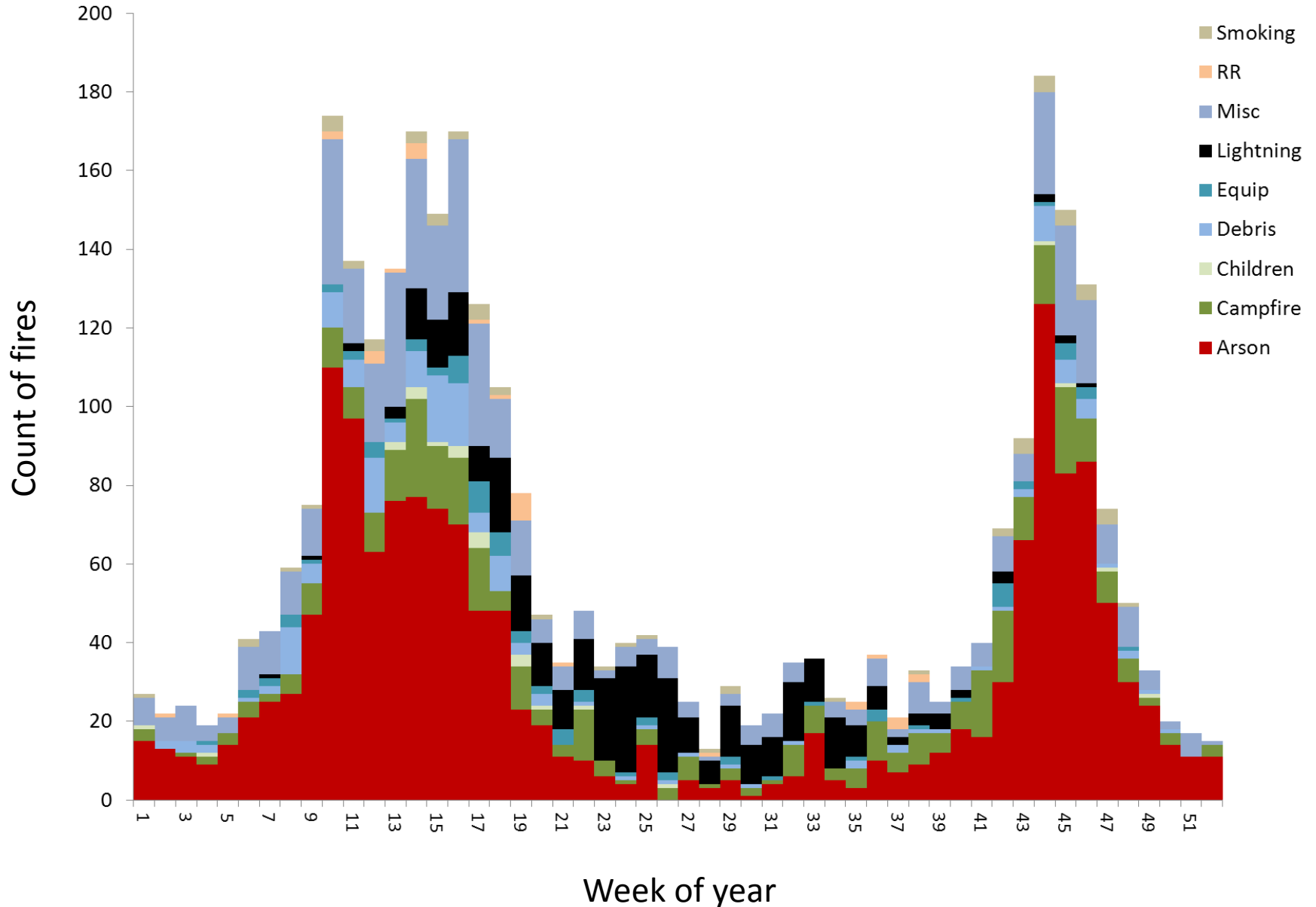
**Legend**

**Hotspot frequency  
2 mile neighborhood**



# Fires reported on National Forest Lands by cause

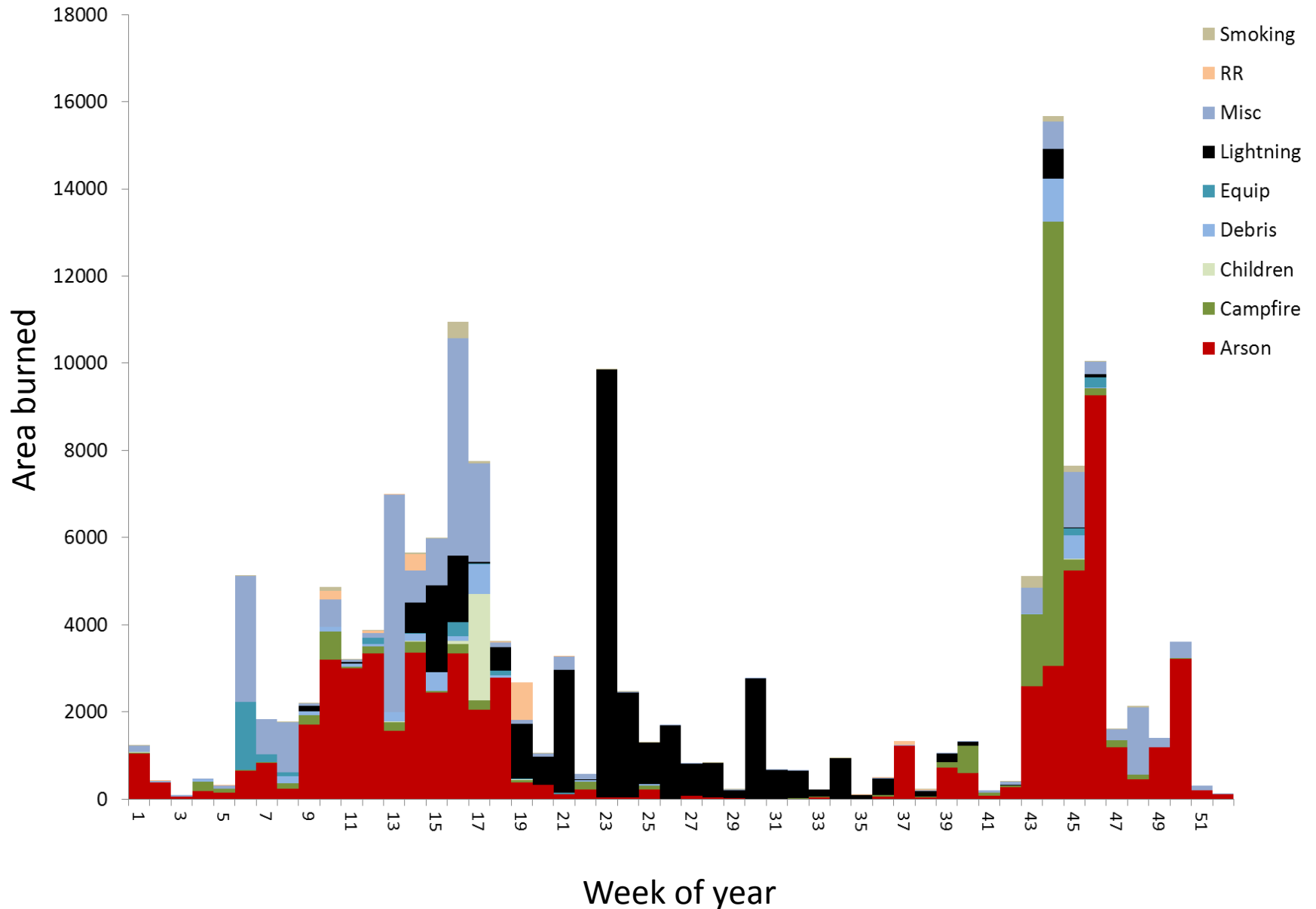
for GA, NC, VA, TN, KY, WV, PA, OH and NY; 2000-2010





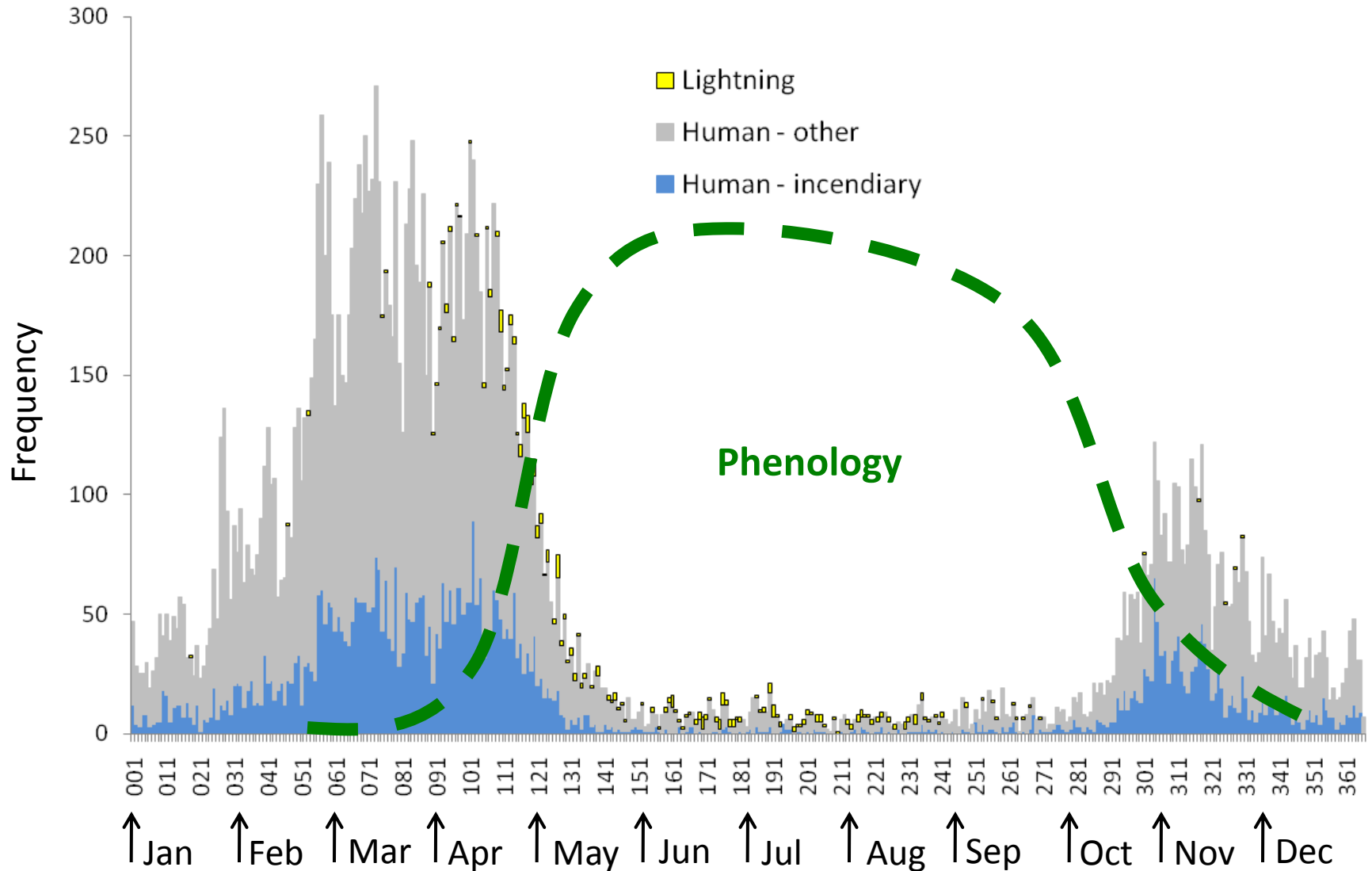
# Fires reported on National Forest Lands by cause

for GA, NC, VA, TN, KY, WV, PA, OH and NY; 2000-2010



# Western North Carolina Wildfires 1970-2009

## 17 Southern Appalachian Counties (Non-Federal Lands)





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*A PLANNING FRAMEWORK FOR INTEGRATING  
MULTIPLE VALUES AND UNCERTAINTY*







# Comparative Risk Assessment Framework and Tools



# The CRAFT process

*What's the problem?*

Specify  
Objectives

*What to do?*

Design  
Alternatives

*What could happen?*

Predict  
Effects

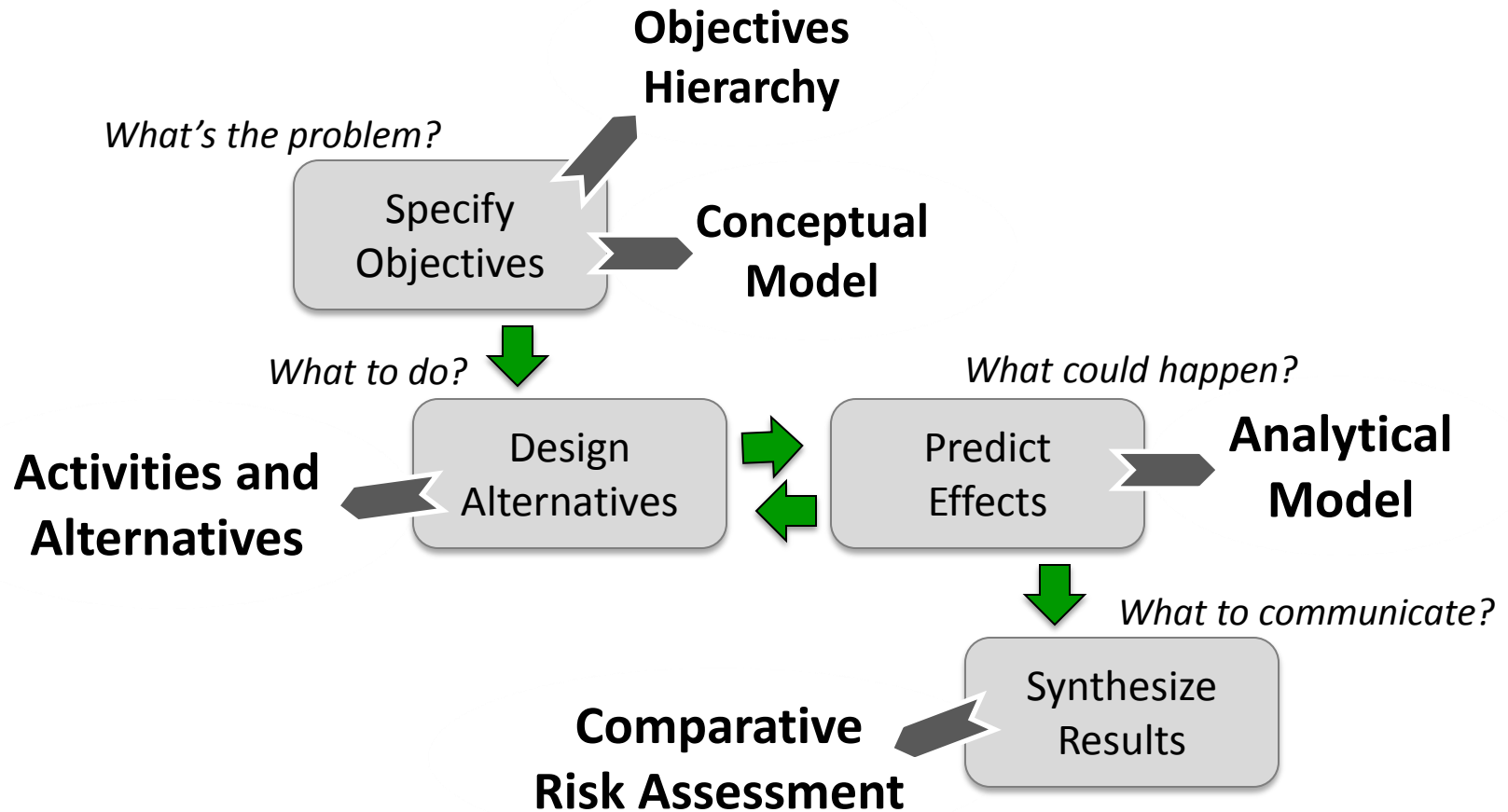
*What to communicate?*

Synthesize  
Results





# The CRAFT process



# The CRAFT process

## 1. Specify objectives

### Goal 1

Objective 1.1  
Strategy 1.1.1

### Goal 2

Objective 2.1  
Strategy 2.1.1  
Strategy 2.1.2  
Objective 2.2  
Strategy 2.2.1

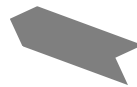
Strategies and causal understanding suggest tactical actions for Alternatives



Revise  
alternatives

Endpoints

are measurable outcomes



## 2. Design alternatives

No Action

Alternative A

Alternative B

Somewhat  
controllable

What we  
can control

Assessment  
endpoint

Somewhat  
controllable

What we  
can't control

Assessment  
endpoint

## 3. Predict effects

## 4. Synthesize results



# The Eastern Forest Environmental Threat Assessment Center



## SUMMARY

- Products and tools for static and dynamic ecosystem monitoring and characterization
- Products and tools for predicting short and long-term change
- A framework for integrating ecological and other values at risk



# The Eastern Forest Environmental Threat Assessment Center



[\*http://forestthreats.org\*](http://forestthreats.org)

**MONITORING**

**ASSESSMENT**

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