Geospatial Tools for Science Delivery and Supporting Forest Management Decisions

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NEMAC
National Environmental Modeling and Analysis Center

NC GIS Conference
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Collaborations and Partnerships

- USDA Forest Service's EFETAC (Eastern Forest Environmental Threat Assessment Center)
  - Science communicated to variety of audiences
  - Science to inform management options

- SENRLG (Southeast Natural Resource Leader's Group)
  - Climate change impacts to human and natural systems in North Carolina

Forest Management Challenges

- Competing values (trade-offs) and increasing risk

A Decision Support Framework

- Understanding the problem and setting goals
  - What is it that we care about?
  - How should we measure our values?
- Analyzing the effects of management options
  - How will certain actions achieve our goals?
  - How do these actions reduce risk?
- Communicating to a variety of stakeholders
  - Who is affected and how?

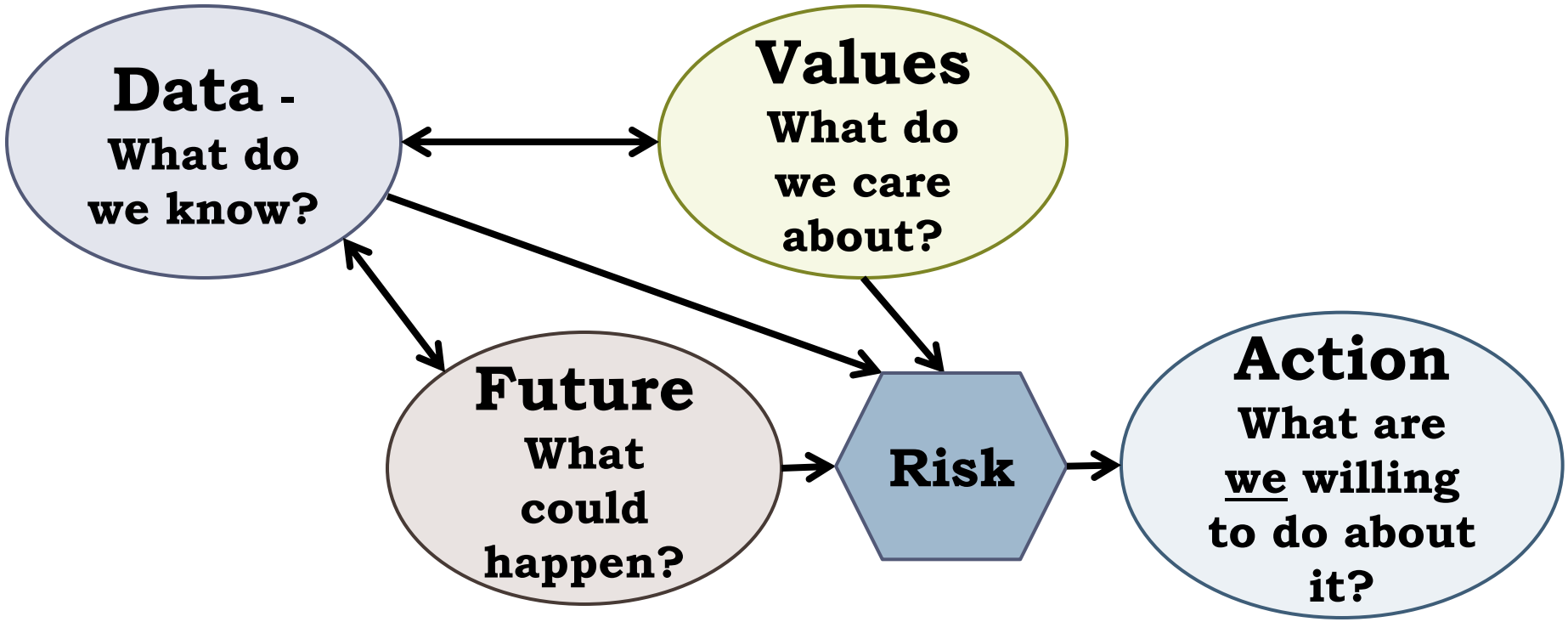
Principles of Decision Support

- Provide information that represents multiple stakeholder **values**, perspectives, and issues
- Provide information at **scale** of decision (multiple)
- Recognize how to reduce **risk** and take advantage of opportunity
- **Adaptable** to changing needs and available information
- Information should be **accessible** and understandable to decision makers and in a timely manner.

"Efforts to produce, disseminate, and facilitate the use of data and information in order to improve the quality and efficacy of decisions"

- Informing Decisions in a Changing Climate (2009)

Data to Decisions

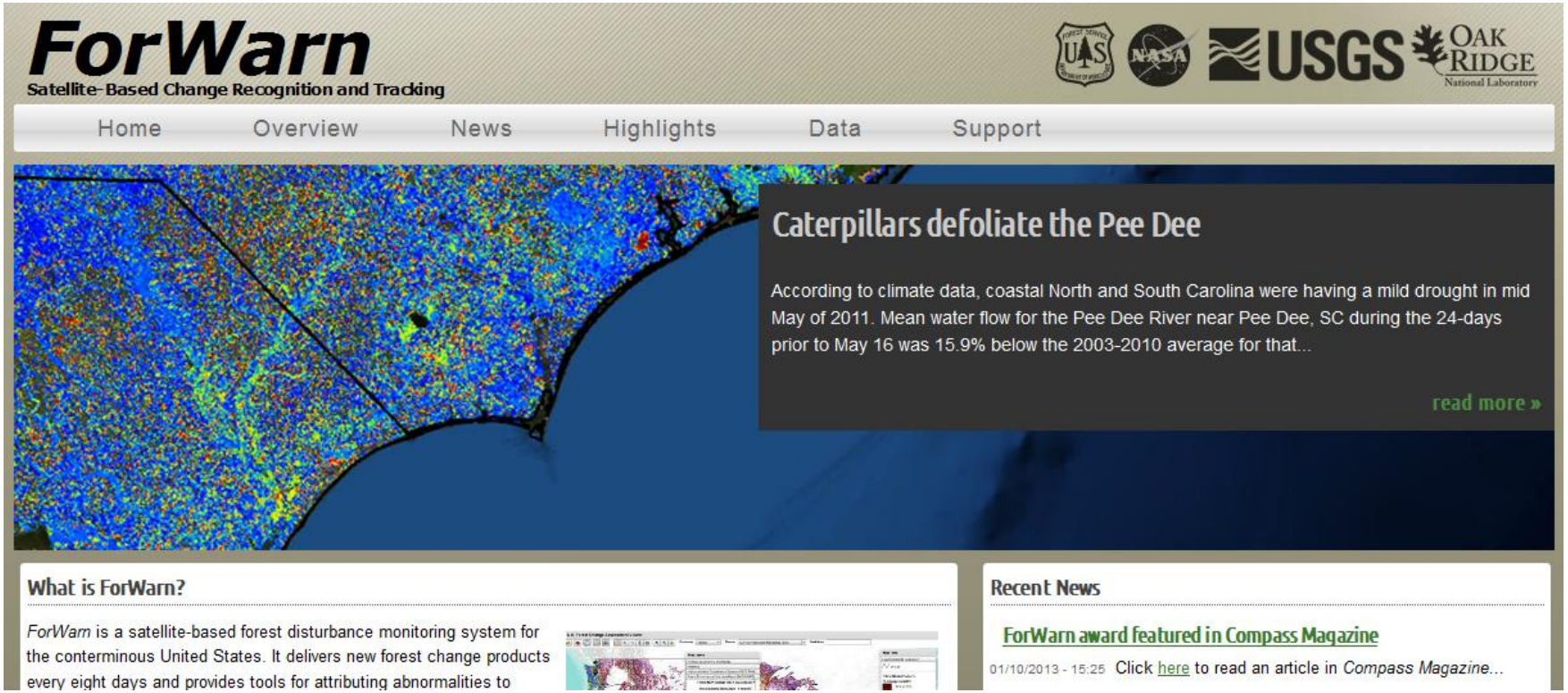


GIS provides information at the scale needed for the decision and helps inform choices

ForWarn: Satellite-based Forest Change Recognition and Tracking

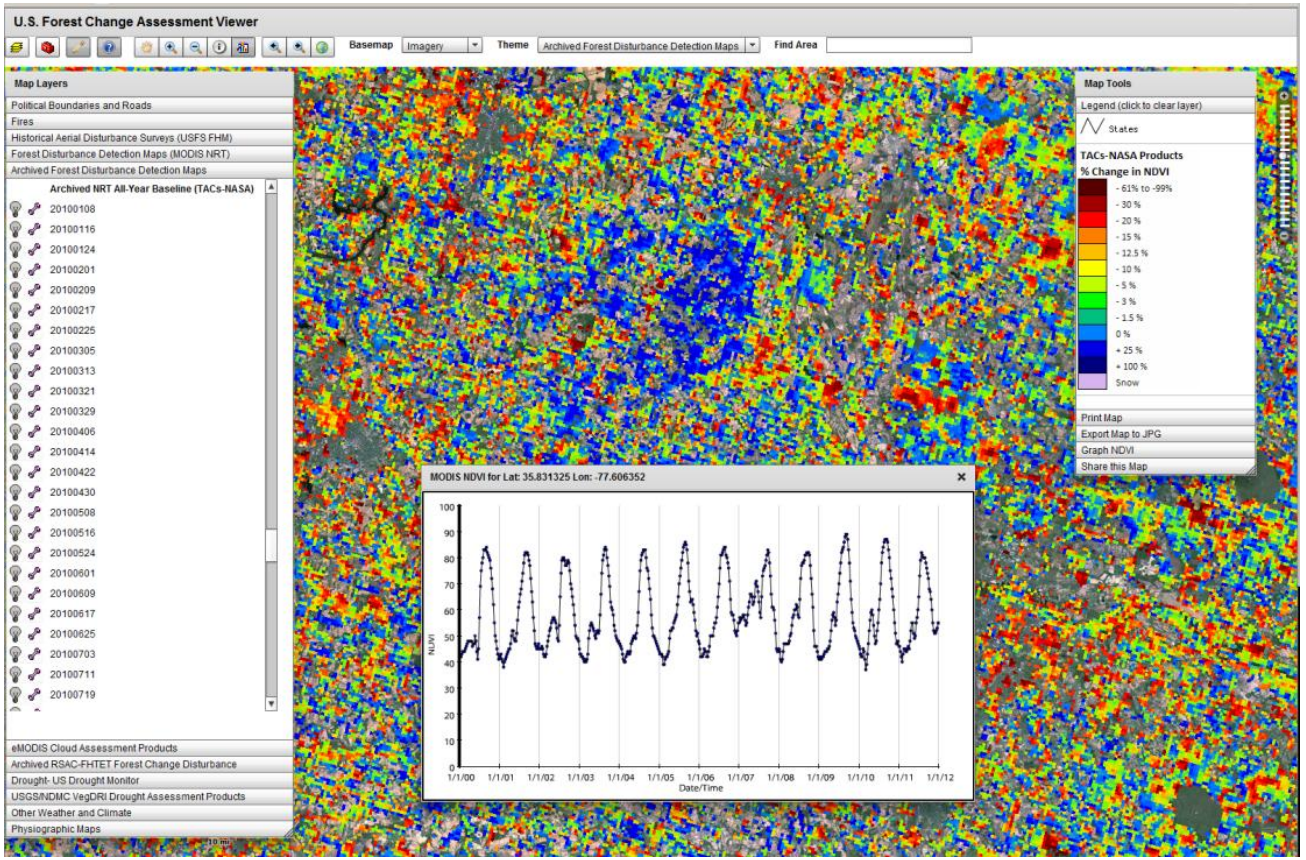
- Making scientific knowledge and information accessible
- Satellite image updated every 8 days
- NDVI and Change Detection Products track forest conditions

www.forwarn.forestthreats.org



ForWarn: Assessment Viewer

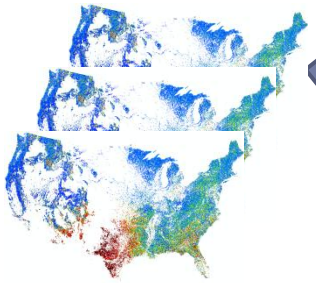
- Forest Change Products from 2010-present in Near-real Time
  - Compared to multiple baseline averages
- Interactive Multigraph displays NDVI from 2000-2011



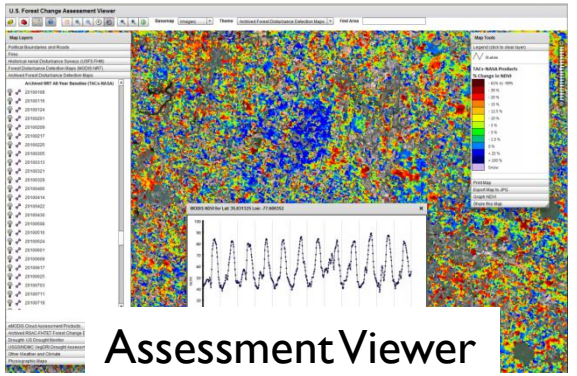
ForWarn: GIS Web Services

- Over 1,000 data layers
  - Using PostGIS and Mapserver on "back end"
  - All available online and as WMS or WCS for custom analysis

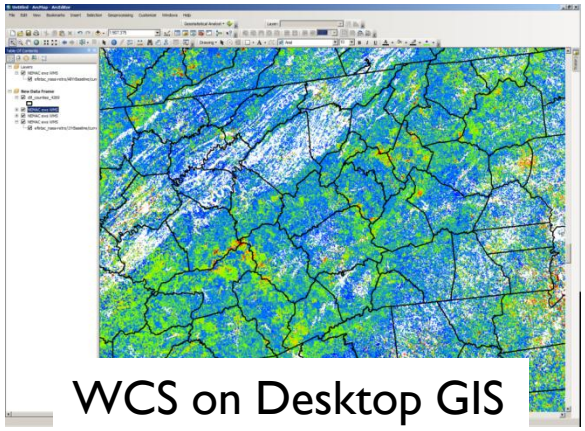
Vector



Raster



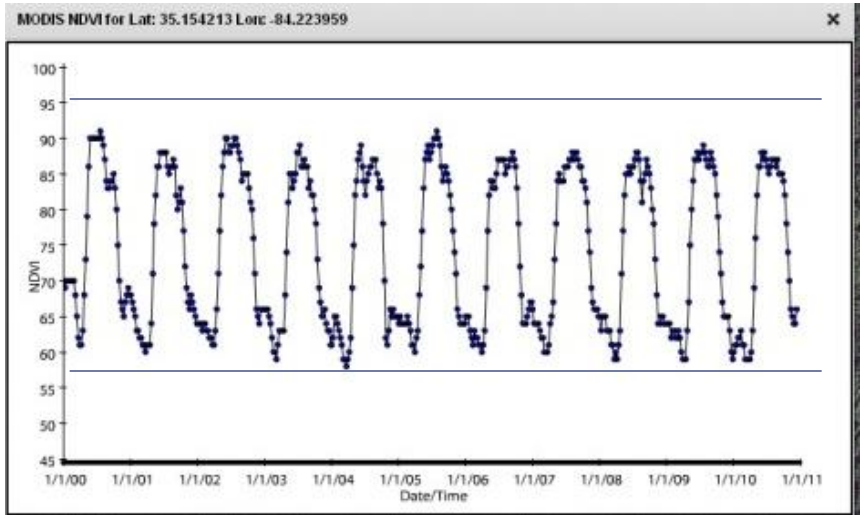
Assessment Viewer



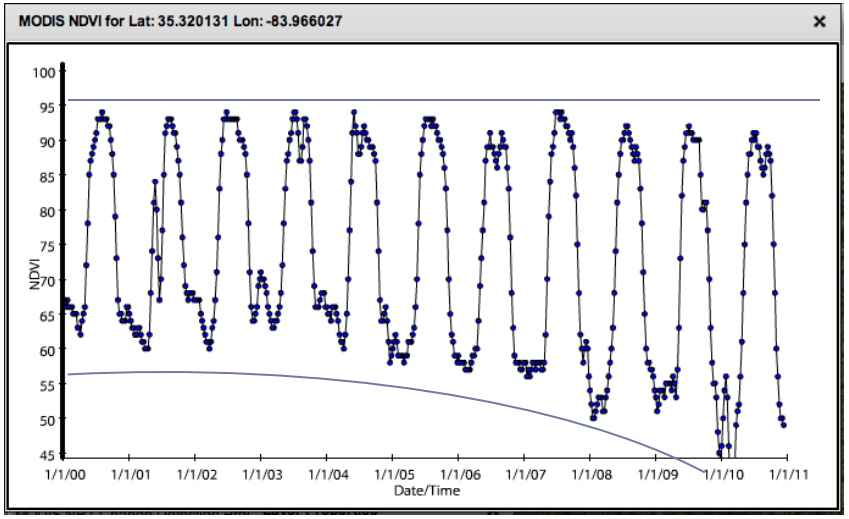
WCS on Desktop GIS

Hemlock Woolly Adelgid, WNC

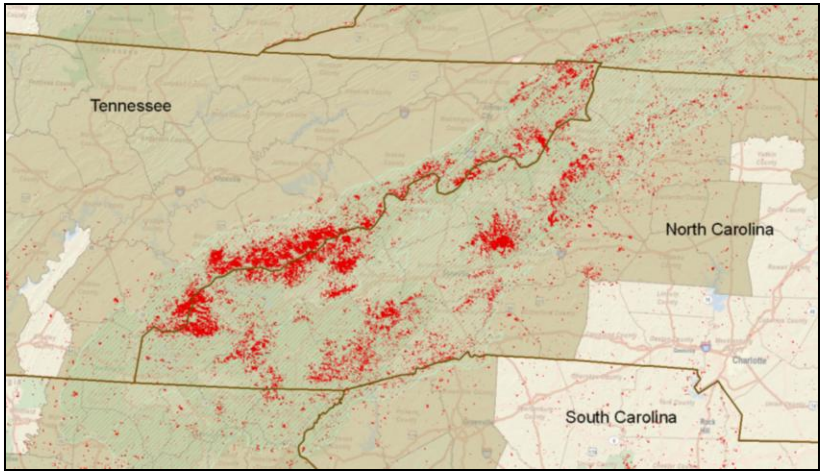
Typical Curve for Healthy Hemlock



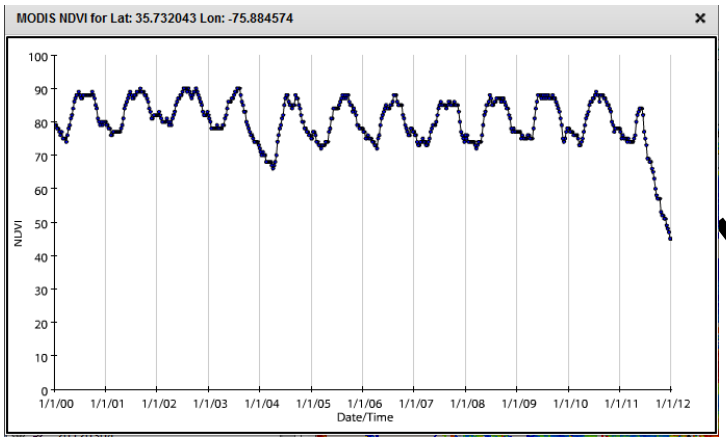
Typical Curve for Hemlock Affected by HWA

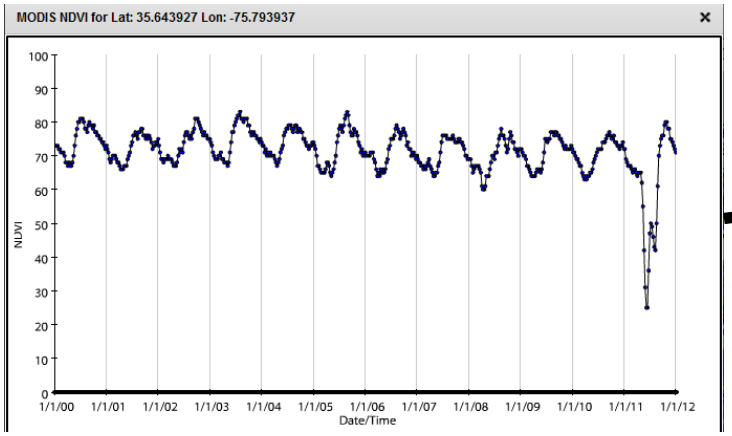


Custom Desktop Analysis through WCS (Web Coverage Service)

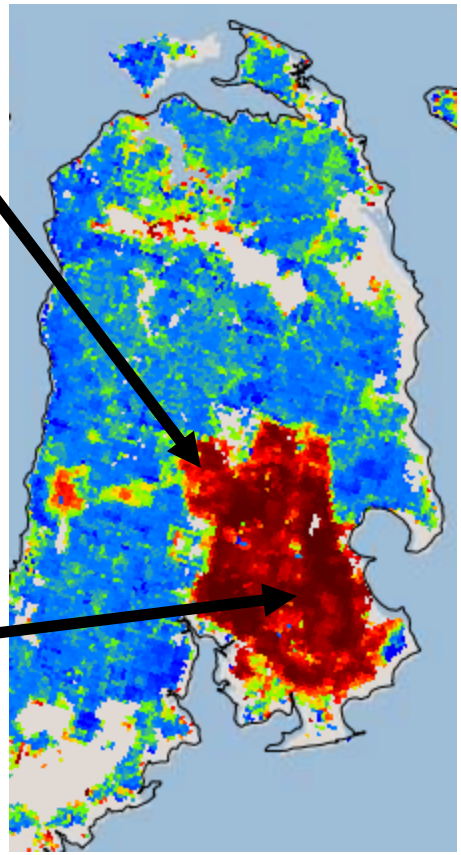


Pains Bay Fire, Dare County NC

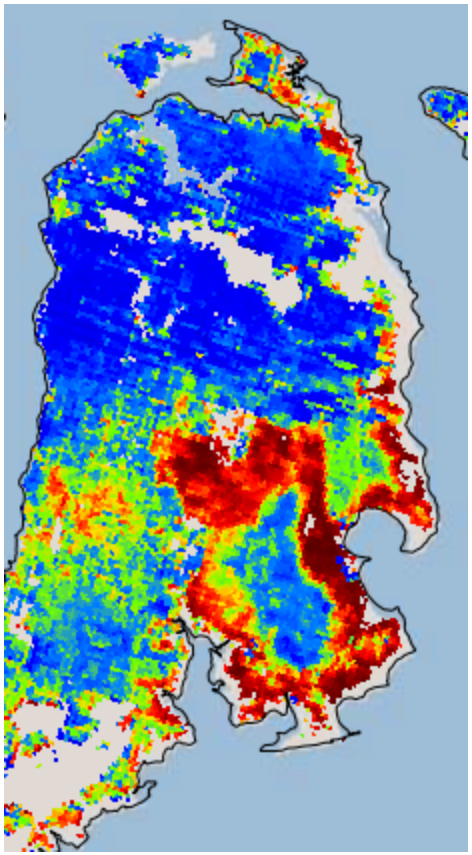




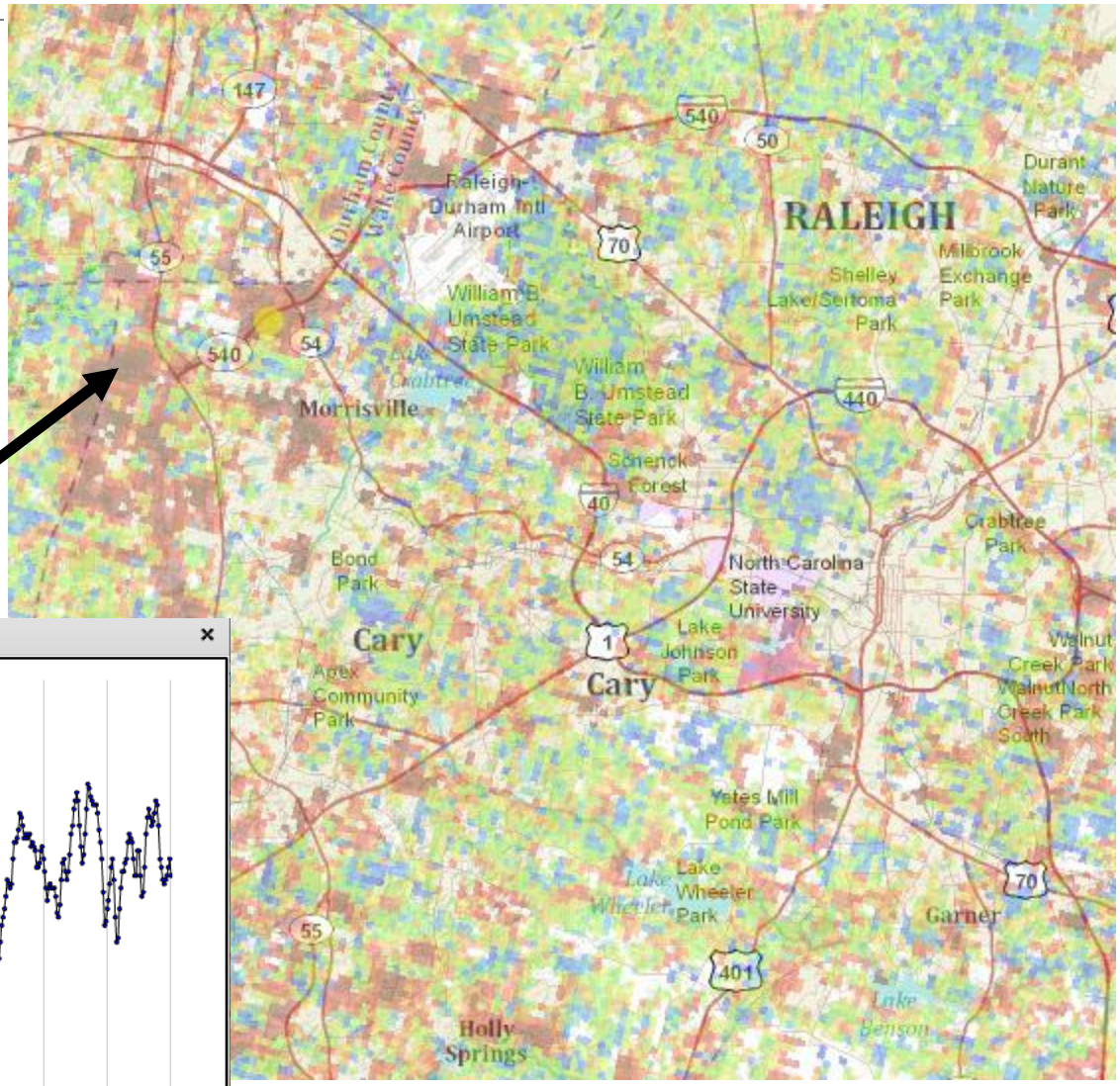
7/27/2011



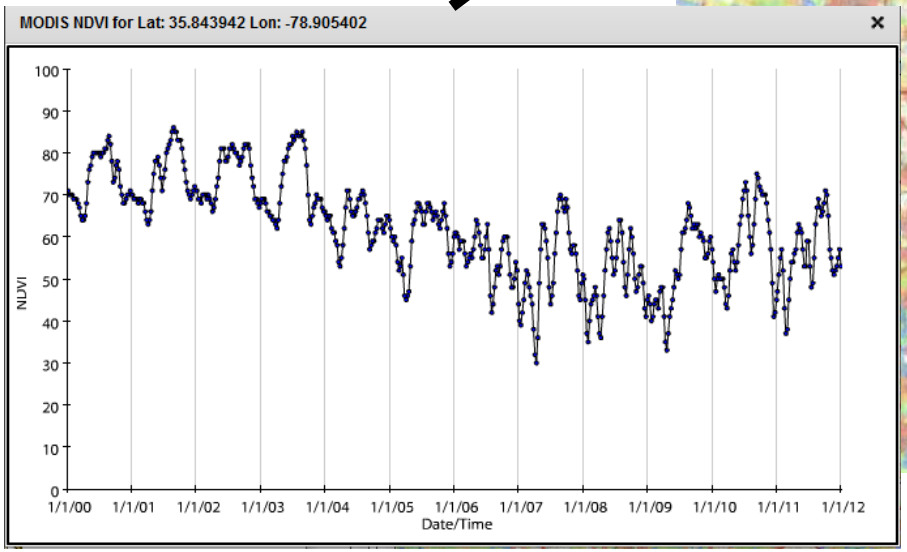
12/26/2011

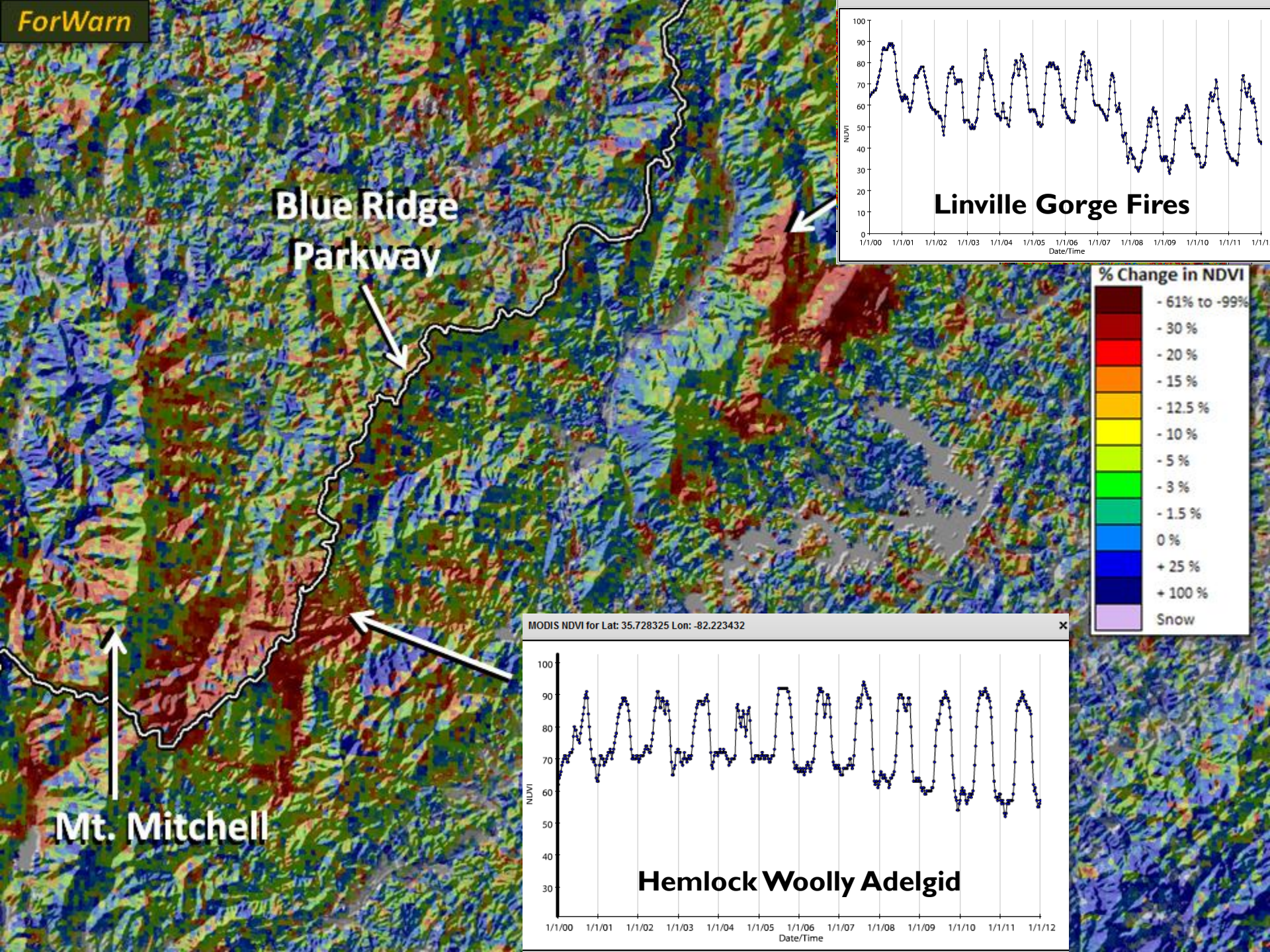


Forest Change in Raleigh, NC



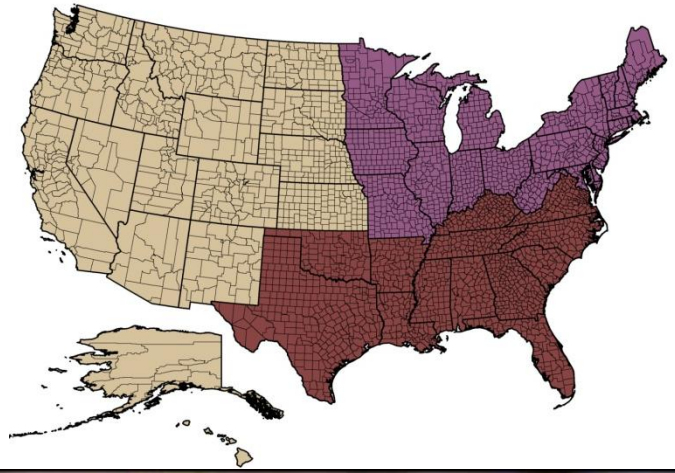
1/9/2013




ForWarn
Blue Ridge Parkway
Mt. Mitchell
Linville Gorge Fires
NDVI
Date/Time
% Change in NDVI
- 61% to -99%
- 30 %
- 20 %
- 15 %
- 12.5 %
- 10 %
- 5 %
- 3 %
- 1.5 %
0 %
+ 25 %
+ 100 %
Snow
MODIS NDVI for Lat: 35.728325 Lon: -82.223432
Hemlock Woolly Adelgid
1/1/00 1/1/01 1/1/02 1/1/03 1/1/04 1/1/05 1/1/06 1/1/07 1/1/08 1/1/09 1/1/10 1/1/11 1/1/12

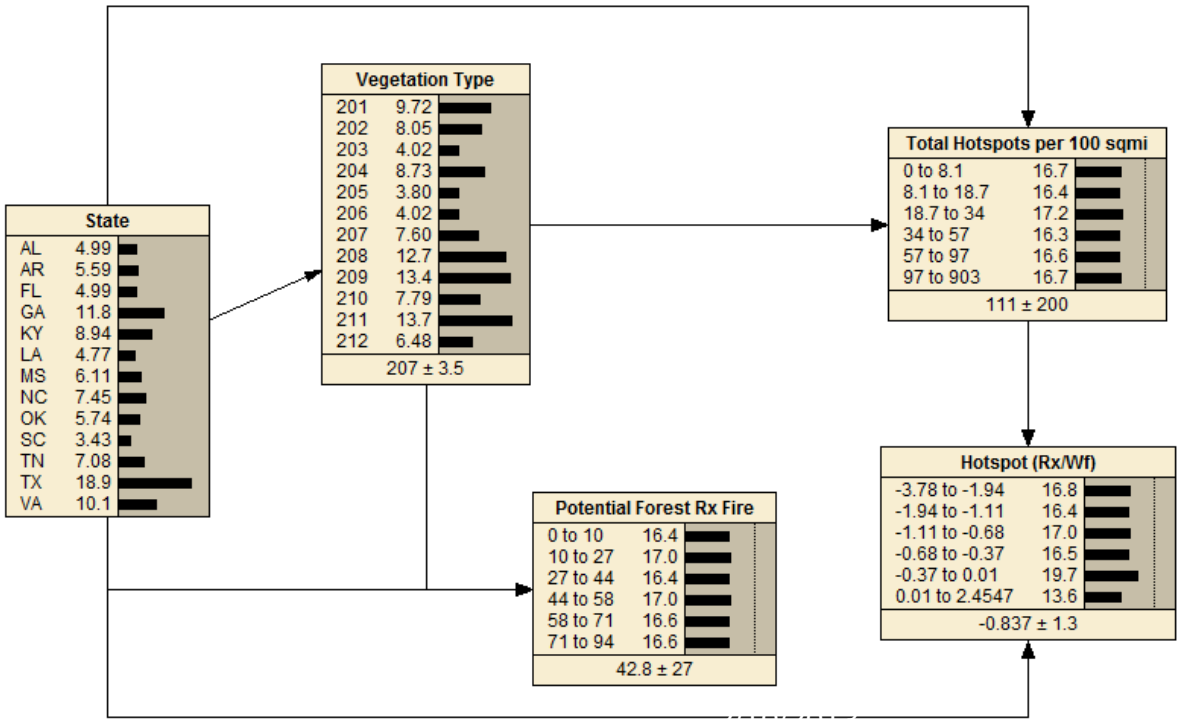
National Cohesive Fire Strategy

- Using science to inform management options
- Focus Areas
  - Resilient Landscapes
  - Fire Adapted Communities
  - Response to Wildfire
- National County-level Analysis



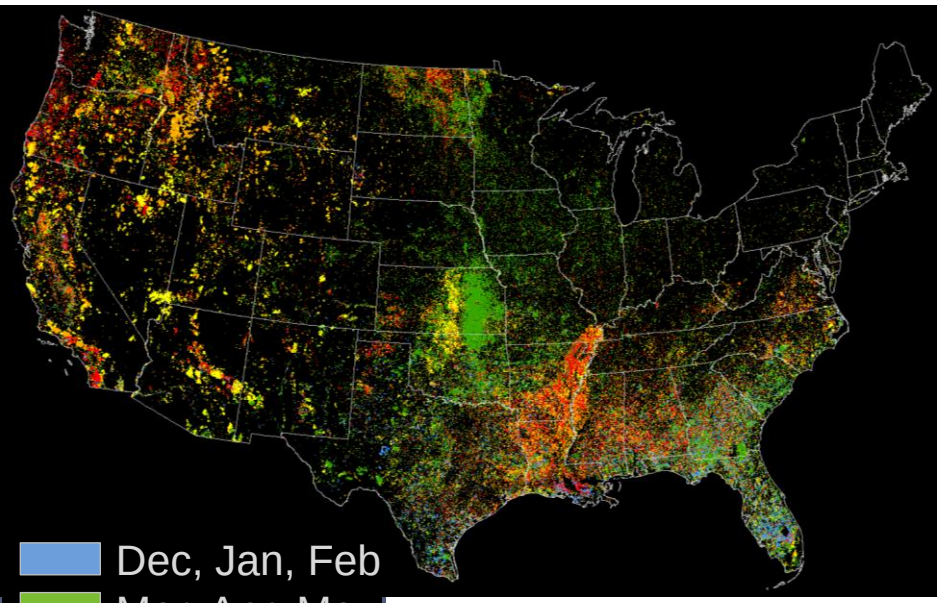
Analytical Approach

- Influence Diagrams, a.k.a. Bayesian Belief Networks
  - Used to show causal relationships
  - Uses conditional probability and probabilistic modeling to quantify relationships.
  - Highly flexible.



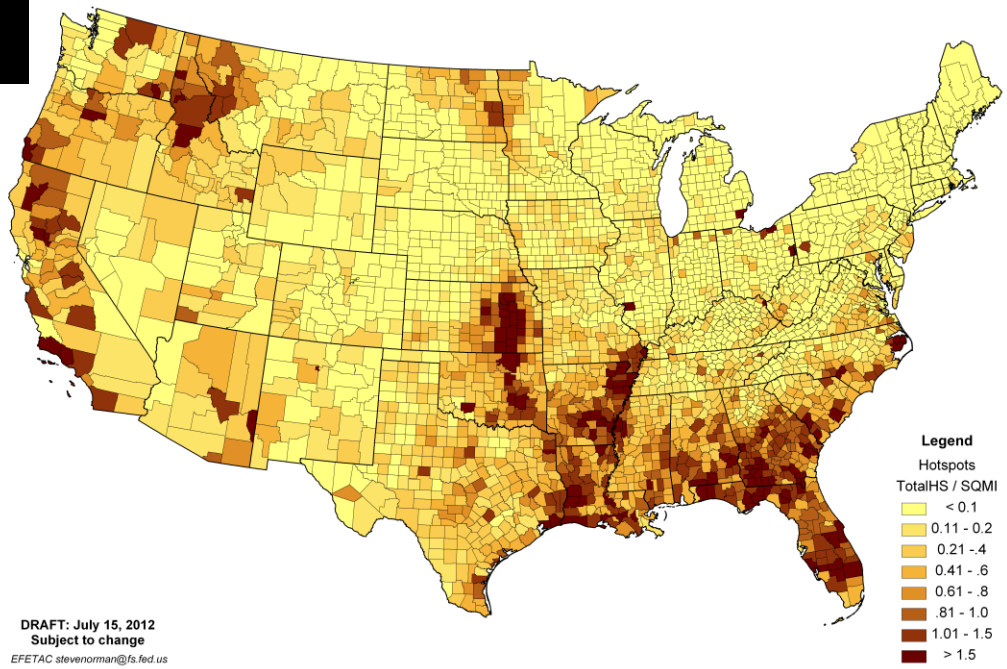
Preliminary Data

Supporting County Level Analysis



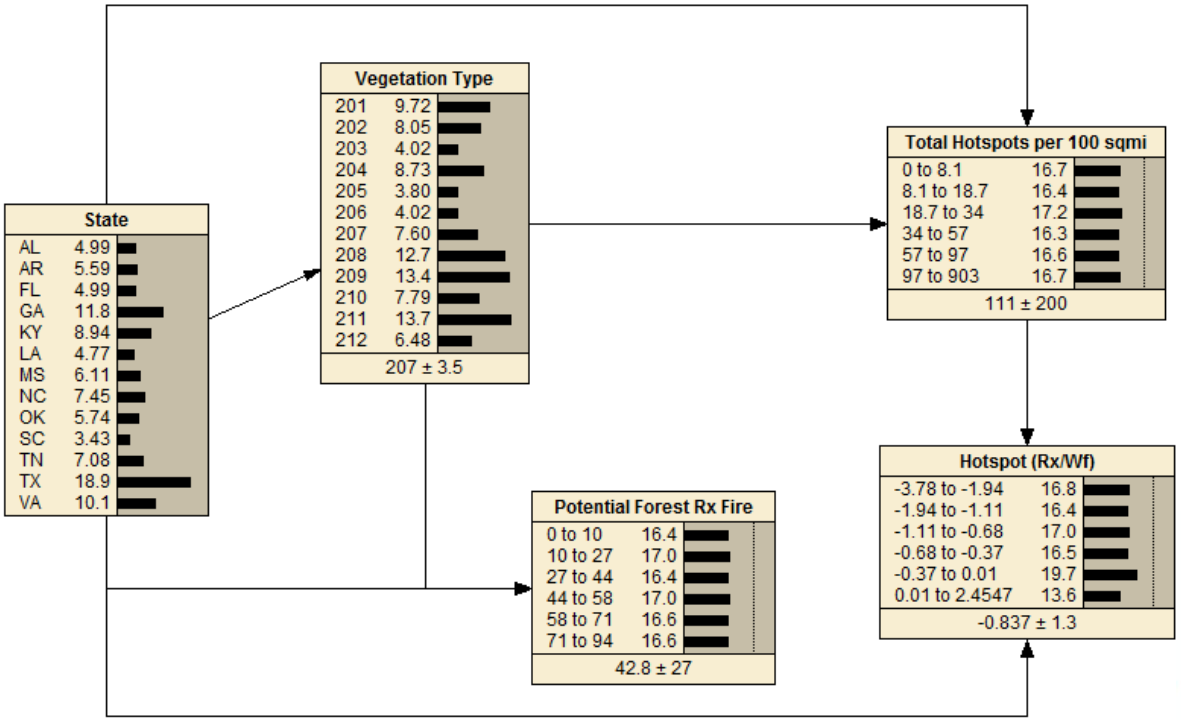
Seasonality of fire from space

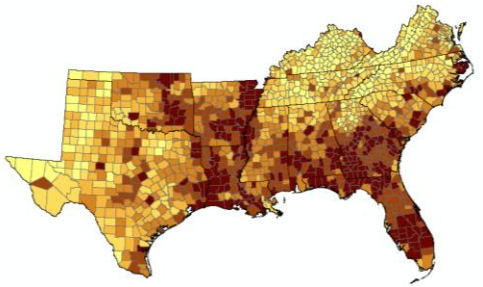
as inferred from MODIS hotspots
2001-2011

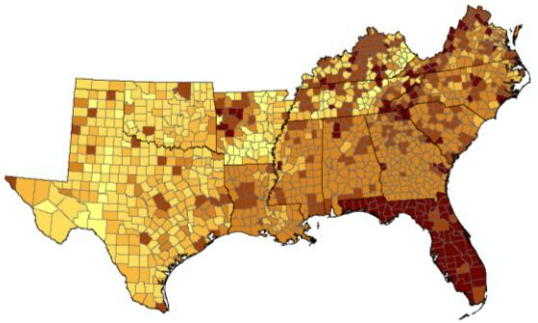


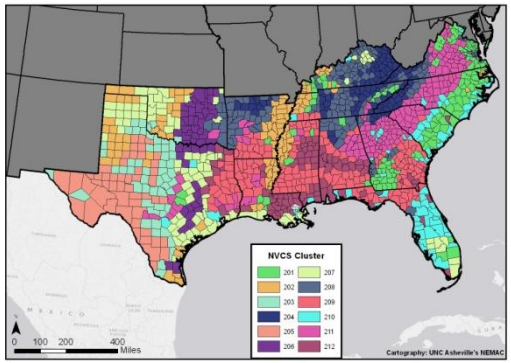
Preliminary Data

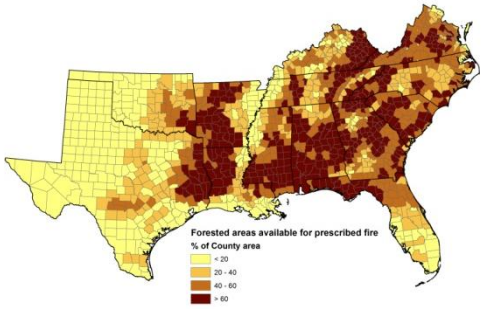
Prescribed Fire in the Southeast











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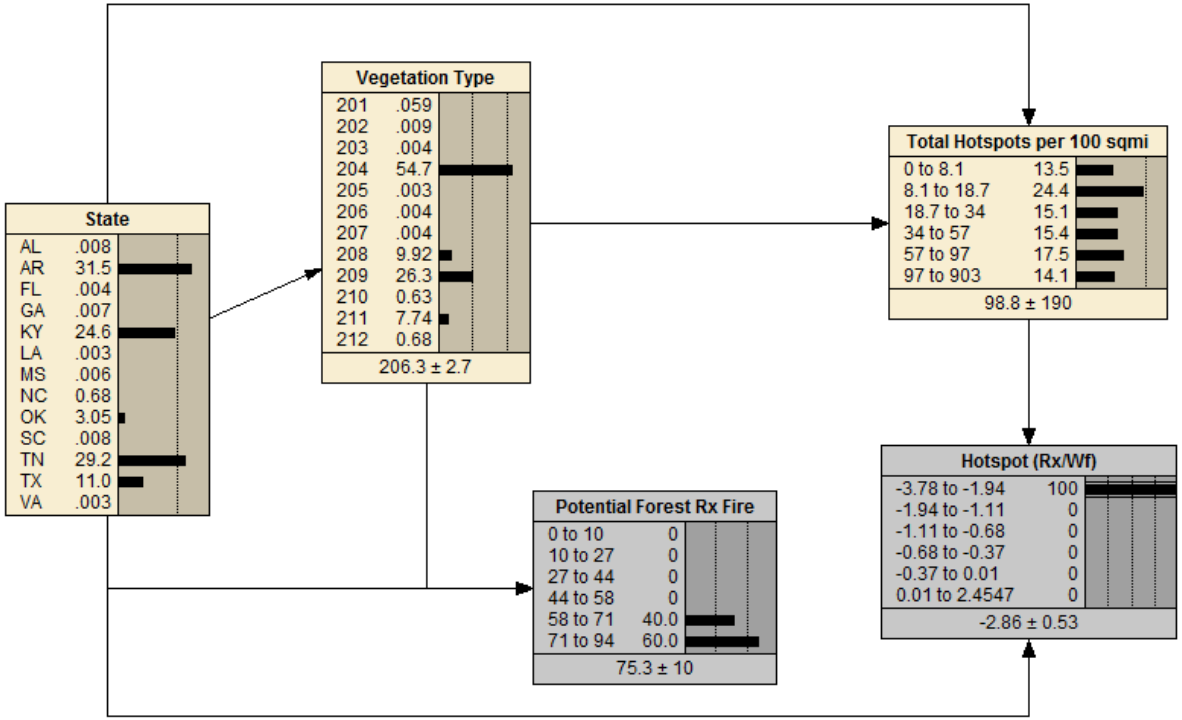
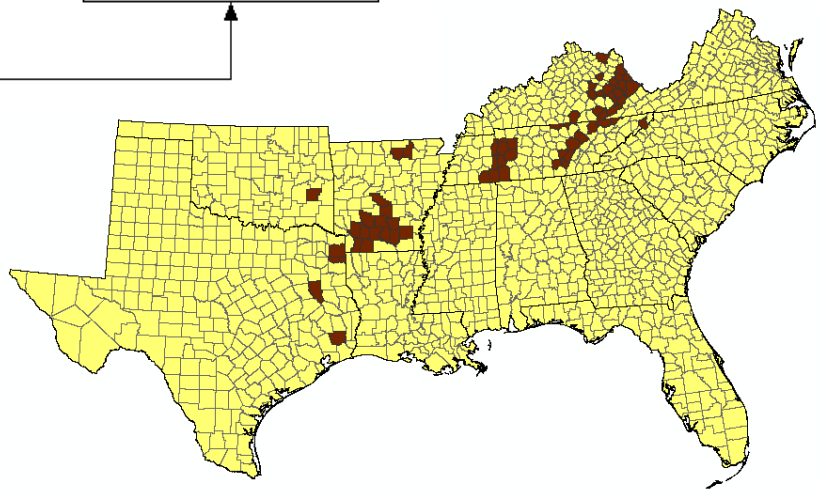


Counties with little prescribed fire activity but high potential



Preliminary Data

Summary

- GIS crucial to supporting/communicating analytical process for forest management decisions
- Process more important than Products
- Products and tools should be able to provide information at a relevant scale for decision making
- Open-source solutions
  - *"Open source isn't about saving money, it's about doing more stuff"*
- Making information accessible
  - Better OGC standard support needed in client side software
- Transparency in "building blocks" of analytical process

Acknowledgements

- ForWarn Team
  - William Hargrove, William Christie, Steve Norman, (USFS EFETAC), Joe Spruce (NASA)
- Cohesive Strategy National Science Analysis Team
  - Danny Lee, Steve Norman (USFS EFETAC), Tom Quigley (METI)
- Southeastern Natural Resource Leaders Group
  - Rick Durbrow (EPA)

Resources

- ForWarn Website
  - www.forwarn.forestthreats.org
- National Cohesive Strategy
  - www.forestsandrangelands.gov
- Informing Decisions in a Changing Climate
  - National Research Council (2009)

Thanks!

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