

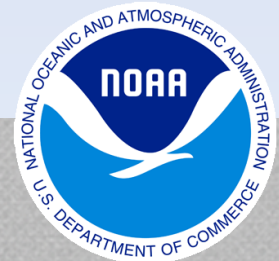
# Frost and Freeze Data and Impacts to the Agriculture, Construction and Transportation Industry *Decision Support Tools, etc.*



Jim Fox

Director, UNC Asheville's NEMAC

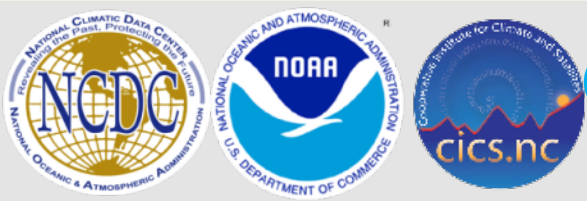
March 21, 2013



# UNC Asheville's NEMAC

## National Environmental Modeling and Analysis Center

- **Applied Research** and technology development of environmental and climate data sets
  - Data and GIS
  - Visualization
  - Decision Making
- **Decision Support tools** for Flood Mitigation, Emergency Response, Forest Health, Water Resource Issues, Planning, Vulnerability and Resilience
- **Collaboration** among government, academia and private enterprise
- **Active Undergraduate Research**



# Climate Literacy Education and Research (CLEaR)



## Eastern Forests Environmental Threat Assessment Center (EFETAC)



## Renaissance Computing Institute State of North Carolina

### Local and State Government



### Mountain Resources Commission

### Companies



**ELUMENATI**  
IMMERSIVE PROJECTION DESIGN

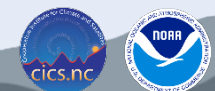
**Brown AND Caldwell**

**LandDesign**



### Others

Southeast Natural Resource Leaders Group



# Overview

- **Baseline changes in climate increases risk of weather impact**
  - Late Frost impact on plants after early onset to growing season
  - Change of growing season length impact on natural system
  - Freeze and thaw impacts on mobility and design
- **Non-climate issues add to sensitivity**
  - Agriculture practice changes, Forest invasives and pests
  - Population and demographic changes, Economic Issues
  - Transportation planning and design
- **Group Decision Making is a process that needs to be actively supported with appropriate technologies and toolsets**
- **Collaboration is key – the three sectors of government, academia and industry must work together to meet this challenge**

# Decision Making Building Blocks

**Data -  
What do we  
know?**

- Housing
- Transportation
  - Energy
- Jobs/Economic Dev.
- Natural and Cultural Resources
  - Land Use
  - Health

# Decision Making Building Blocks

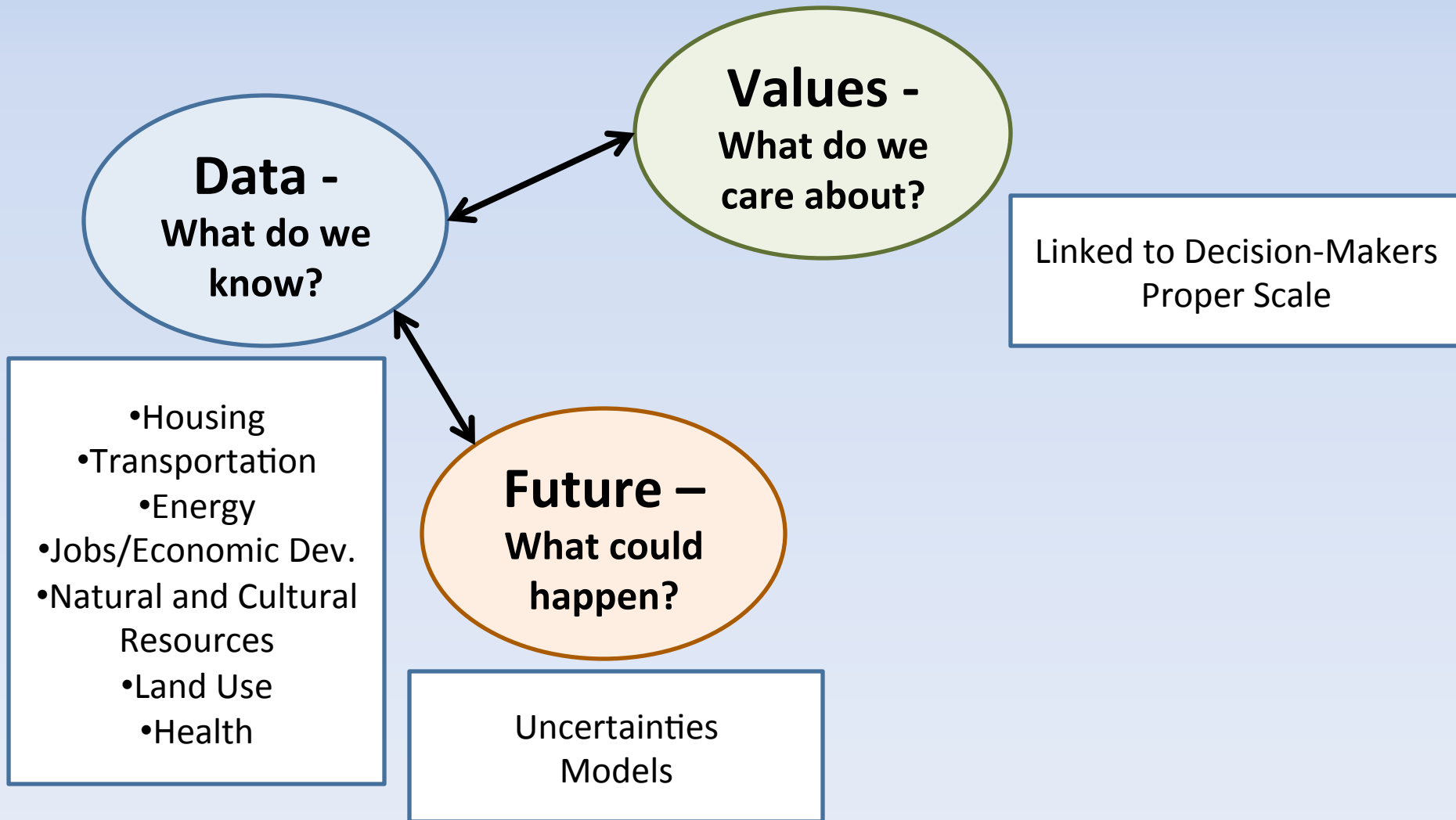
**Data -  
What do we  
know?**

**Values -  
What do we  
care about?**

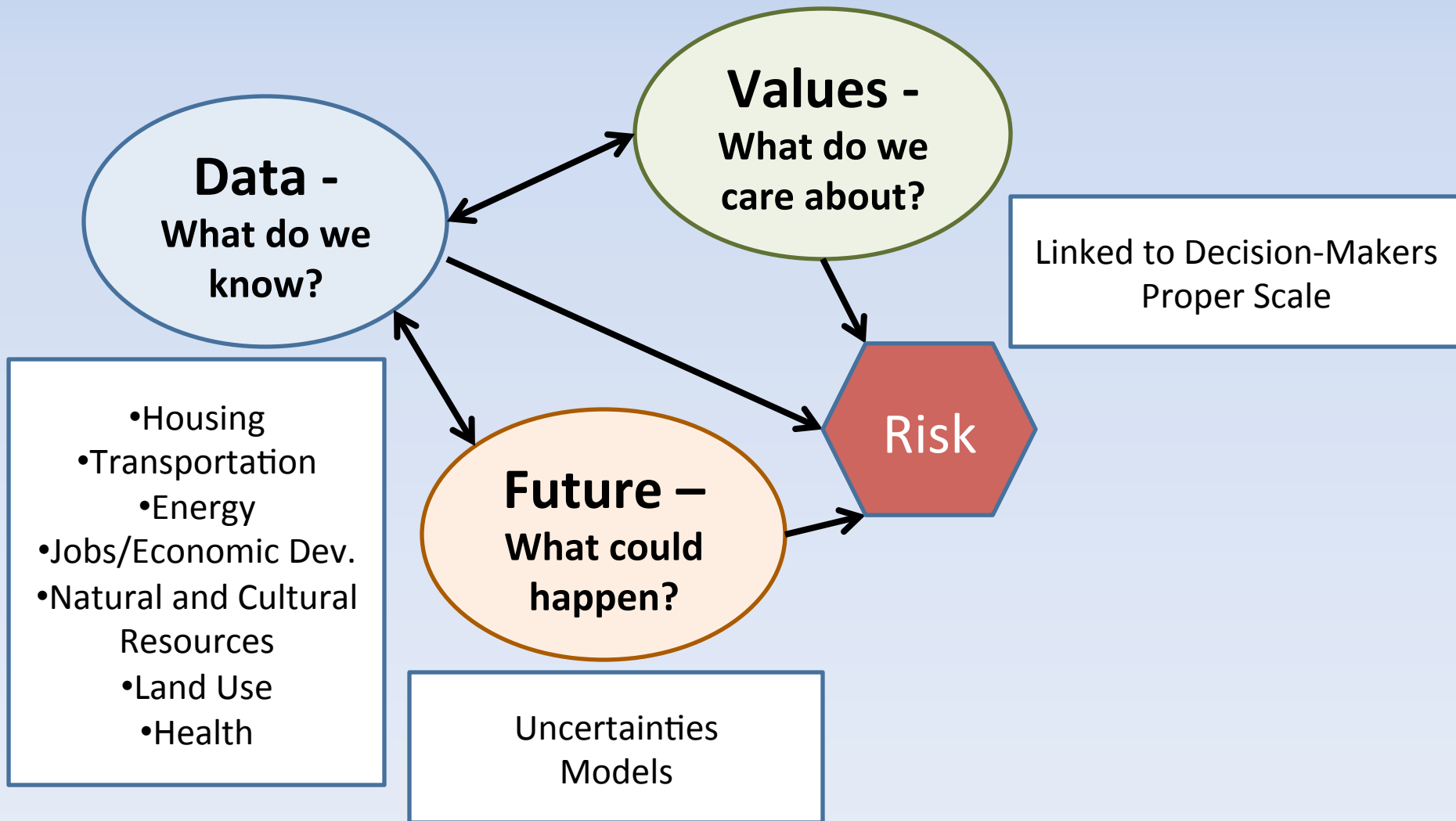
Linked to Decision-Makers  
Proper Scale

- Housing
- Transportation
  - Energy
- Jobs/Economic Dev.
- Natural and Cultural Resources
  - Land Use
  - Health

# Decision Making Building Blocks

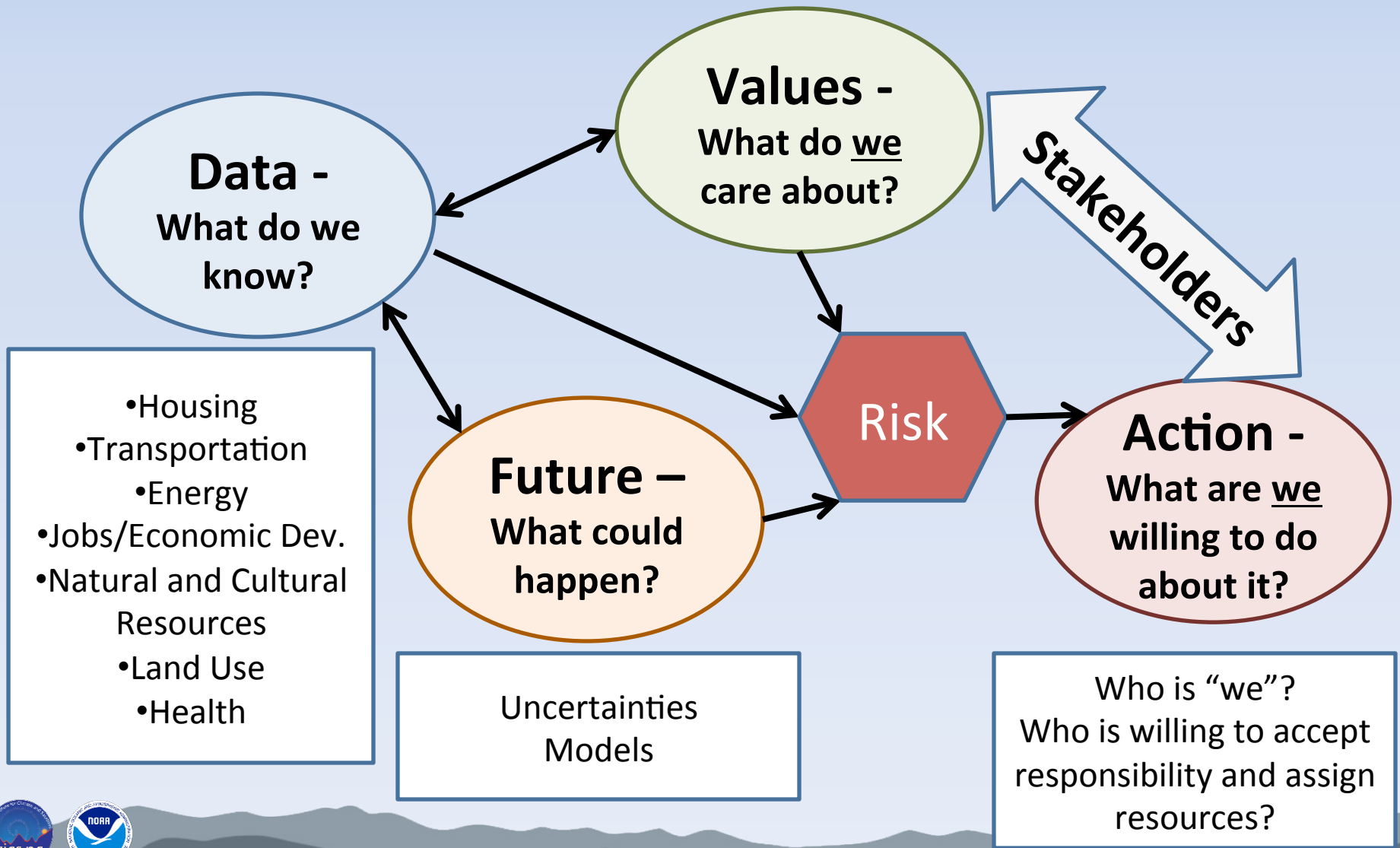


# Decision Making Building Blocks





# Decision Making Building Blocks



# National Climate Assessments

[www.globalchange.gov](http://www.globalchange.gov)

Decision Portals, GIS Viewers, Facilitation in support of the NCA

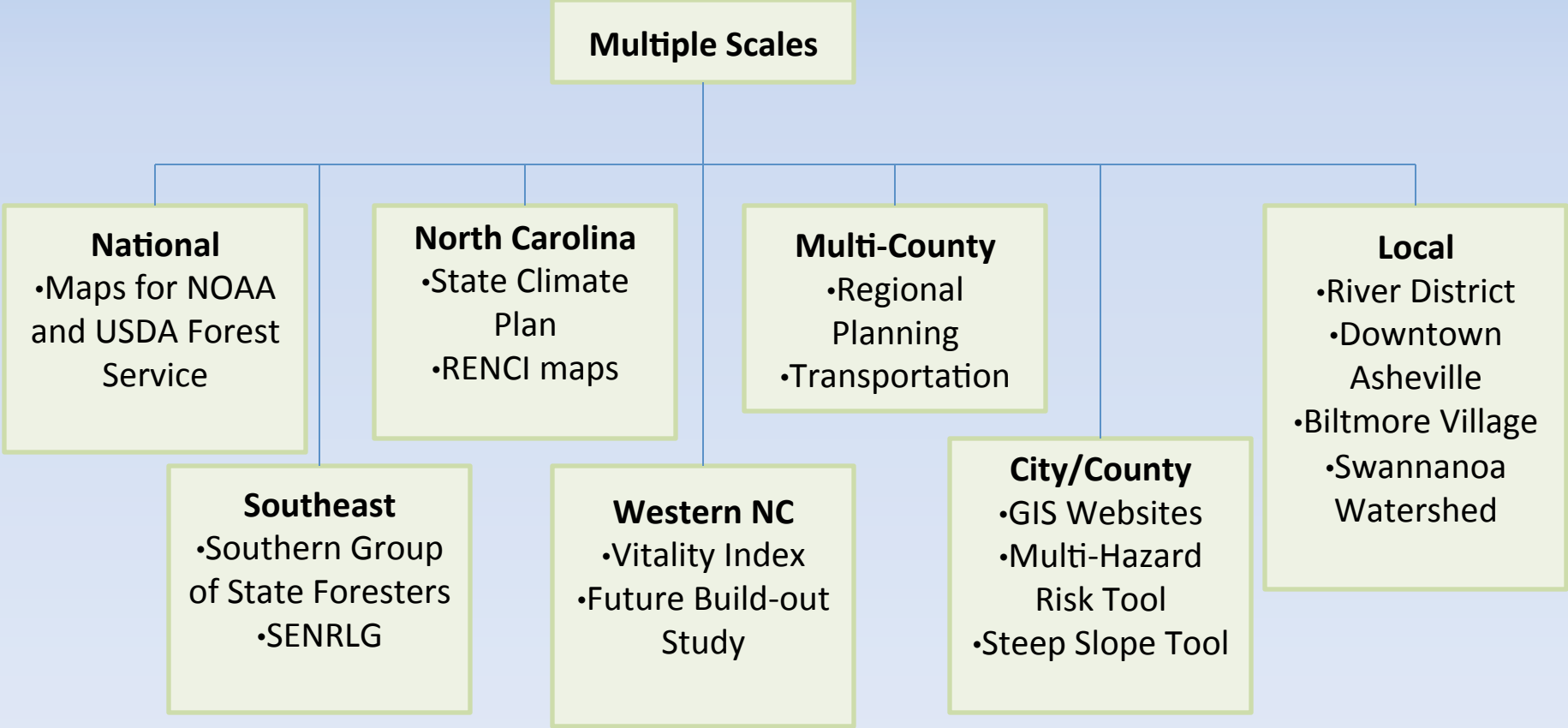
# National Climate Assessment

- **Decision:** Integrated solutions that consider factors including economic development, transportation, agriculture, etc.
- **Scale:** National, Regional and Local
- **Use of Climate Data:** Climate impacts on key issues and sectors

# Design of **Database** to Support Assessment

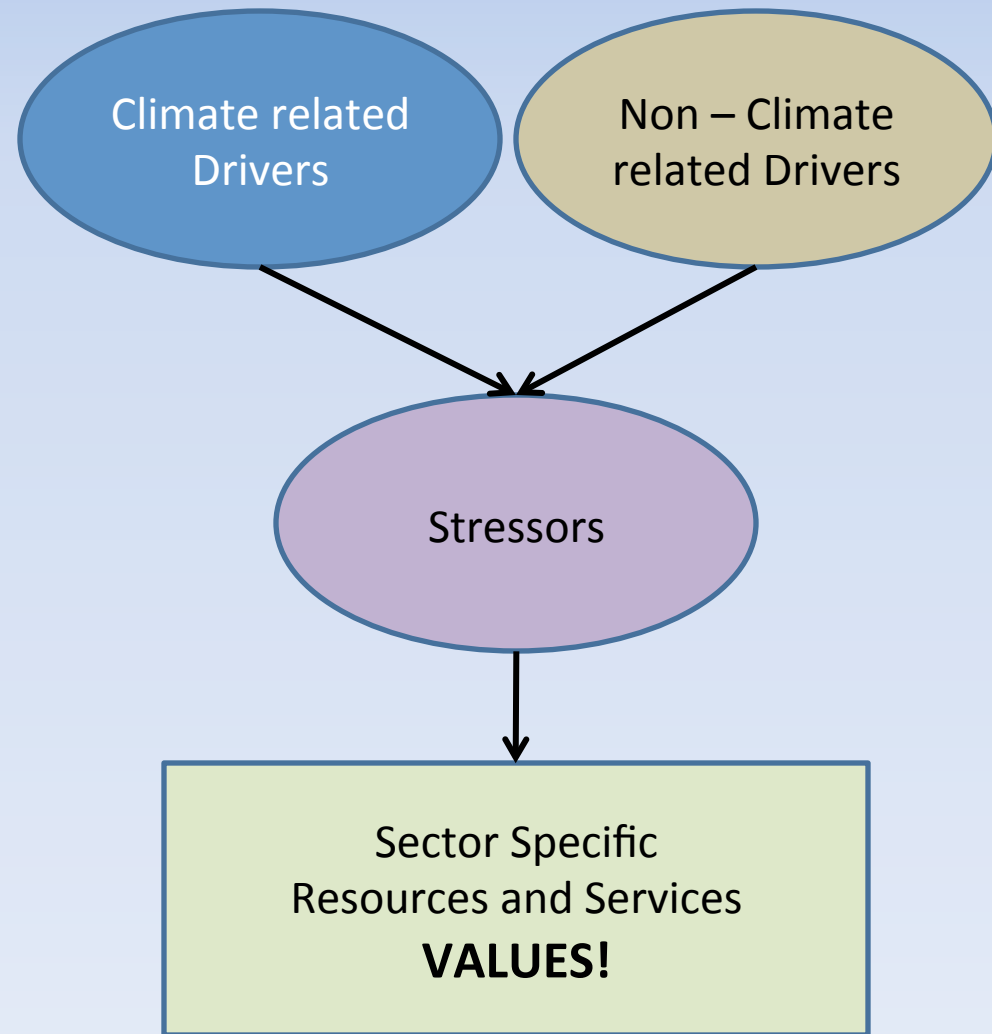
Scale	Sector (with subsectors)	Climate Condition
National Regional - SE State State Region River Basin	Transportation Natural Environments Water Resources Coastal Resources Marine Resources Land Resources Agriculture and Forestry Energy Production and Use Human Social Systems Human Health & Welfare Air Quality	Low Temp days/nights High Temp days/night Cold spells (cold snaps) Warm spells (heat waves) Cool seasons/warm seasons Heavy precipitation events Rare precipitation events Drought Tropical cyclones Extreme extra-tropical storms Small scale severe weather Sea level rise

# Example of Multi-Scale Approach

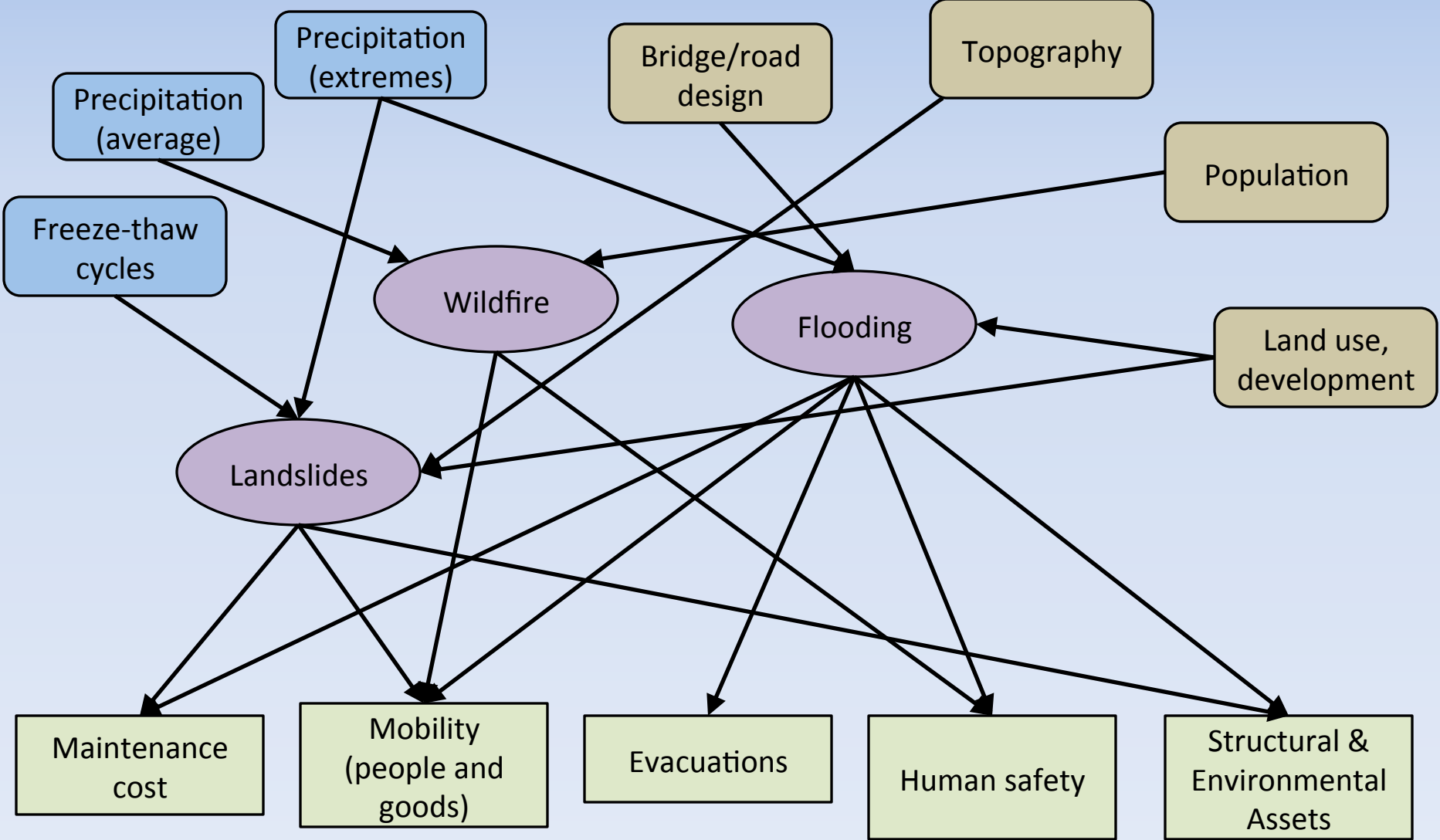


# Assessments Lead to Decisions

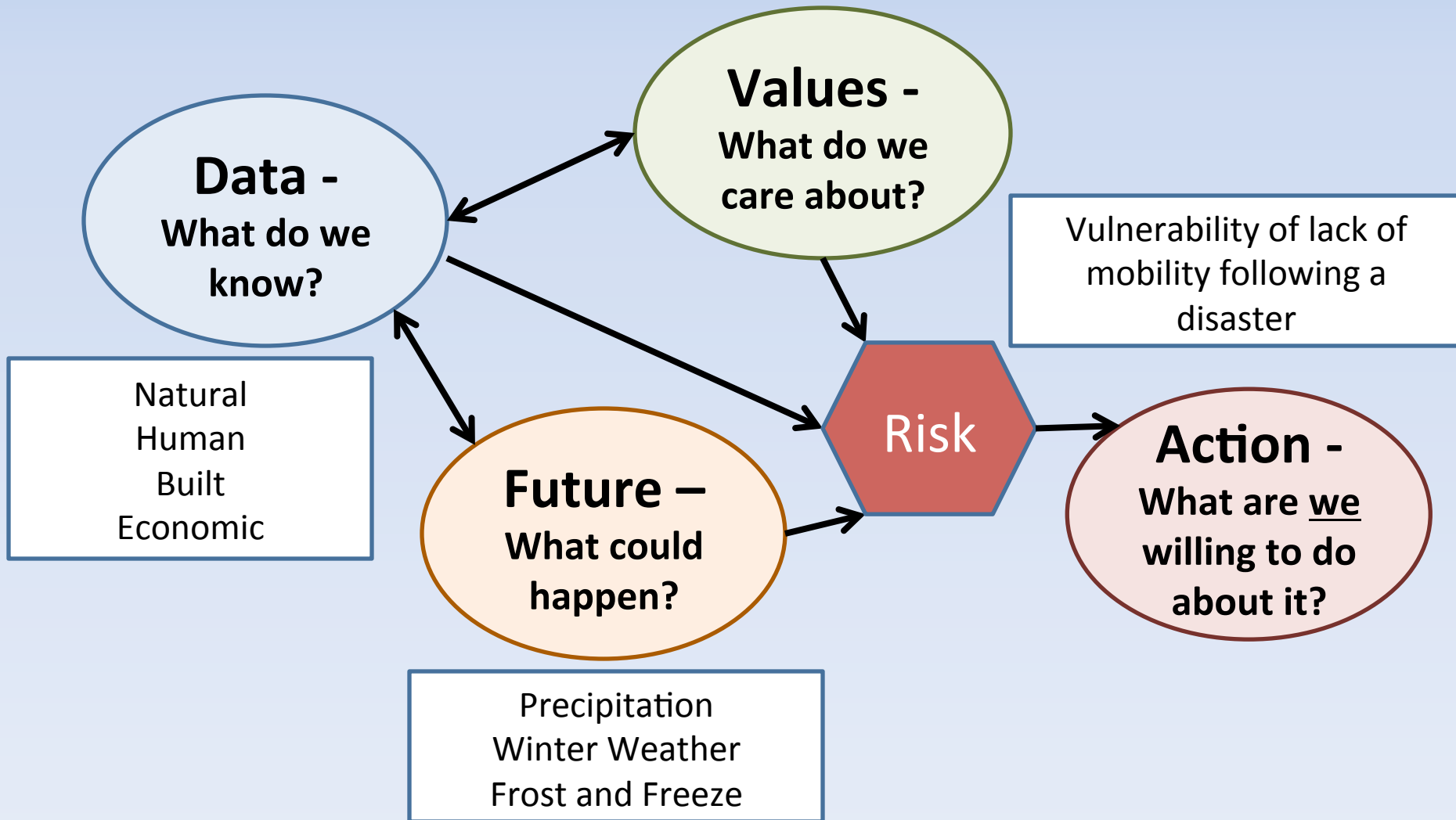
- Communities will **not** make decisions based on climate alone
- Driven by **values**, not data
- Must engage with decision makers from the beginning



Sector: **Transportation**



# Western North Carolina Transportation Planning

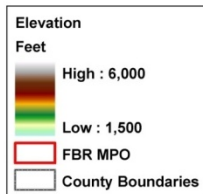
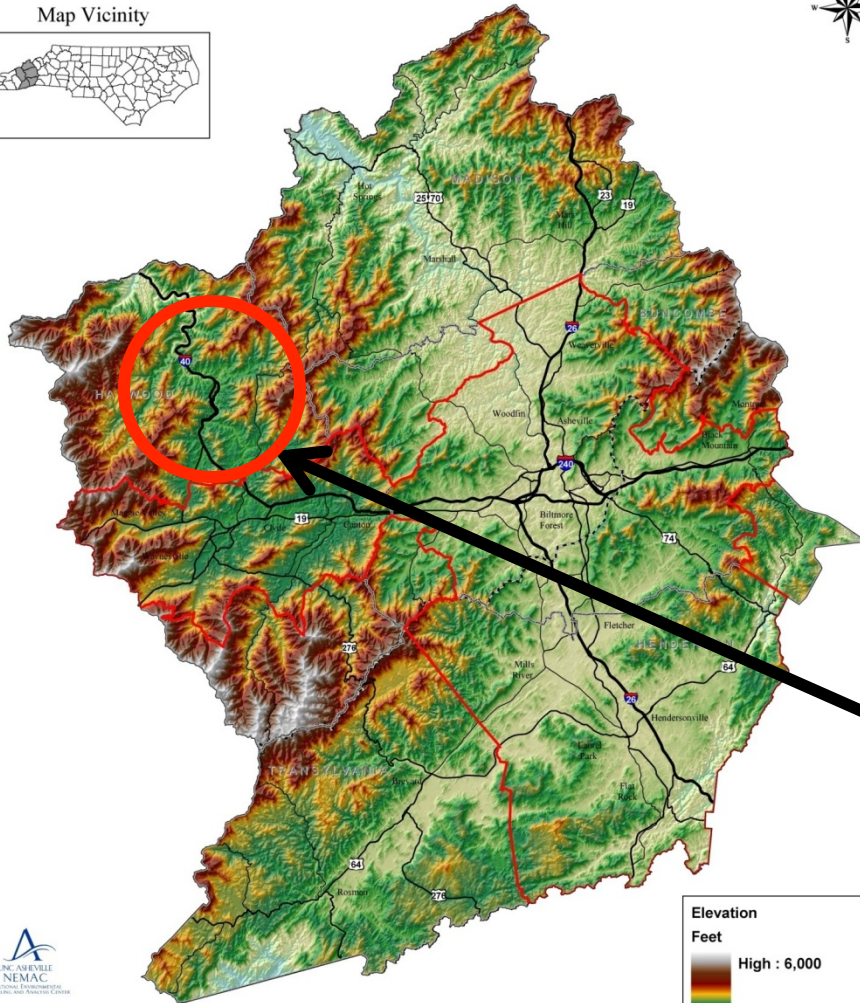




## Elevation

Land-of-Sky Regional Council Transportation Planning Area

Map Vicinity



Sources: NC Floodplain Mapping Program; NC CGIA

0 10 20 Miles



# I-40 Landslide in 2010

- **Vulnerability** is related to mobility in the transportation sector
- Freeze following a major rain initiated the landslide
- \$200 Million Impact





NEMAC

UNC Asheville's National Environmental  
Modeling and Analysis Center

ForWarn

[www.forwarn.forestthreats.org](http://www.forwarn.forestthreats.org)



**National scale, updated every eight days, change detection system**



Frost and Freeze Data and Impacts to the Agriculture, Construction and Transportation Industry



# ForWarn

Satellite-Based Change Recognition and Tracking


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

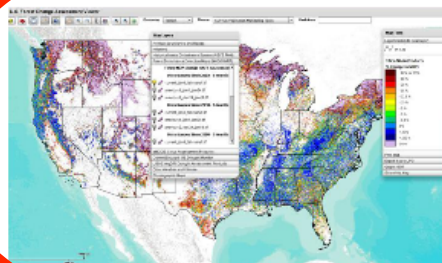

## Heavy snowpack in the Northwest

A strong La Niña in the tropical east Pacific contributed to an unusually heavy snowpack in the Pacific Northwest during the 2010-11 winter. As seen in this 32-day time sequence for western Washington and Oregon, spring greenup conditions were...

[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...

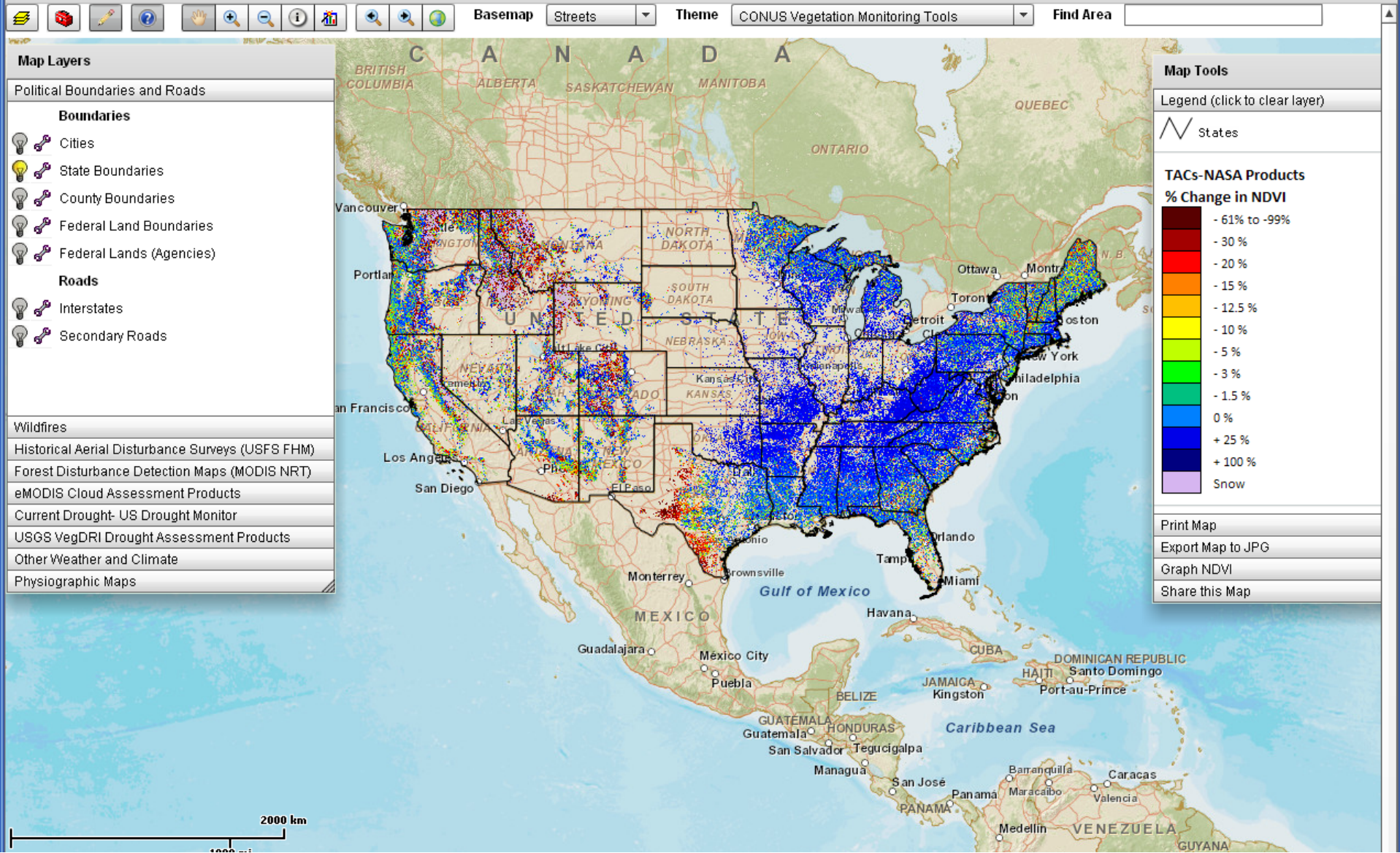
[more news »](#)
[USDA Forest Service](#)
[EFETAC](#)
[WWETAC](#)
[Policies and Links](#)
[Privacy Policy](#)
[Accessibility Statement](#)
[FOIA](#)
[Non-discrimination Statement](#)
[White House](#)
[usa.gov](#)
[Log In](#)

## Website for Visualization and Story Telling – Forest Health is Value Driver

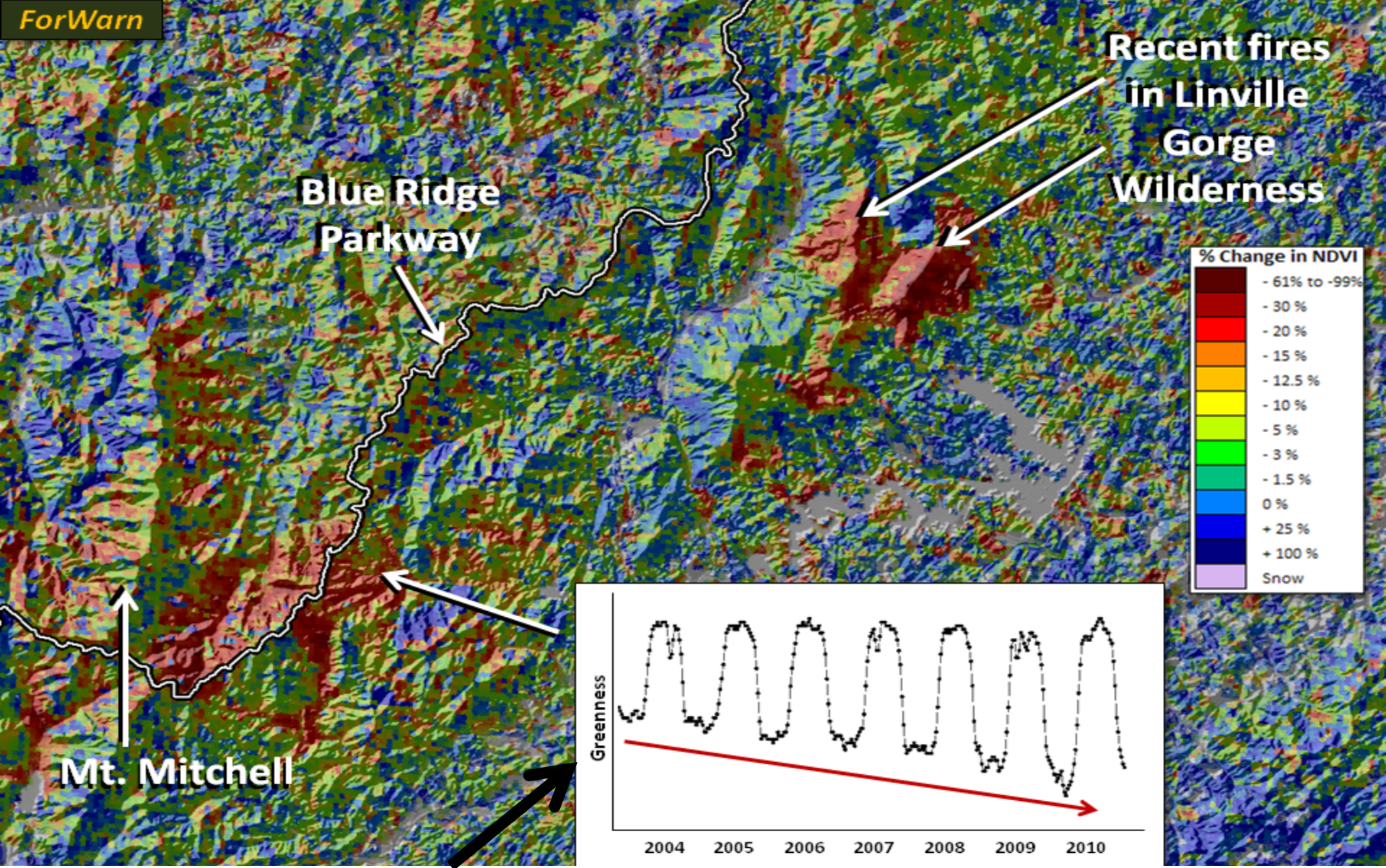


Frost and Freeze Data and Impacts to the Agriculture, Construction and Transportation Industry





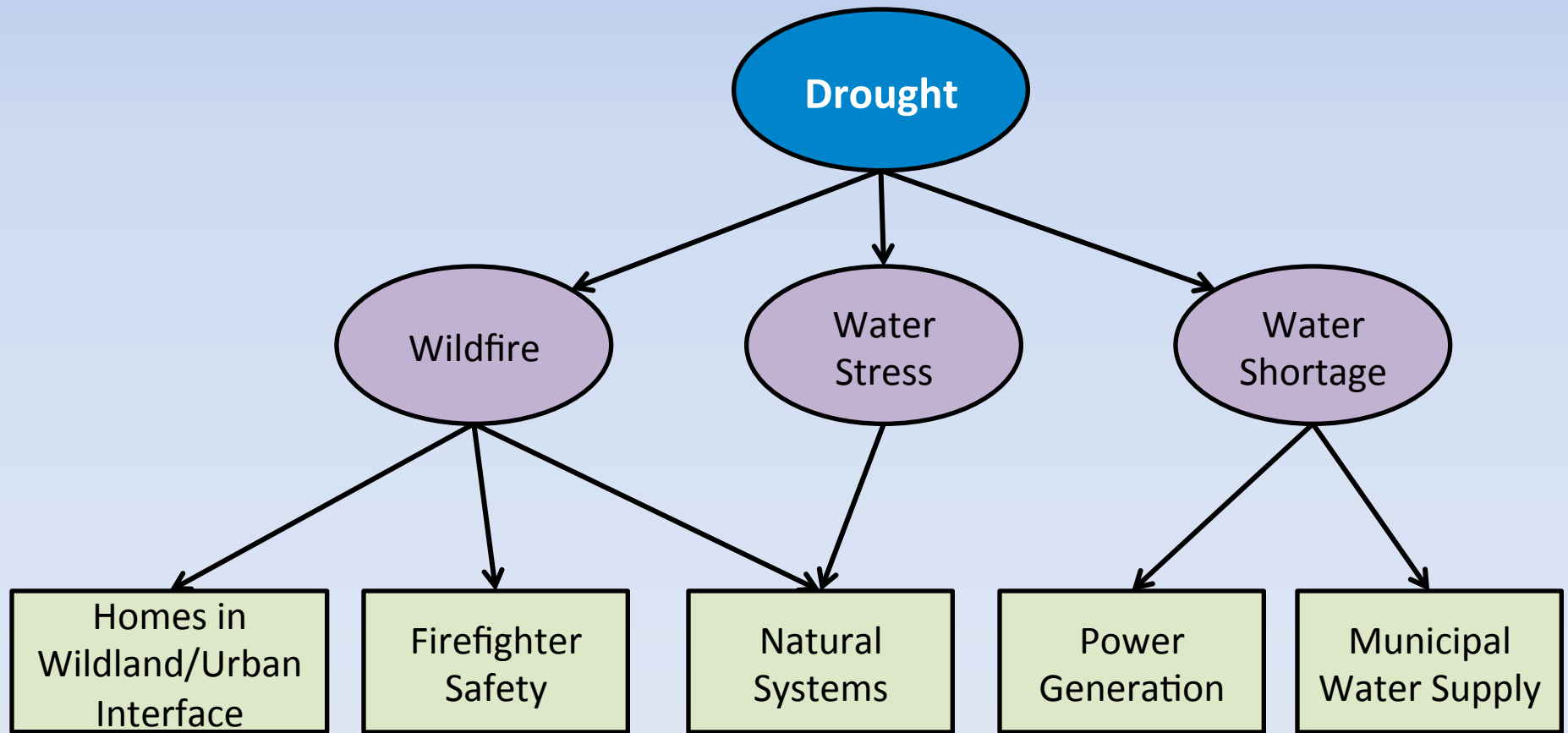
# GIS Viewer for scalability and determining cause and effect



Multigraph tool (imbedded in GIS Viewer) allows users to see in the temporal dimension

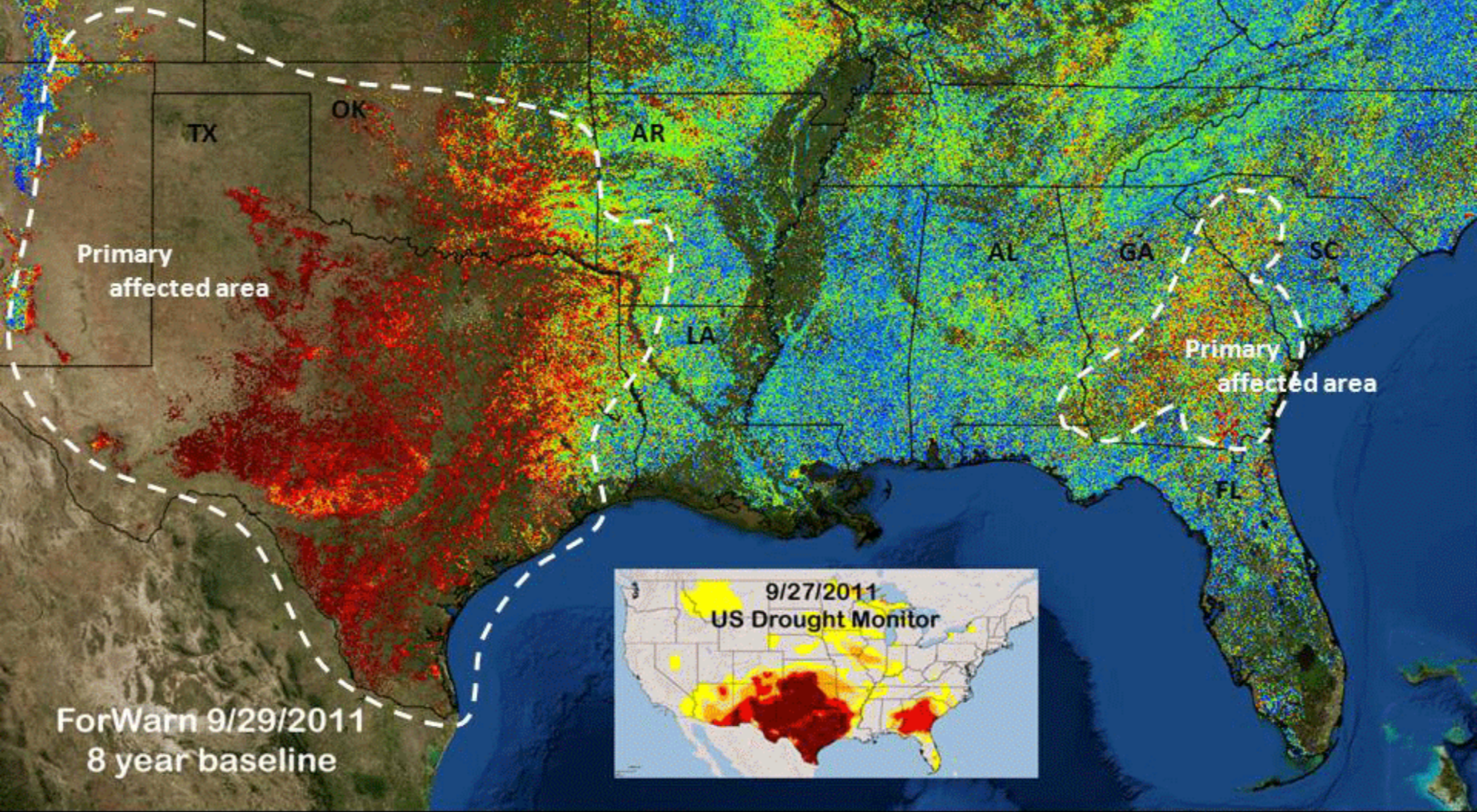
**Red pixels on map shows a deviation from the 10-year normal**

# Climate Assessment Conceptual Model of Linked Relationships



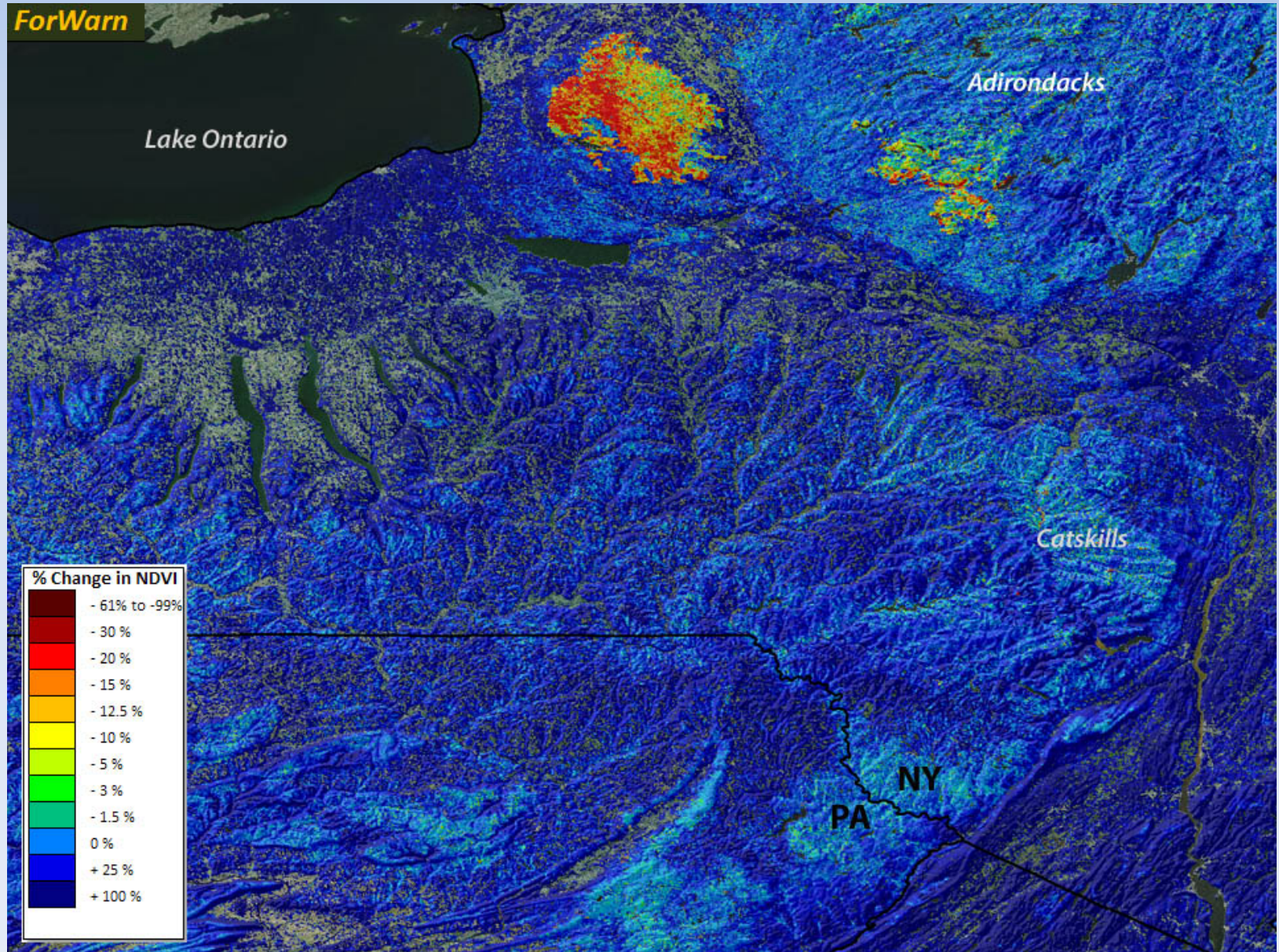
Assessments **lead to** decisions (and actions!): Focus on resources and values lets the customer understand why climate matters.

# 2011 Drought Effects on Forest Vegetation



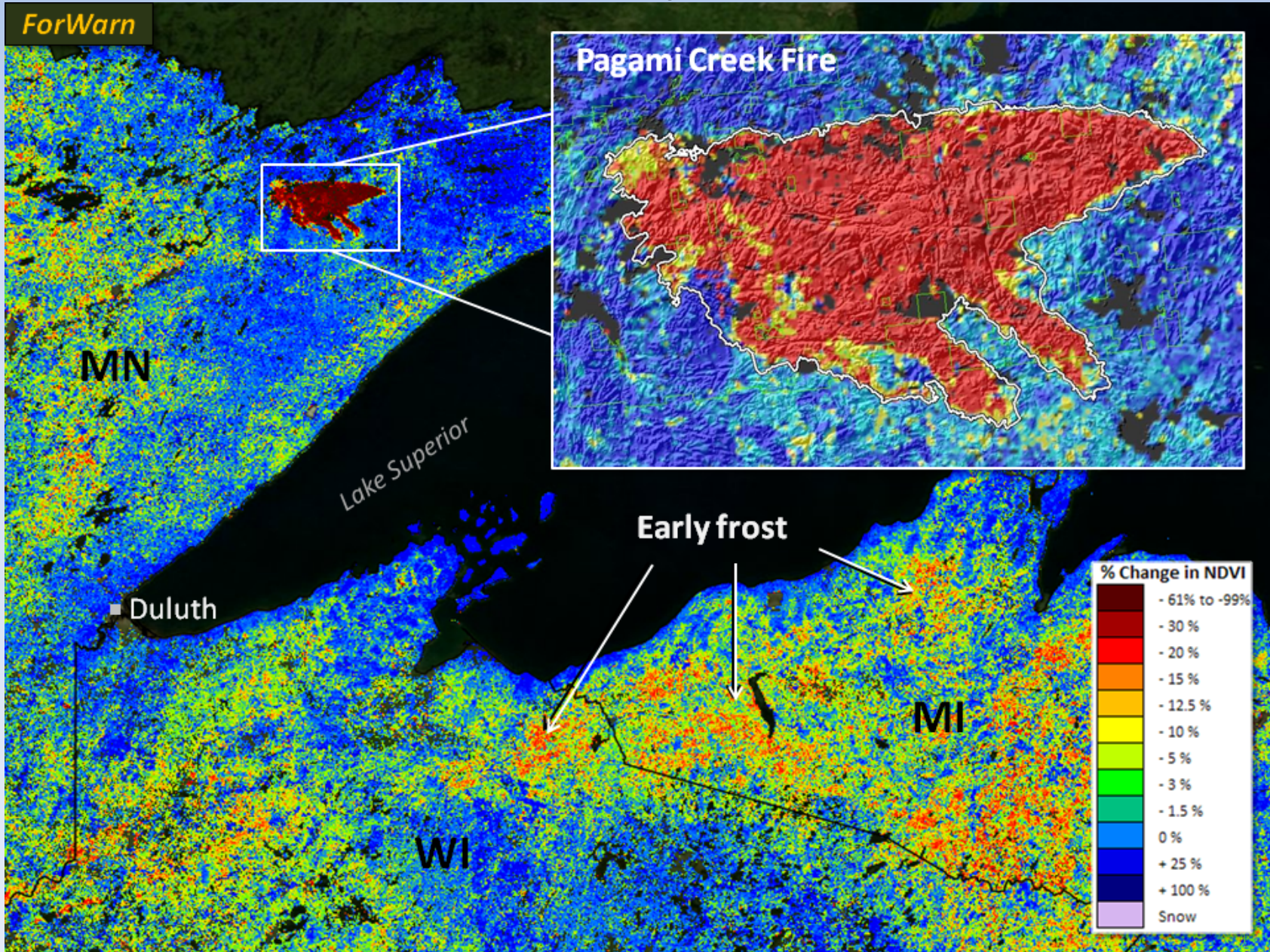
Storytelling on the web to support the GIS Viewer

# Lake-effect snow delays 2010 spring



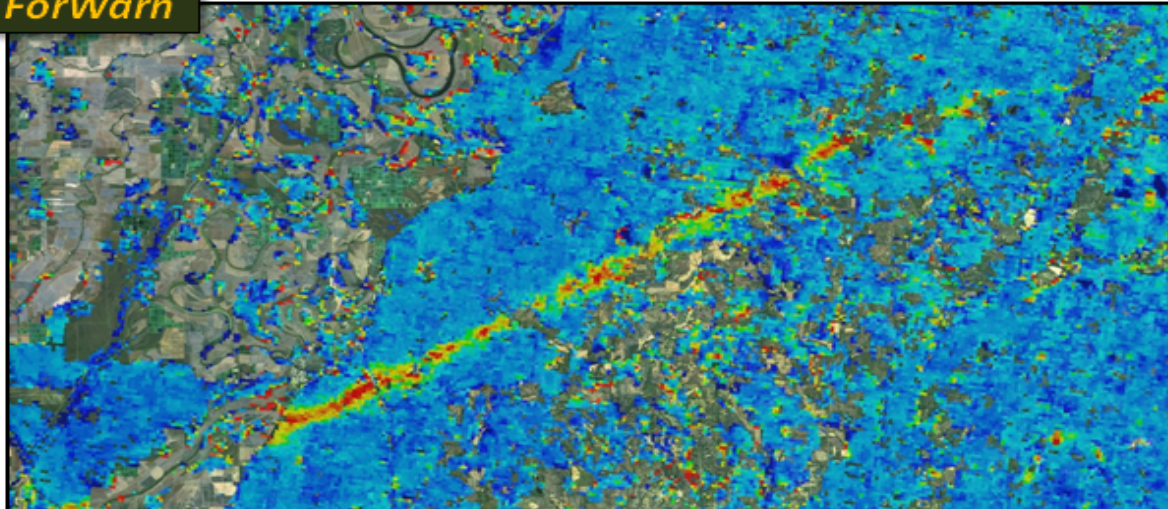


# Fire and Frost Impact – Fall of 2011

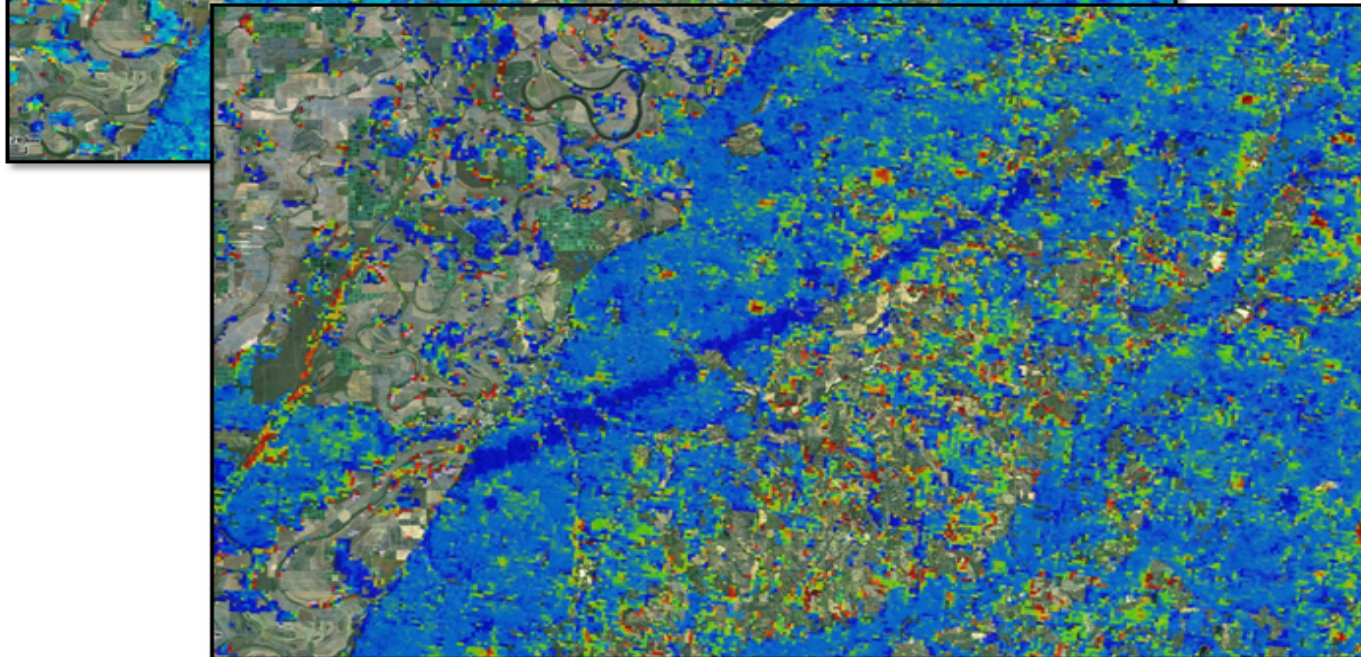


# Yazoo, Mississippi Tornado Recovery

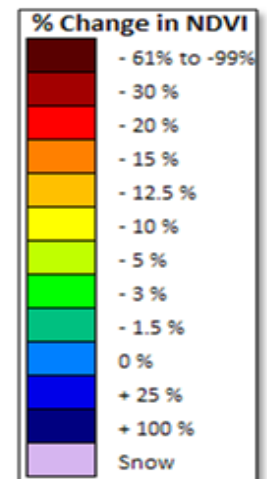
ForWarn



June 17, 2010  
compared to 2009



June 17, 2011  
compared to 2010



# North Carolina Mountain Resources Commission

## Vitality Index

[www.wncvitalityindex.org](http://www.wncvitalityindex.org)



**County Decision Makers needed some help – we provided an online tool with 160 metrics**








Frost and Freeze Data and Impacts to the Agriculture, Construction and Transportation Industry



## Home

-  **Overview**
-  **Natural**
-  **Human**
-  **Built**
-  **Economic**
-  **Download PDF**

The Western North Carolina Vitality Index reports on the 27 counties of Western North Carolina through the perspectives of the region's natural, social, built, and economic environments. Designed to assist local governments, interest groups, and the public in furtherance of the Mountain Resources Commission's overall mission to *"take care of our natural resources to enhance and sustain quality of life and ensure the long term health of our region and our people,"* this resource allows the information necessary to:

- Protect our region's abundant and unique natural resources,
- Promote development and land use planning that accommodates sustainable growth,
- Preserve the heritage and culture that defines our communities while strengthening public health, and
- Improve the region's local economic activity and expand its influence.

This index is sorted into four categories.



**The Natural Environment** – From the pristine streams and rivers to the towering Blue Ridge Mountains, this analysis of Western North Carolina's natural resources reports on the vitality and sustainability of our topography and geology, the state of our weather and climate, water quality, and air quality.



**The Human Environment** – With generations of experience honed down to an efficient craft, local music, art, heritage, and spiritual values are important elements that reflect all Western North Carolinians. This study observes the region through a lens focused on our population, human health, education, and culture.



**The Built Environment** – Looking at the region's status on land use, housing, transportation, water supply, energy, and natural stressors, hazards, and risks, this analysis covers the places we work, shop, play, travel, and live. Through careful planning, these uses can be balanced to minimize their environmental impacts in order to ensure a lasting and productive community.



**The Economic Environment**– A look at the region's standing on income and poverty, employment, agriculture, forestry, and tourism is essential to promoting a locally sustainable and resilient economy.



© 2012 Mountain Resources Commission

The home page of the website note the imbedded GIS Viewer



**Legend**

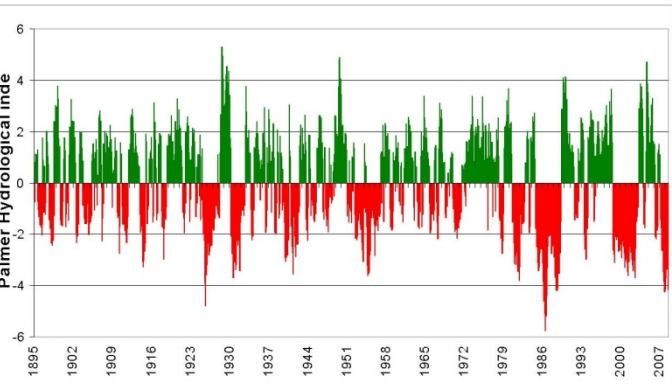
- County Seats
- Interstates
- Highways
- ▣ Corporate Limits
- ▭ County Boundaries
- ▶ Lakes
- Rivers

**Councils of Government**

- High Country Council of Governments
- Isothermal Planning and Development Commission
- Land of Sky Regional Council
- Northwest Piedmont Council of Governments
- Southwestern Commission
- Western Piedmont Council of Governments

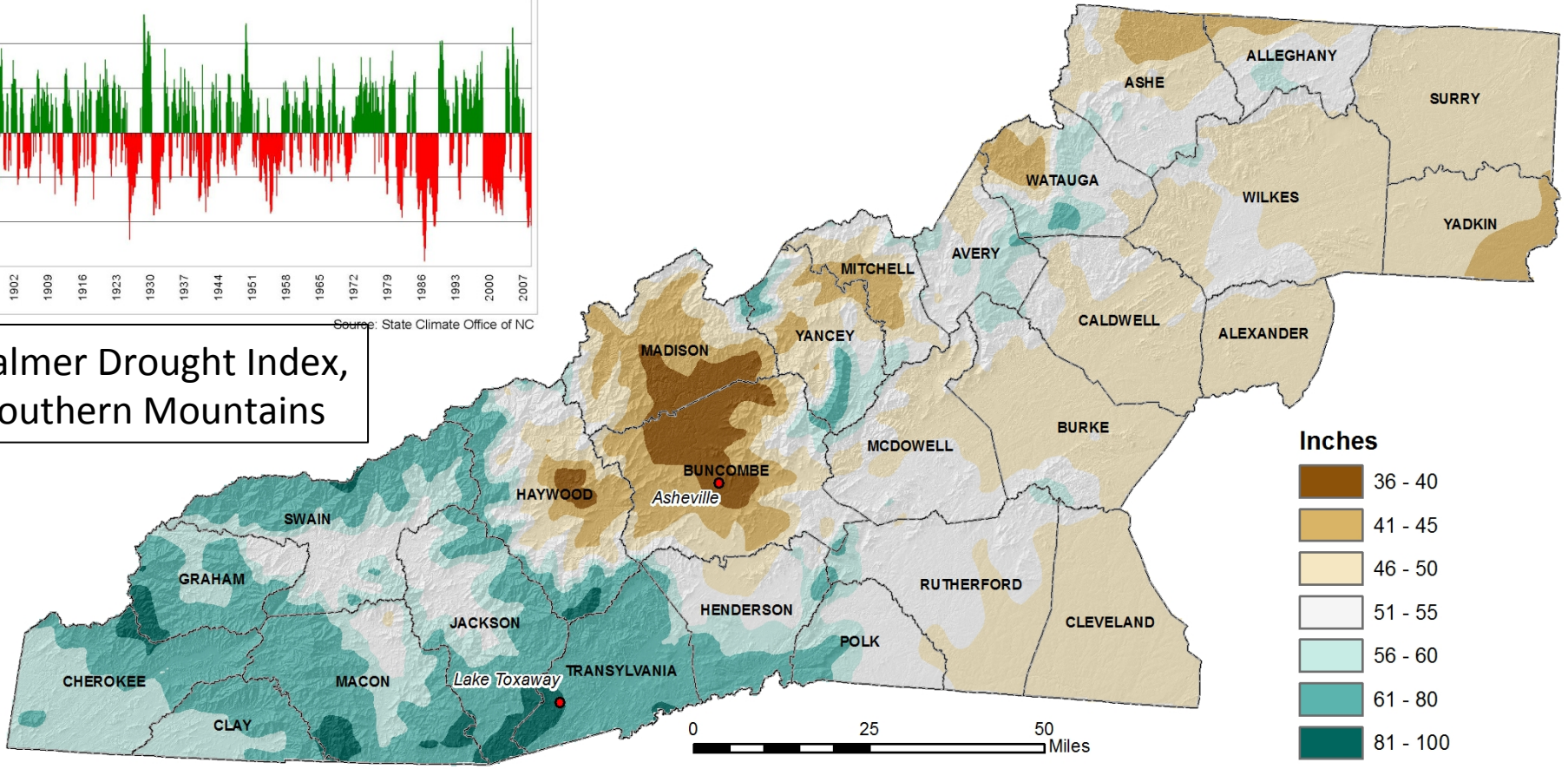
# Decision makers at county and regional scale

# Average Annual Precipitation (1981 - 2010)



Source: State Climate Office of NC

Palmer Drought Index, Southern Mountains



Regionally specific products aided by storytelling turns a map into a tool



NEMAC

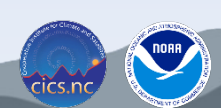
UNC Asheville's National Environmental  
Modeling and Analysis Center

# Buncombe County Multi-Hazard Risk Tool

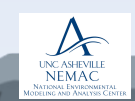
[risktool.nemac.org/buncombe](http://risktool.nemac.org/buncombe)



Emergency Managers needed an integrated decision tool for FEMA reporting



Frost and Freeze Data and Impacts to the Agriculture, Construction and Transportation Industry



# Multi-Hazard Risk Tool

- **Purpose of study:** Tool for Emergency Managers that integrates
- **Decision:** How to plan for multiple risks including flooding, wildfire, landslides, winter storms, dam failure, etc.
- **Scale:** Buncombe County
- **Use of Climate Data:** Drought, flooding, precipitation, winter storm occurrence



Map Viewer -- hold down SHIFT key and drag mouse to zoom

Map Image ESRI Streets Map View Flood Map Zoom Black Mountain Reports Parcel Count Risk Report Run

Parcel Count Risk Report  
Parcel Value Risk Report

Map Tools

Layer List

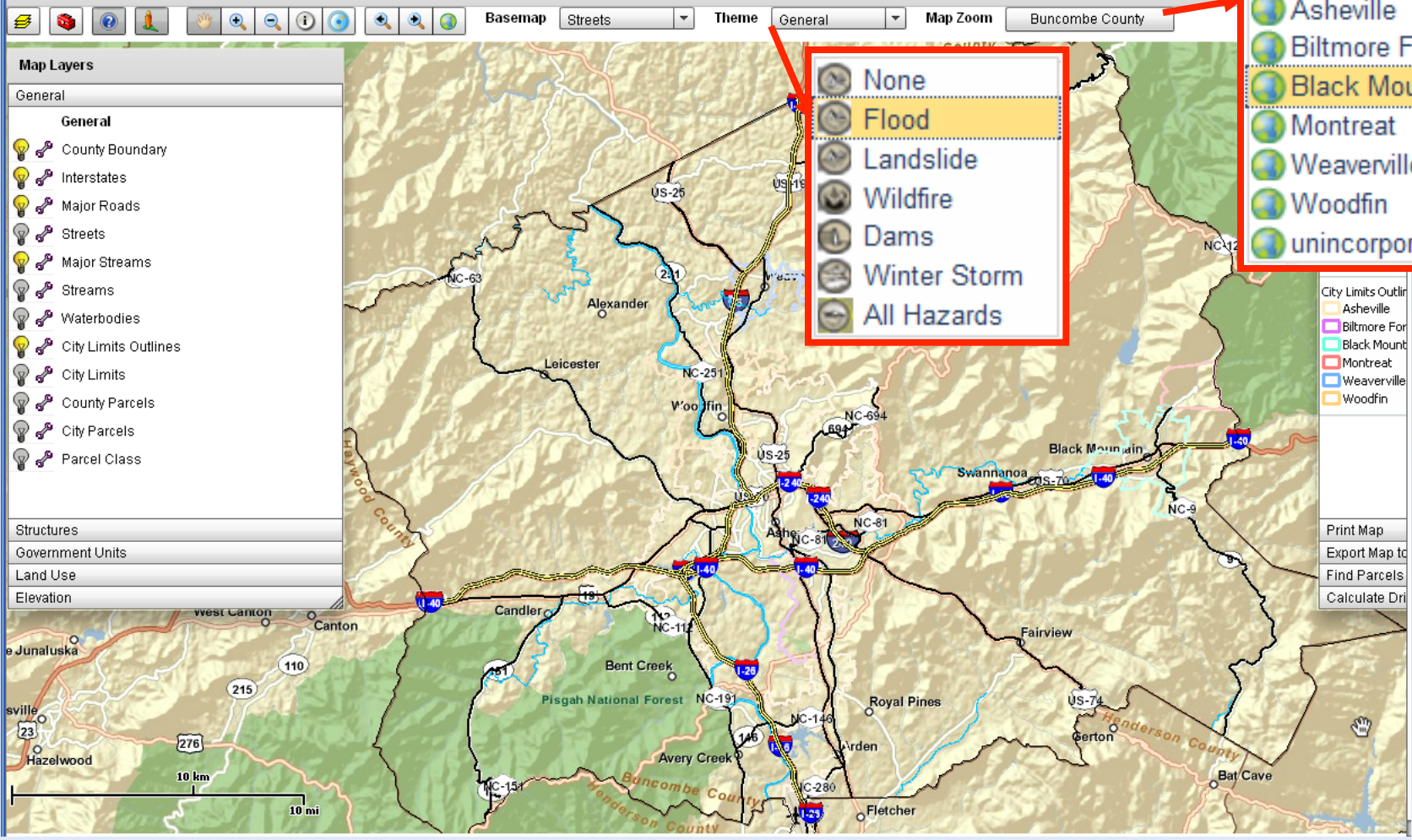
Layer Name	Visible	Transp.
Asheville Parcels by Report Area	<input type="checkbox"/>	0
EOC Locations	<input type="checkbox"/>	0
<b>Flood Layers</b>		
Frances Highwater Marks	<input type="checkbox"/>	0
NCFMP Floodway 2007	<input type="checkbox"/>	0
Parcels in Floodway	<input type="checkbox"/>	0
NCFMP 100yr Floodplain 2007	<input checked="" type="checkbox"/>	0
Parcels in 100yr Floodplain	<input checked="" type="checkbox"/>	0
NCFMP 500yr Floodplain 2007	<input type="checkbox"/>	0
Parcels in 500yr Floodplain	<input type="checkbox"/>	0

Legend

- County Boundary
- Interstates
- Major Roads
- Major Streams
- City Limits Outlines
  - Asheville
  - Biltmore Forest
  - Black Mountain
  - Montreat
  - Weaverville
  - Woodfin
- NCFMP 100yr Floodplain 2007
- Parcels in 100yr Floodplain

Tool tied to individual parcels – integration with City of Asheville and Buncombe County GIS Databases

# Buncombe County Multi-Hazard Risk Tool

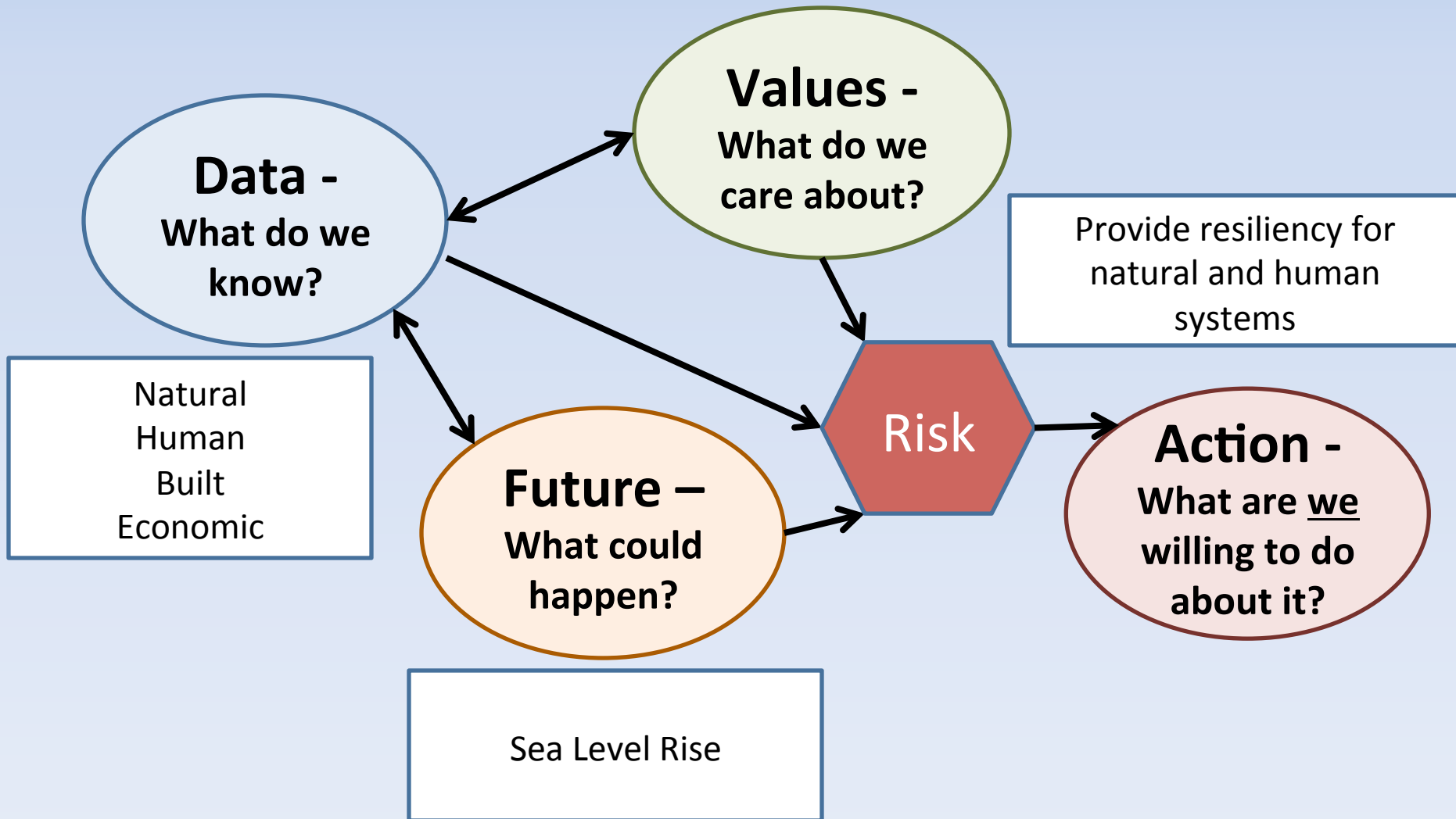


- Buncombe County
- Asheville
- Biltmore Forest
- Black Mountain
- Montreat
- Weaverville
- Woodfin
- unincorporated area

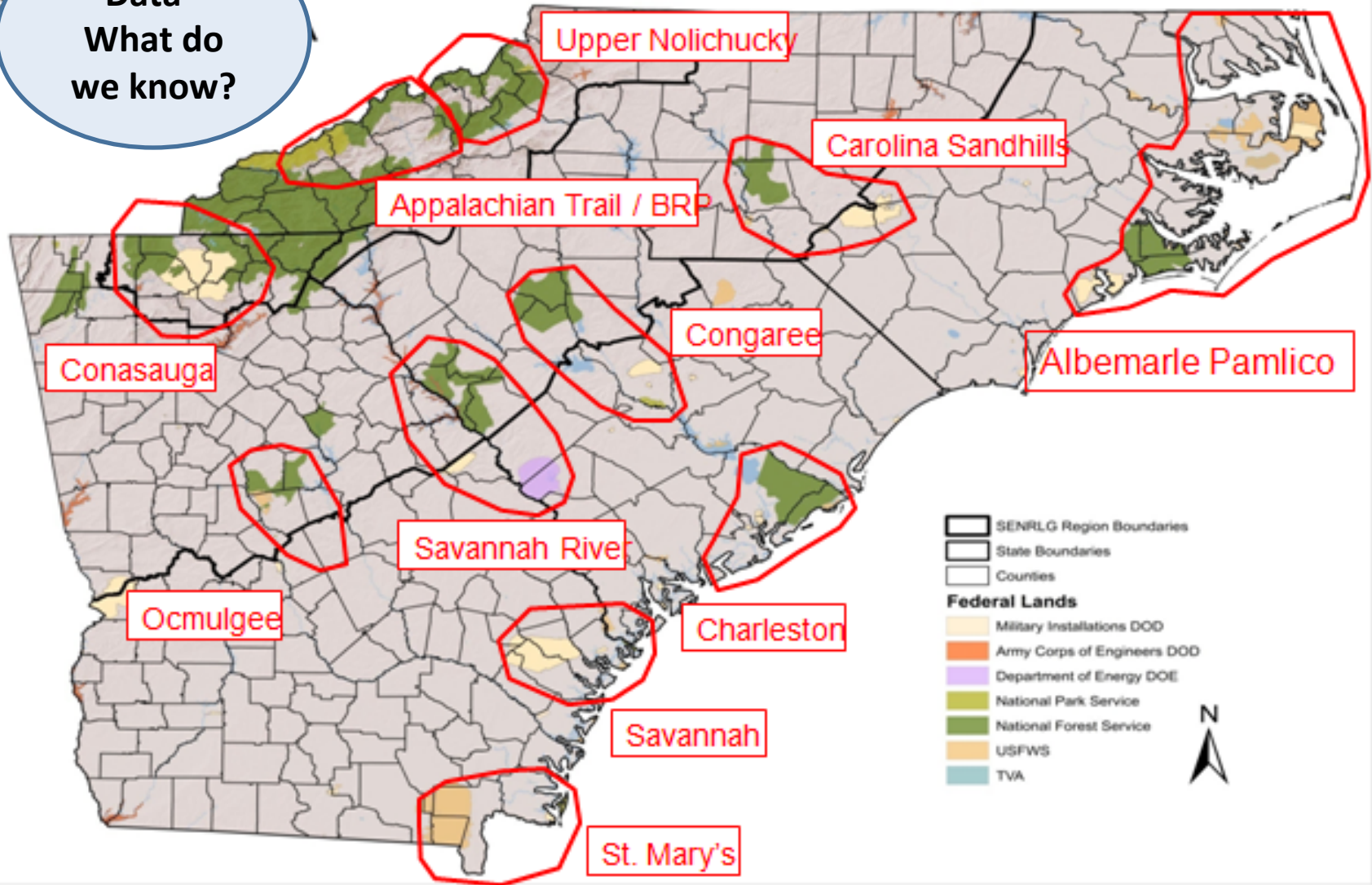
- None
- Flood
- Landslide
- Wildfire
- Dams
- Winter Storm
- All Hazards

- City Limits Outline
- Asheville
- Biltmore Forest
- Black Mountain
- Montreat
- Weaverville
- Woodfin
- Print Map
- Export Map to
- Find Parcels
- Calculate Drive

# Albemarle Pamlico Sea Level Rise



Data -  
What do  
we know?



During the first phase of the study, areas that will be impacted by climate change were identified



**Data -  
What do  
we know?**



**Values -  
What do we  
care about?**



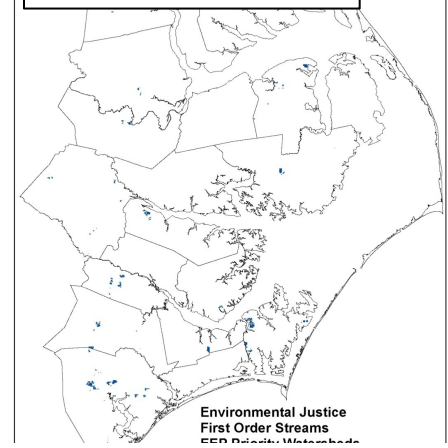
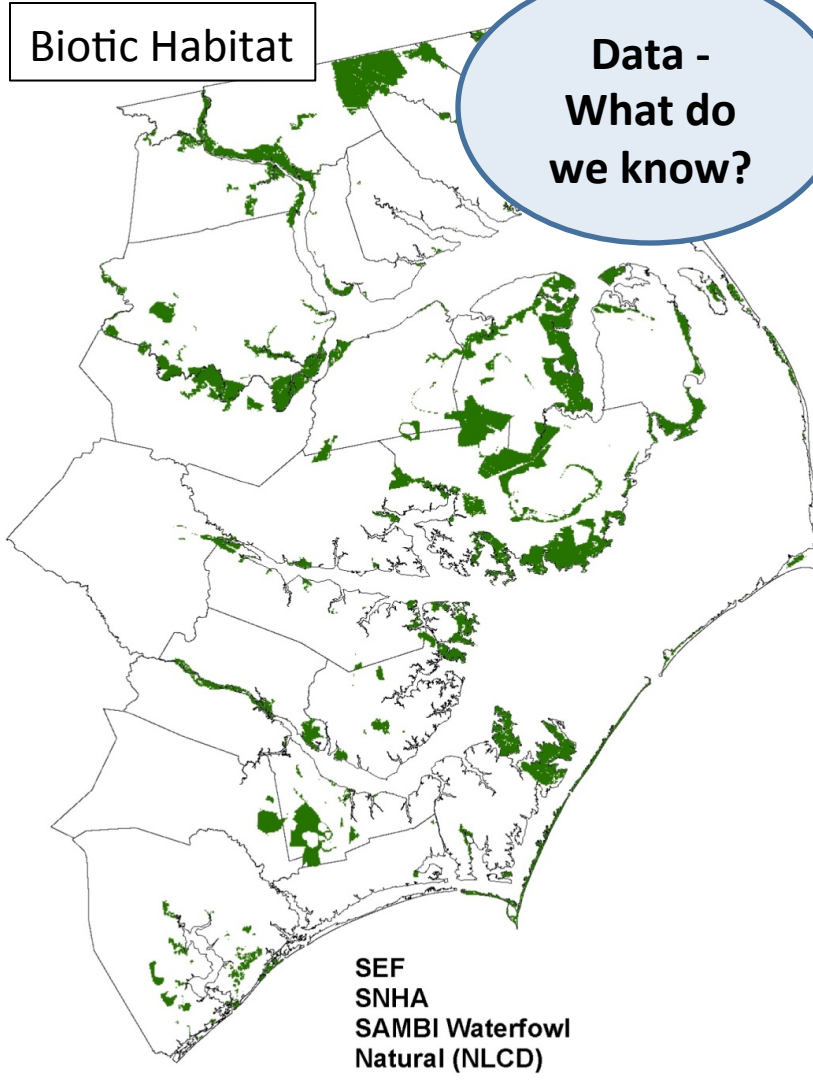
**Maps are important, but facilitation leads to decision making in group settings**

Biotic Habitat

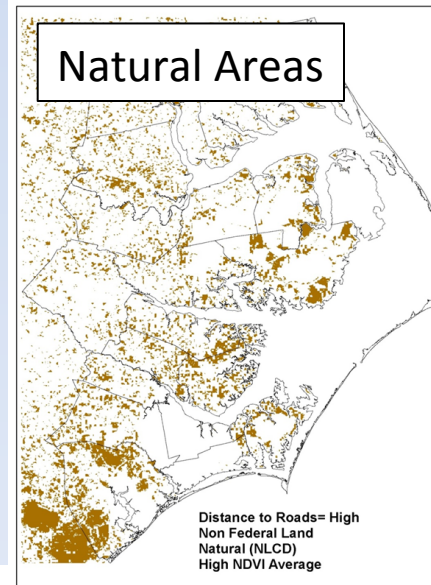
Data -  
What do  
we know?

Values -  
What do we  
care about?

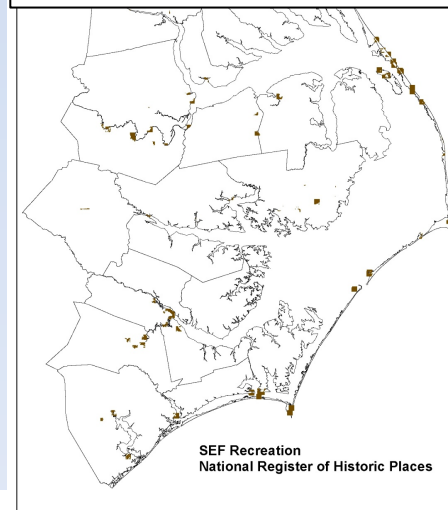
Drinking Water



Natural Areas



Recreation & Tourism

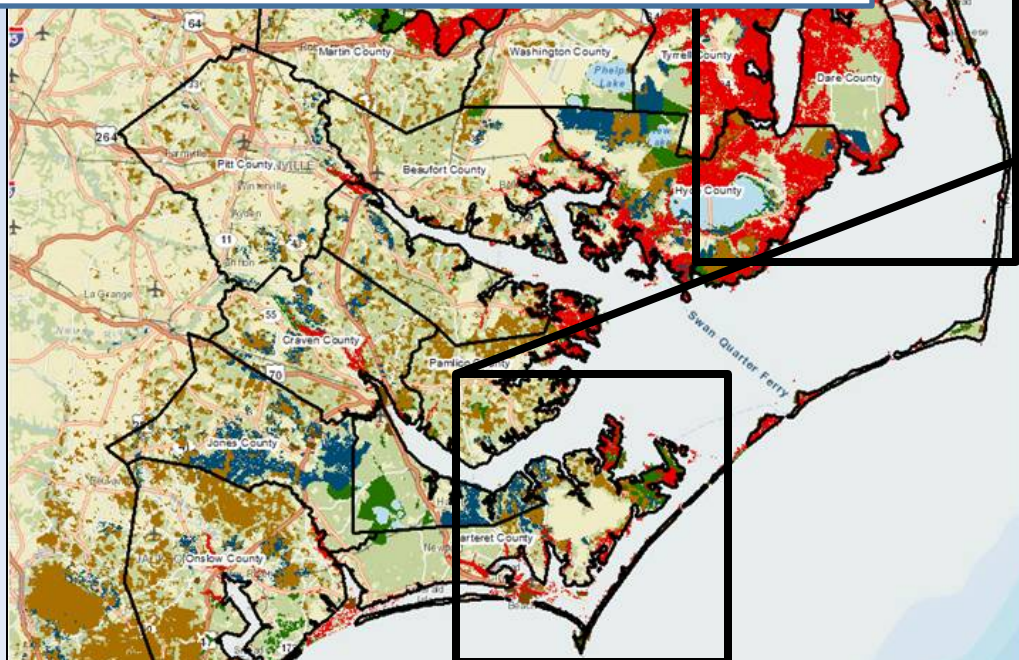


During the second phase, key value drivers for the 12 Federal Agencies were mapped:  
1) Biotic Habitat, 2) Natural Areas, 3) Drinking Water, and 4) Recreation & Tourism

**Data -  
What do  
we know?**

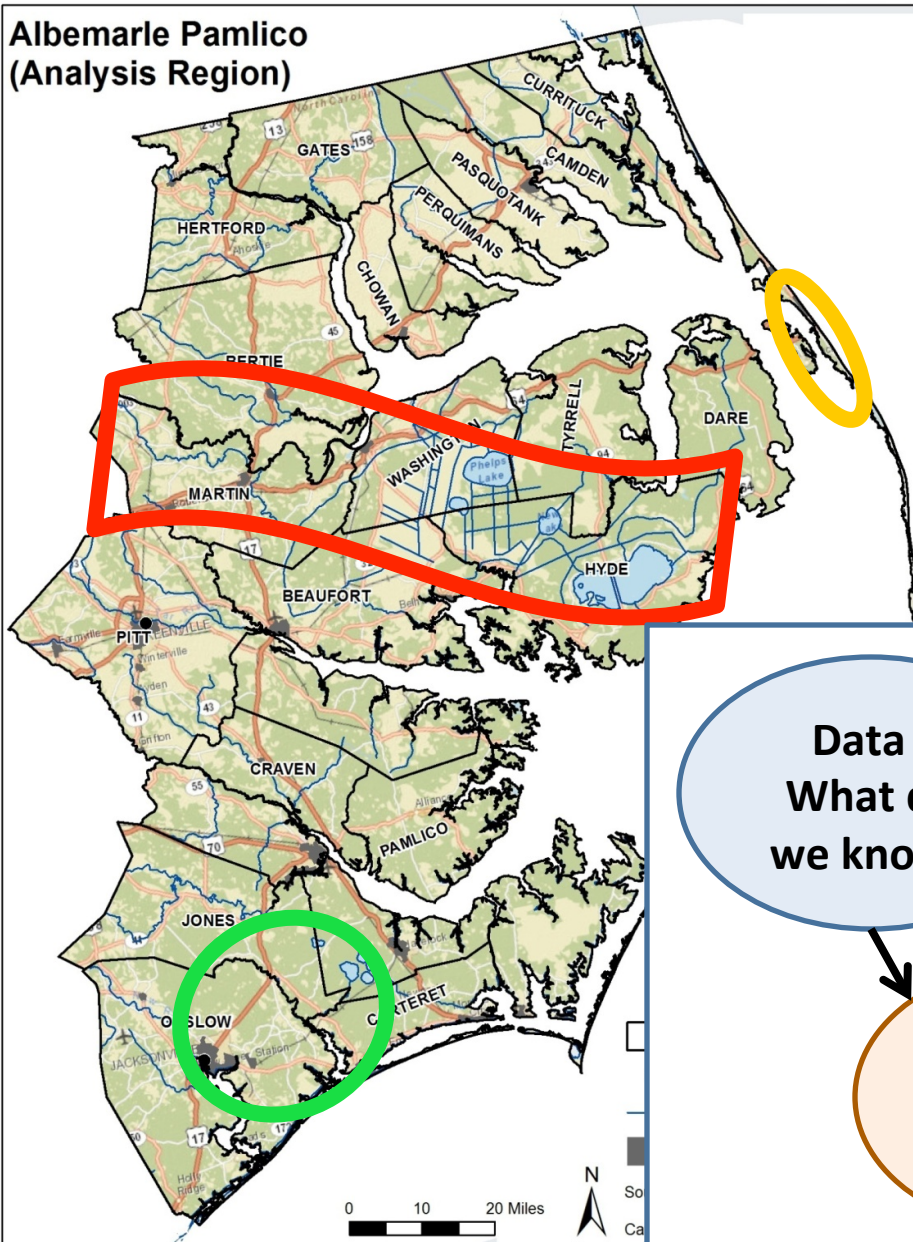
**Values -  
What do we  
care about?**

**Future -  
What could  
happen?**

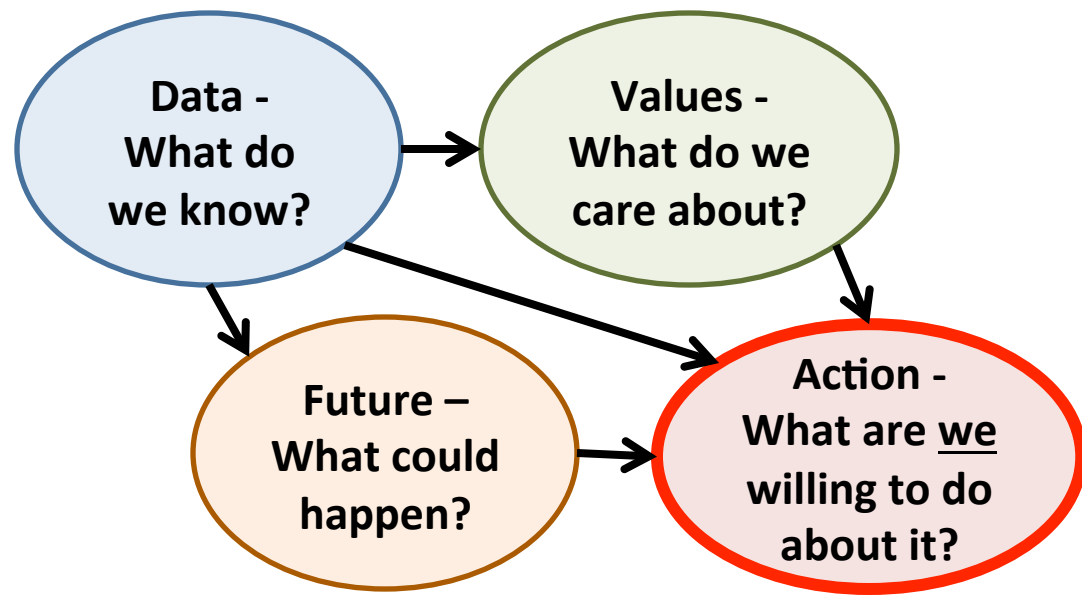


## Combined Stories with Sea Level Rise Scenarios

## Albemarle Pamlico (Analysis Region)



Three Prioritized Areas for **Action** – areas where the agencies are more likely to match local dollars to build resilience.





# Summary

- **Baseline changes in climate increases risk of weather impact**
  - Late Frost impact on plants after early onset to growing season
  - Change of growing season length impact on natural system
  - Freeze and thaw impacts on mobility and design
- **Non-climate issues add to sensitivity**
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- **Collaboration is key – the three sectors of government, academia and industry must work together to meet this challenge**

# Questions?

Jim Fox

[jfox@unca.edu](mailto:jfox@unca.edu)