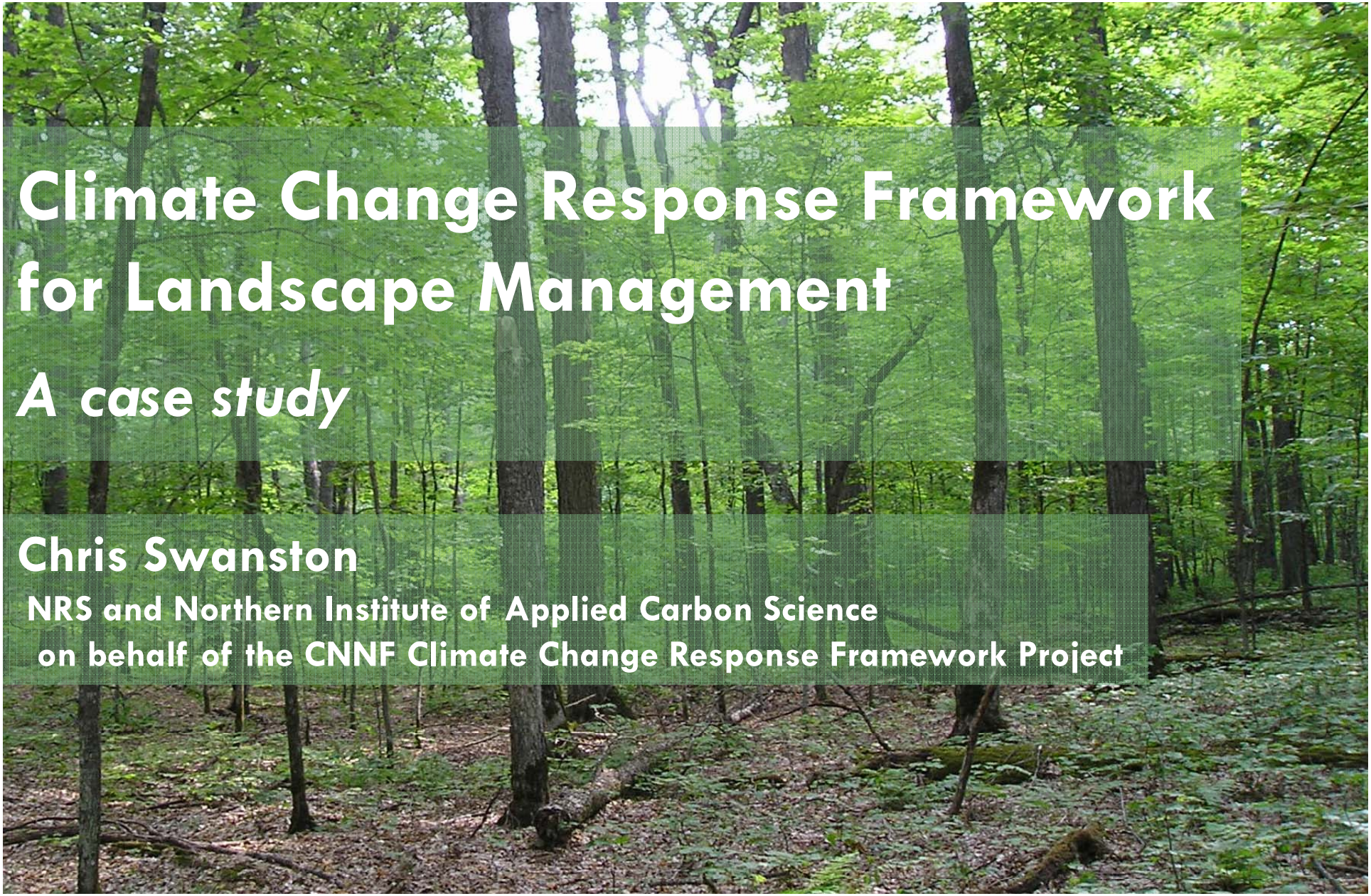


Climate Change Response Framework for Landscape Management

A case study

Chris Swanston

NRS and Northern Institute of Applied Carbon Science

on behalf of the CNNF Climate Change Response Framework Project

Who's involved? In addition to NIACS:

- *Northern Research Station*
- *Chequamegon-Nicolet National Forest (CNNF)*
- *Eastern Region Regional Office*
- *Northeastern Area State and Private Forestry*
- *University of Wisconsin-Madison*
- Wisconsin Department of Natural Resources
- Wisconsin Initiative on Climate Change Impacts (WICCI)

Overview

- Approach and setting
- Project components
- Ongoing progress
- Next steps

Climate Change Response Framework

Our goal:

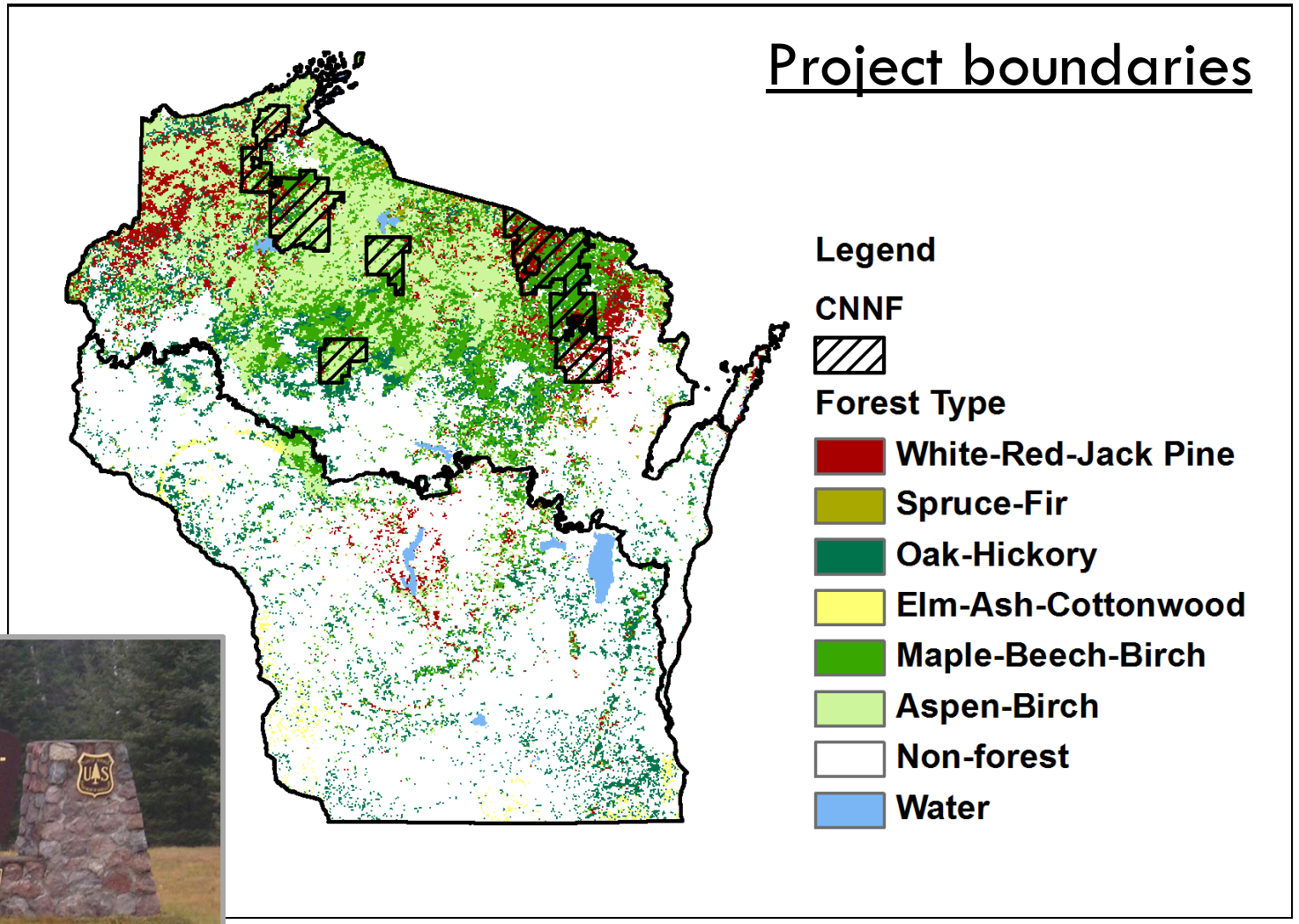
Identify strategies and approaches to climate change adaptation and mitigation relevant to ecosystems in CNNF and northern Wisconsin.

Bridge the gap between

- scales of prediction
- academic discussions of ecosystem responses
- management activities on National Forests
- interactions with the greater community

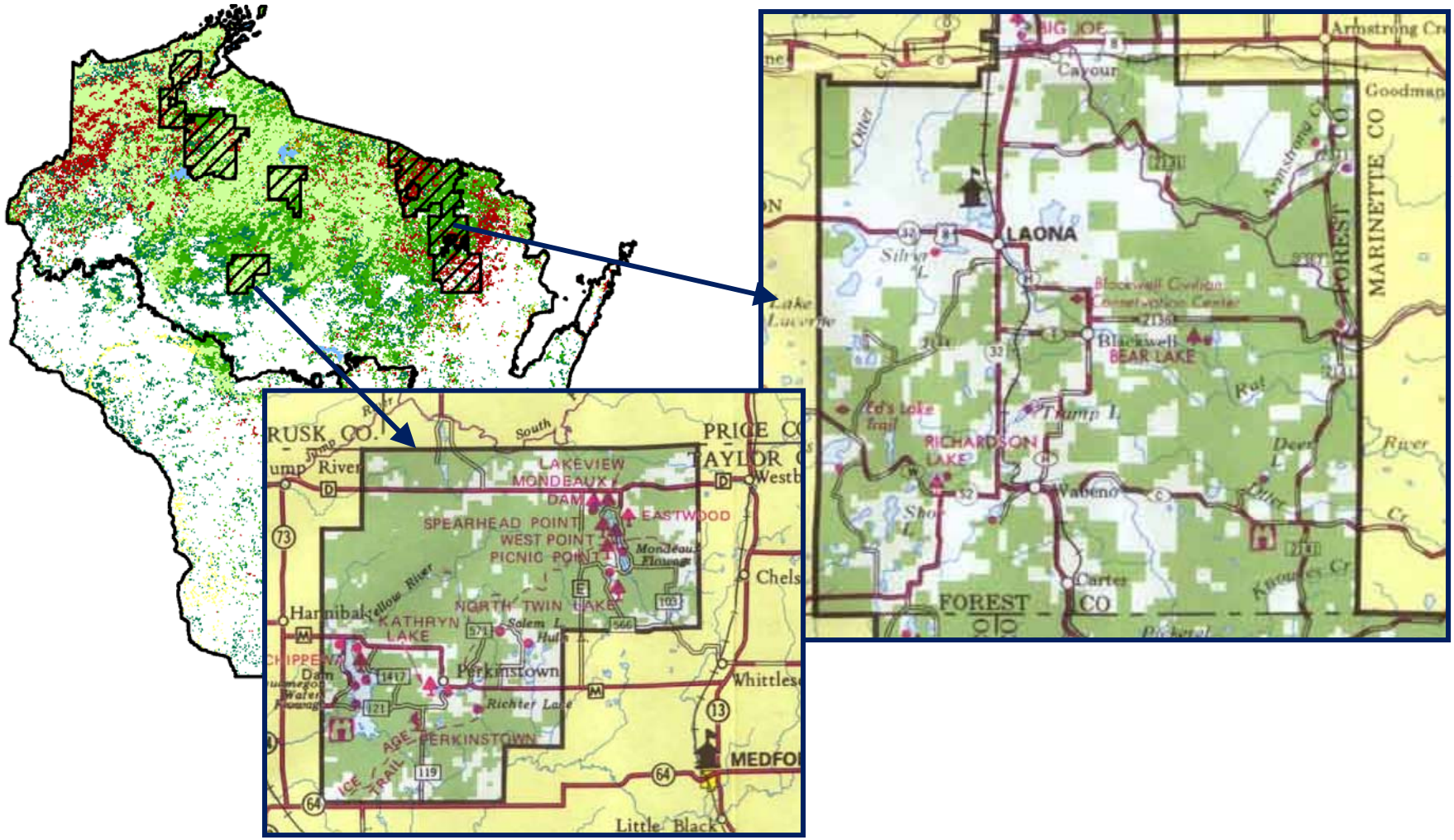
Approach and setting

Climate Change Response Framework



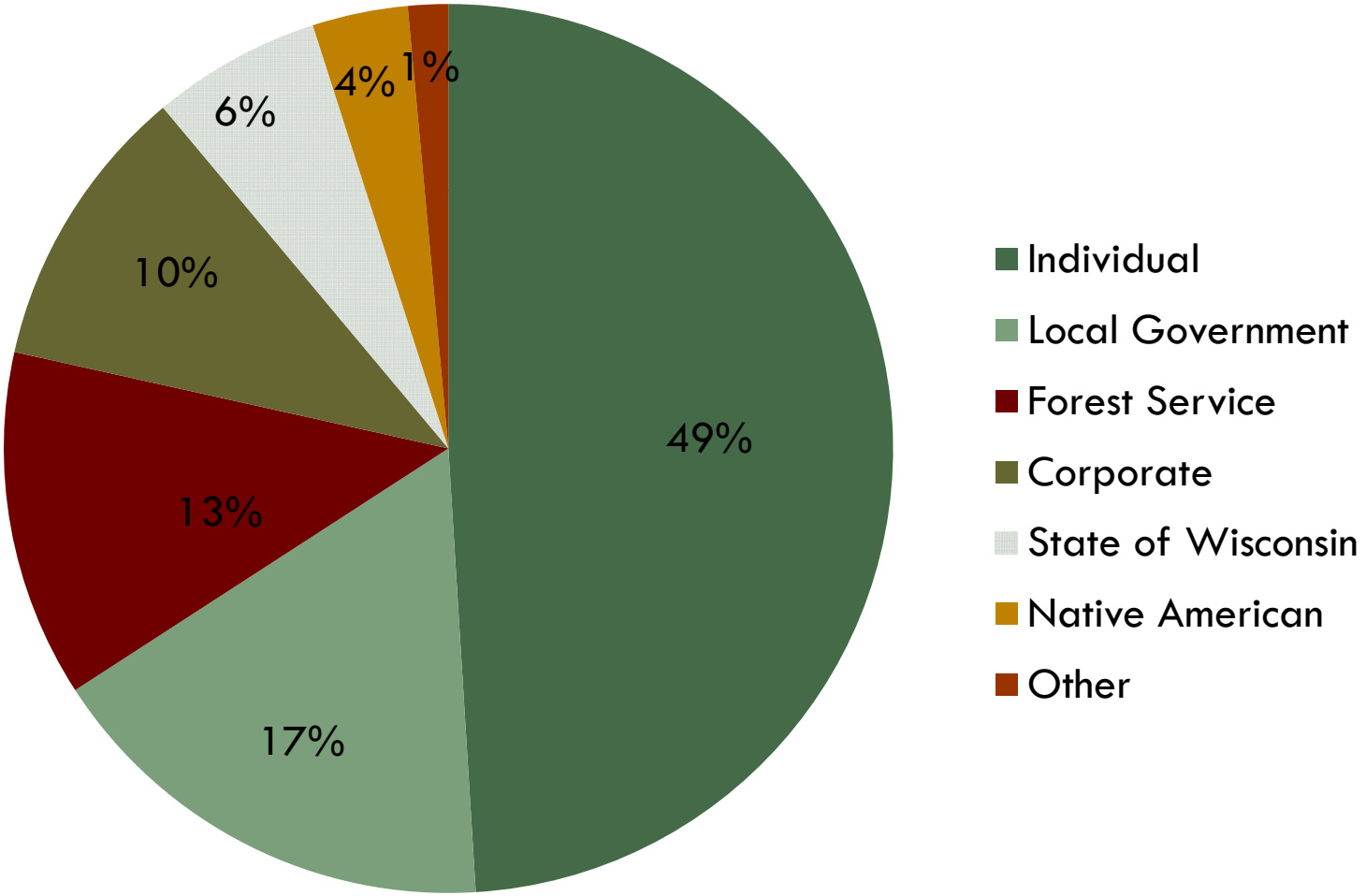
Approach and setting

The CNNF is not contiguous



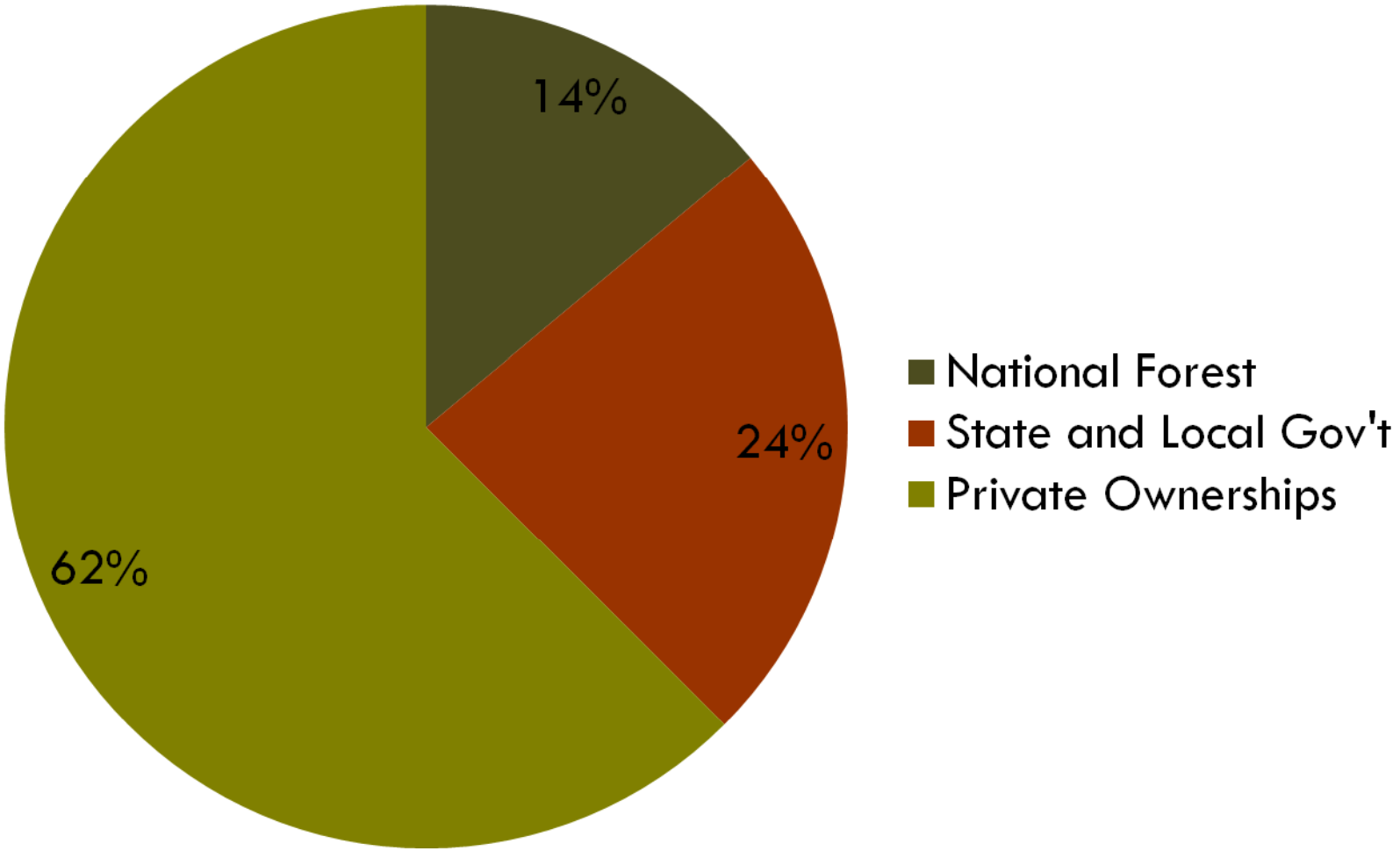
Approach and setting

Only 13% of the forested land is in the CNNF.



Approach and setting

Only 14% of the forest carbon is in the CNNF.



Approach and setting

Climate Change Response Framework

Northern Research Station

Lead: Chris Swanston (also NIACS)

Collaborators: Rich Birdsey, Louis Iverson, Sarah Hines

Chequamegon-Nicolet National Forest

Lead: Tony Erba

Collaborators: Geoff Chandler, Linda Parker, Matt St. Pierre, Suzanne Flory, Connie Chaney

Eastern Region Regional Office

Lead: Tom Doane

Northeastern Area State and Private Forestry

Lead: Barbara Tormoehlen

Collaborators: Gina Childs, Sarah Hines

Northern Institute of Applied Carbon Science

Project Coordinator: Maria Janowiak

Collaborators: Leslie Brandt, Patricia Butler

University of Wisconsin-Madison

Collaborators: David Mladenoff, Tom Gower

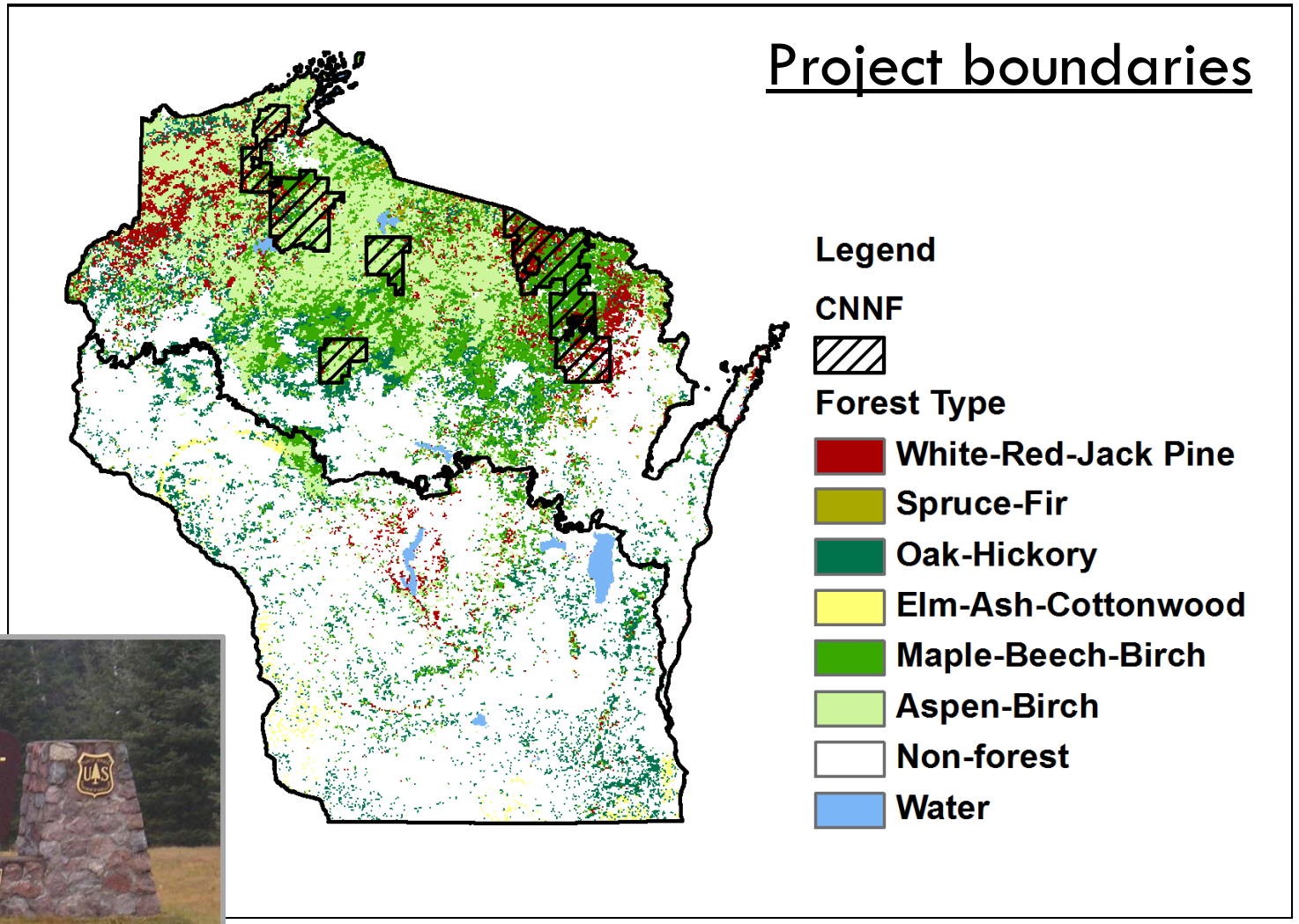
Additional Collaborators

Wisconsin Department of Natural Resources

Wisconsin Initiative on Climate Change Impacts (WICCI)

Approach and setting

Climate Change Response Framework



Project components

- What is vulnerable?
- What are the mitigation options?
- What do our neighbors think?
- What does the research show?
- What don't we know?
- ***How can we respond?***

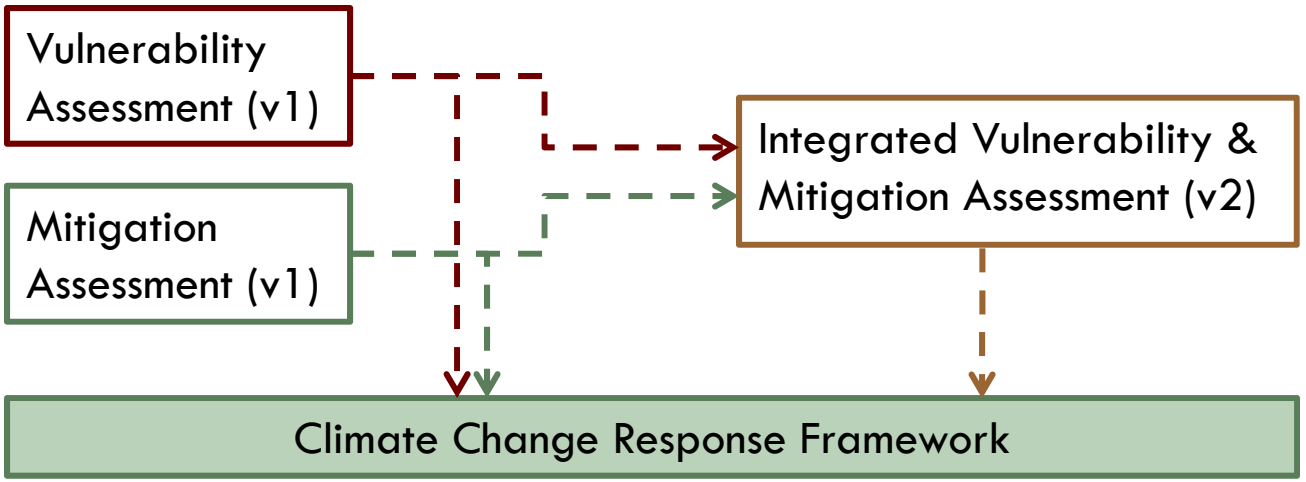
Project components

1) Vulnerability and Mitigation Assessments

Evaluate key ecosystem vulnerabilities and mitigation opportunities within CNNF under a range of future climate uncertainty using existing models and information

Project components

- Will integrate vulnerability and mitigation assessments into a single assessment, and also into Framework
- Adaptation and mitigation need to be considered together when developing management approaches



Project components

1) **Vulnerability and Mitigation Assessments**

2) **Shared Landscapes Initiative**

Foster *dialogue* about climate change, ecosystem response, ecosystem management, and cooperative activities among *CNNF,* regional landowners, and the general public.

Create a **Shared Landscapes Work Group**

Project components

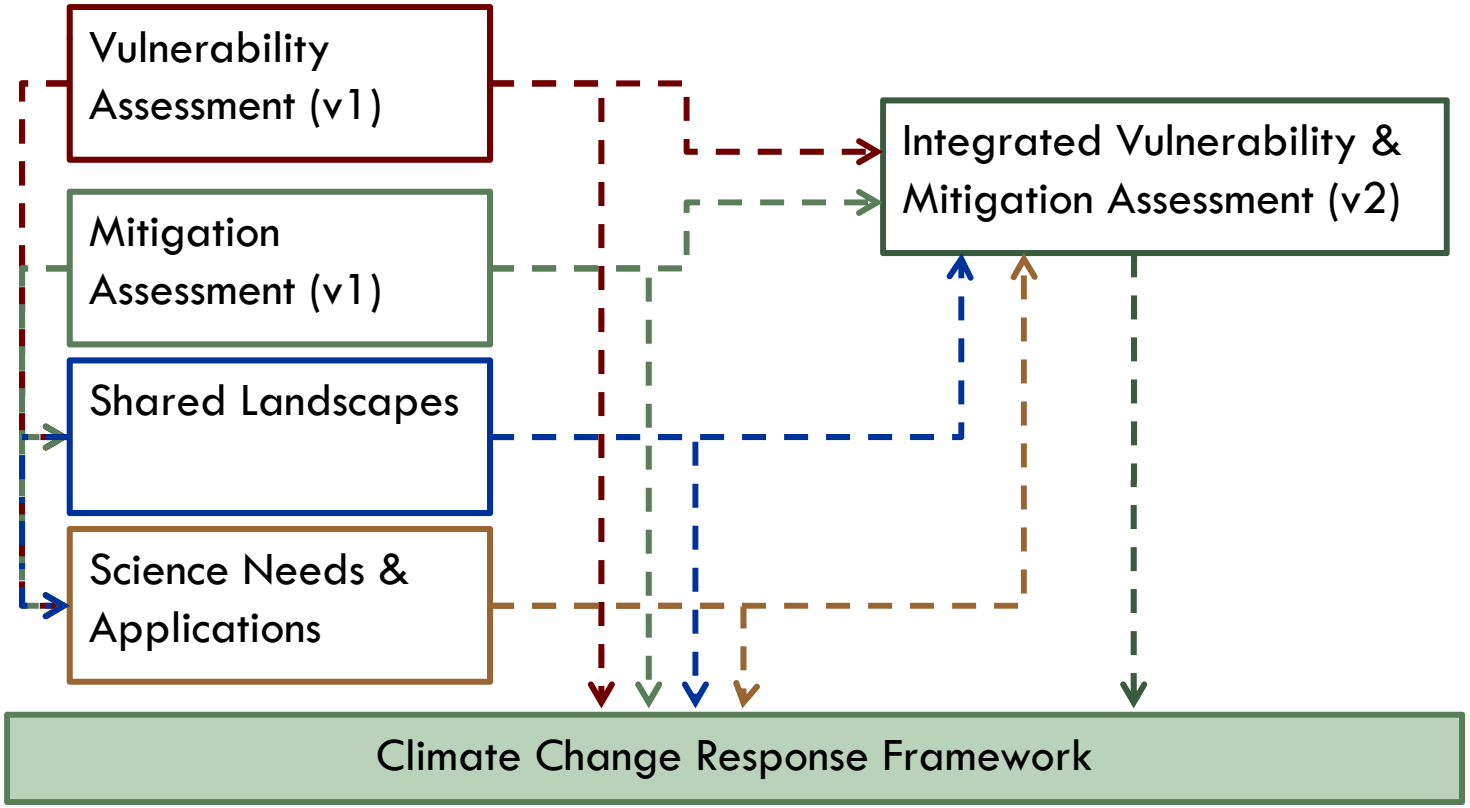
1) **Vulnerability and Mitigation Assessments**
2) **Shared Landscapes Initiative**
3) **Science Needs & Applications Workshop**

Identify the science needs, monitoring infrastructure, and applications necessary for making science-based management decisions at CNNF within the context of climate uncertainty

Create a **Climate Change Science Roundtable**

Project components

- Framework integrates Assessments, reports, and experience
  - Strategies, approaches, examples



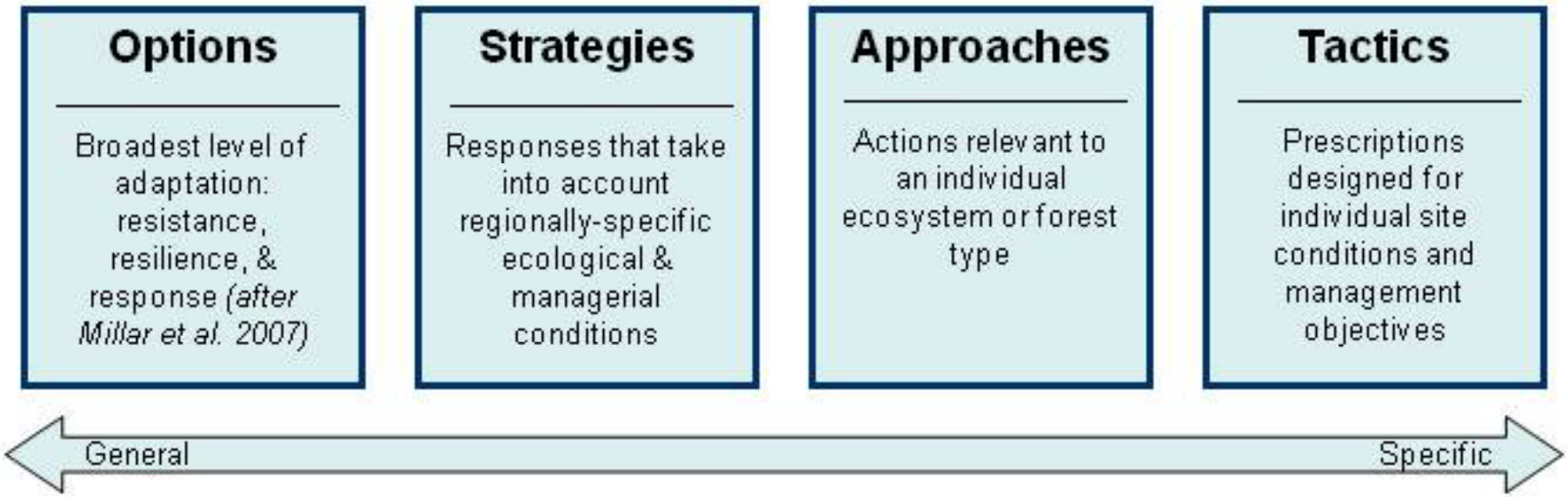
Project components

1) **Vulnerability and Mitigation Assessments**
2) **Shared Landscapes Initiative**
3) **Science Applications & Needs Workshop**
4) **Climate Change Response Framework**

Provide a framework for rapidly incorporating science and monitoring information into CNNF management activities to mitigate carbon emissions and better adapt ecosystems to changing climate

Project components

1) **Vulnerability and Mitigation Assessments**
2) **Shared Landscapes Initiative**
3) **Science Applications & Needs Workshop**
4) **Climate Change Response Framework**



Ongoing progress

drafts
1) **Vulnerability and Mitigation Assessments**

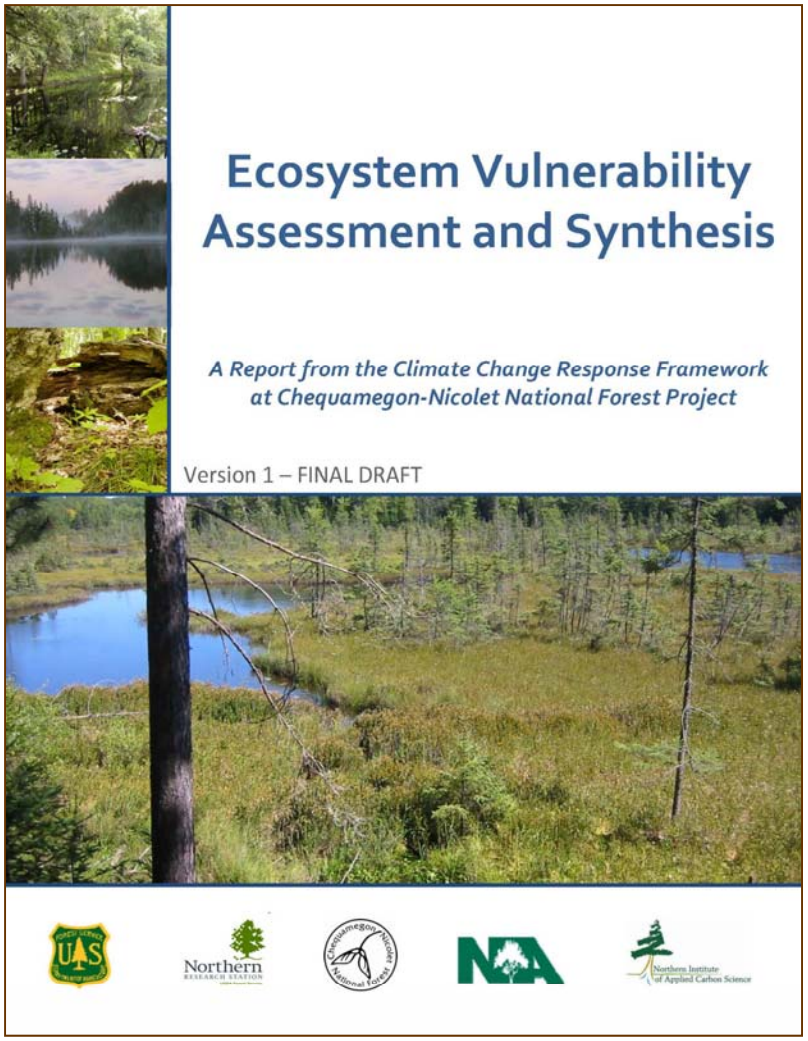
launched
2) **Shared Landscapes Initiative**

Done!
3) **Science Applications & Needs Workshop**

October
4) **Climate Change Response Framework**

Ongoing progress

Ecological Vulnerability Assessment and Synthesis



www.nrs.fs.fed.us/niacs/tools/draft_docs/

Ongoing progress

Vulnerability Assessment - Modeling

- Climate Change Tree Atlas
  - Species distribution model
  - Potential changes in suitable habitat
  - Climate Change Atlas Lab (L. Iverson, USDA Forest Service)
- LANDIS II
  - Process model
  - Simulates interactions, disturbance, management
  - Forest Landscape Ecology Lab (D. Mladenoff, UW–Madison)

Climate Change Tree Atlas: projections

- 76 species
  - 21 show some potential to increase
  - 19 show some potential to decrease
  - 7 show little or no change
  - 29 species have new suitable habitat entering the region

Most of the current dominant tree species show potential for decline

Climate Change Tree Atlas: projections

Ecological Vulnerability Assessment and Synthesis

Large Decline

- Black Spruce
- Balsam Fir
- White Cedar
- Yellow Birch
- Paper Birch
- Quaking Aspen
- White Spruce
- Eastern Hemlock
- Sugar Maple
- Black Ash
- Tamarack
- Big Tooth Aspen

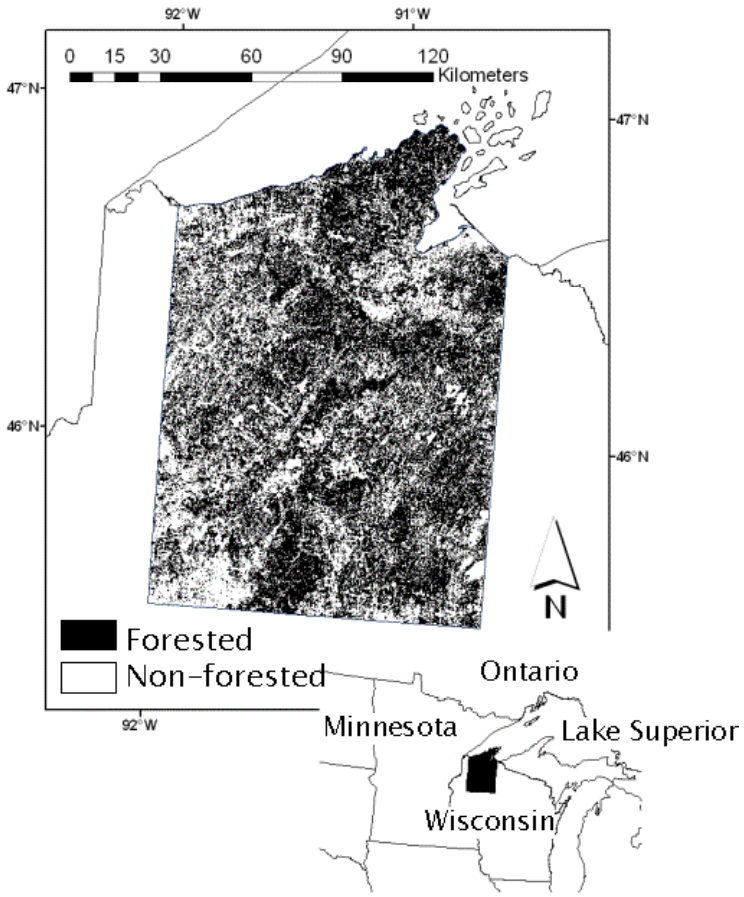
Small Decline

- Jack Pine
- Red Maple
- White Pine
- Butternut

No Change

- Red Pine
- N. Pin Oak
- Basswood
- Red Oak
- Pin and Choke Cherry

LANDIS-II: projections



- Increased biomass
- Balsam fir, paper birch,white spruce, jack pine, and red pine extirpated
- Greatest changes in composition occurred without disturbance.
- Forest management remains a strong driver of forest composition for ~50 years despite projected climate change.

Agreement between models

- Northern and boreal species **decrease** in extent and/or abundance
- Species highly likely to show severe declines are balsam fir, paper birch, and white spruce
- Species likely to show some decline are red pine, jack pine, northern white-cedar, quaking aspen, and yellow birch
- Species with potential to increase are bur oak, black oak, and bitternut hickory

Vulnerabilities

Ecological Vulnerabilities:

Synthesis

Vulnerabilities

- Risk will be greater in low diversity ecosystems
  - Low species diversity
  - Low functional diversity
    - Reliance on saturated soils (lowland conifers)

Vulnerabilities

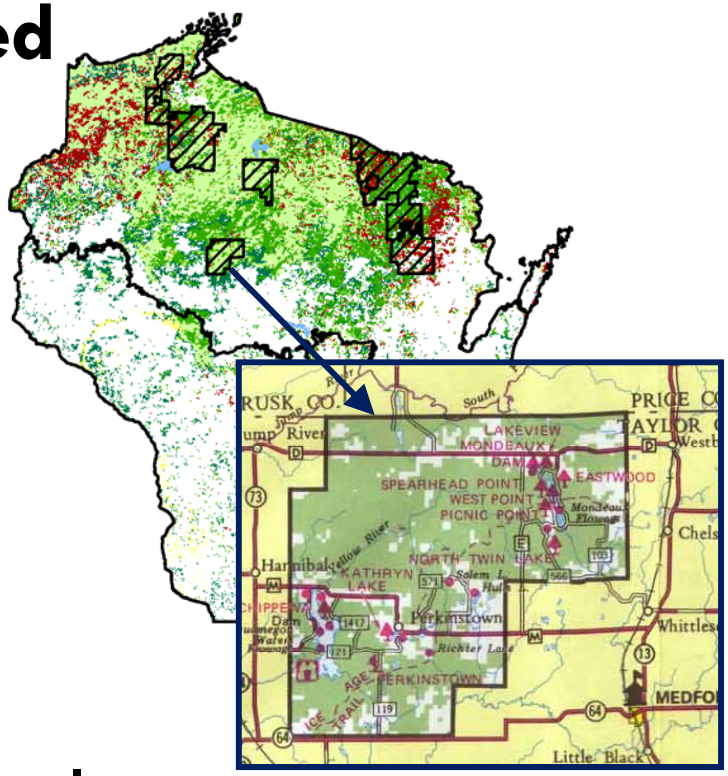
- Disturbance will destabilize static ecosystems
  - Low resilience
    - Lowland conifers
    - Lowland hardwoods
    - Hemlock

Vulnerabilities

- Greater problems for species already in decline, mostly from reduced habitat suitability
  - Hemlock
  - White cedar
  - Yellow birch
  - White spruce

Vulnerabilities

- **Resilience may be weakened in fragmented ecosystems**
  - May not adapt as easily as continuous areas
  - Smaller patch sizes support less species and genetic diversity
  - Greater inhibition of dispersal



Vulnerabilities

- Altered hydrology may jeopardize lowland forests.
  - Rely on saturated soils
  - Vulnerable to drought
  - Low rainfall and high summer temperatures increase risk of peat fires
  - Perched bogs, fed by surface runoff, would be most vulnerable.

Vulnerabilities

- Ecosystem changes will have significant effects on wildlife
  - Spruce grouse – dependent on black spruce, jack pine, balsam fir

Response

Climate Change Response Framework

1) Vulnerability and Mitigation Assessments
2) Shared Landscapes Initiative
3) Science Needs & Applications Workshop

4) Climate Change Response Framework provides approaches to:

- better adapt ecosystems to changing climate
- mitigate carbon emissions
- respond to climate change impacts across ownership boundaries
- rapidly incorporate science and monitoring information into management

Next Steps

- More models!
  - Biome-BGC (Gower – U. Wisconsin-Madison)
  - PnET-CN (Pan – NRS)
  - LM3V (from GFDL earth system; Lichstein – Princeton)
- Expand effort
  - Province 212 (northern MI, WI, MN – 5 NFs)
  - Trust for Public Lands, The Nature Conservancy, American Forest Foundation, The Wildlife Society
  - Workshop for Forest Supervisors and partners
- Climate Change Response Framework


Thank you.