Science Meets Science Fiction:

Seeing into the Future of Ecosystem Conservation

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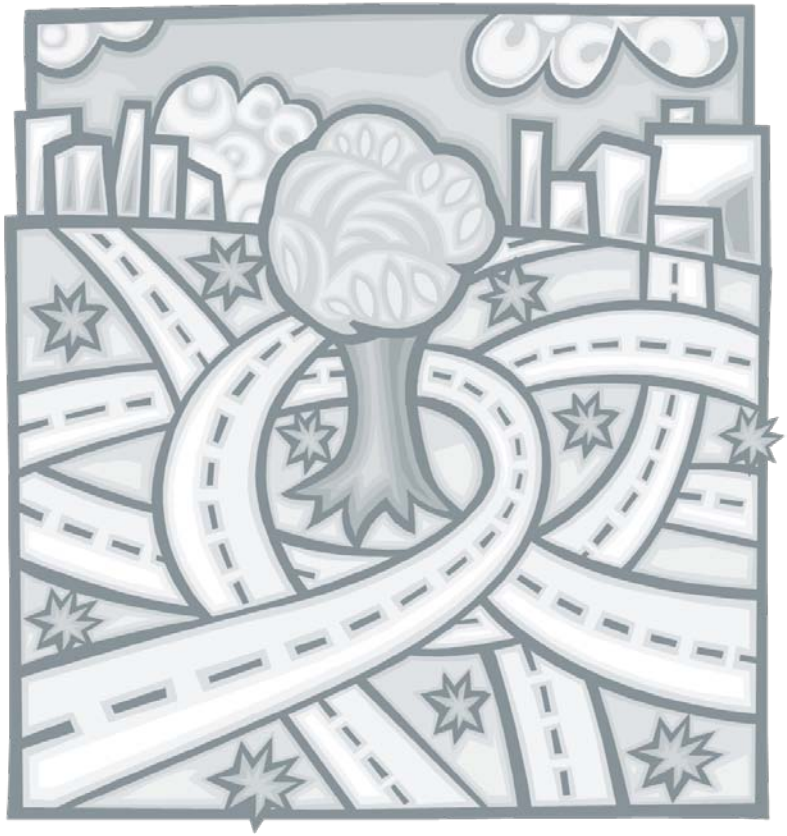
Motivation

Project Aims

Approach

Scenario Building

Next Steps



Road Map

Changing Environment of Conservation

- Ownership patterns
- Drivers of landscape change
- Management goals

Photo from TNC.

Distributed Conservation Strategies

- Spread limited protection efforts over larger areas
- Accommodate a broader range of ownership and management techniques
- Conservation Easements

Motivation

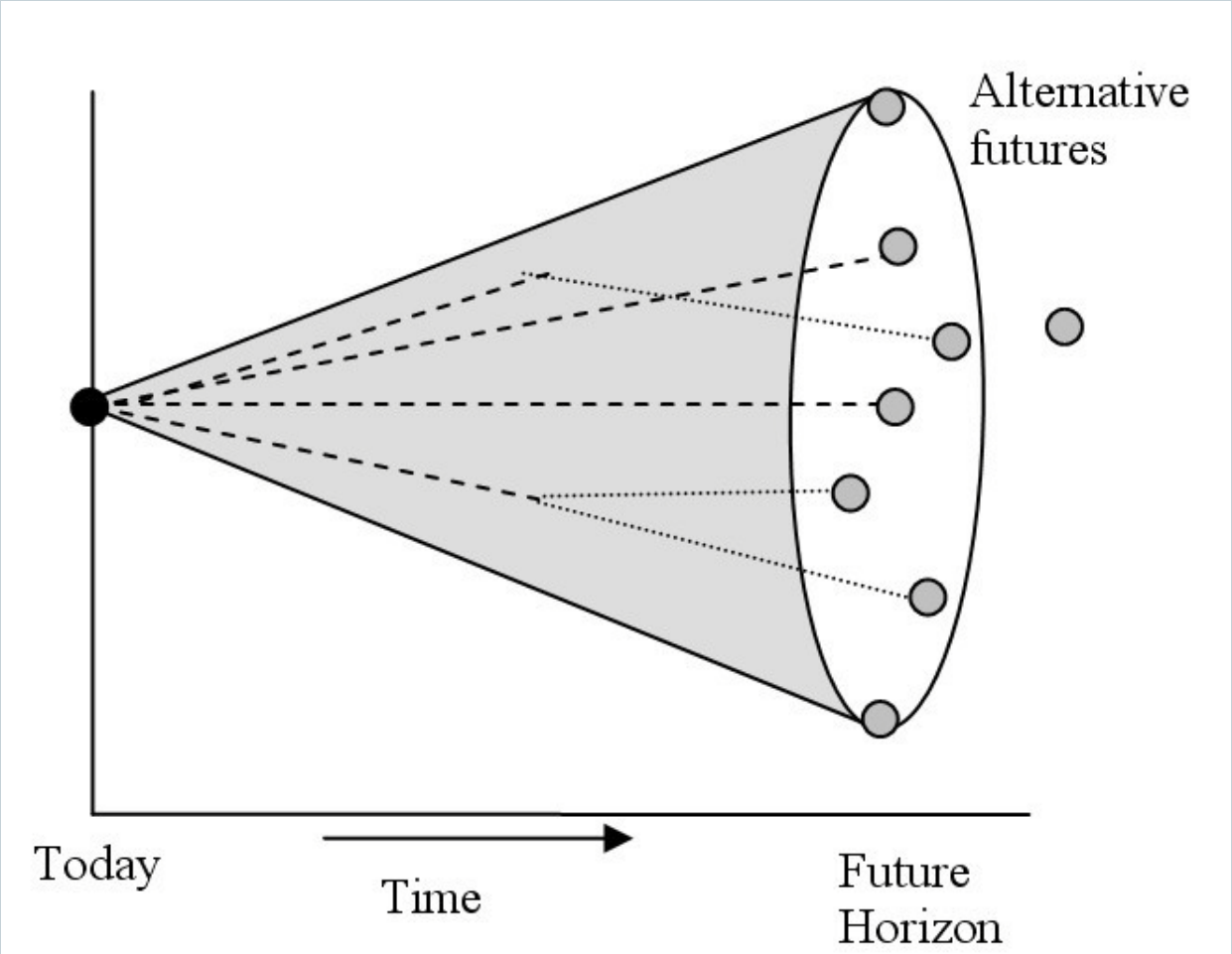
- Are ‘distributed conservation strategies’ effective mechanisms for biodiversity conservation?
- Are they robust to anthropogenic and climate change pressures over the coming centuries?
- Compare different strategies and different spatial arrangement.
- Complement traditional monitoring and adaptive management tools.

Project Aims

- Develop and model spatially explicit landscape scenarios to provide insight into possible landscape futures and their outcomes for biodiversity and ecosystem services.

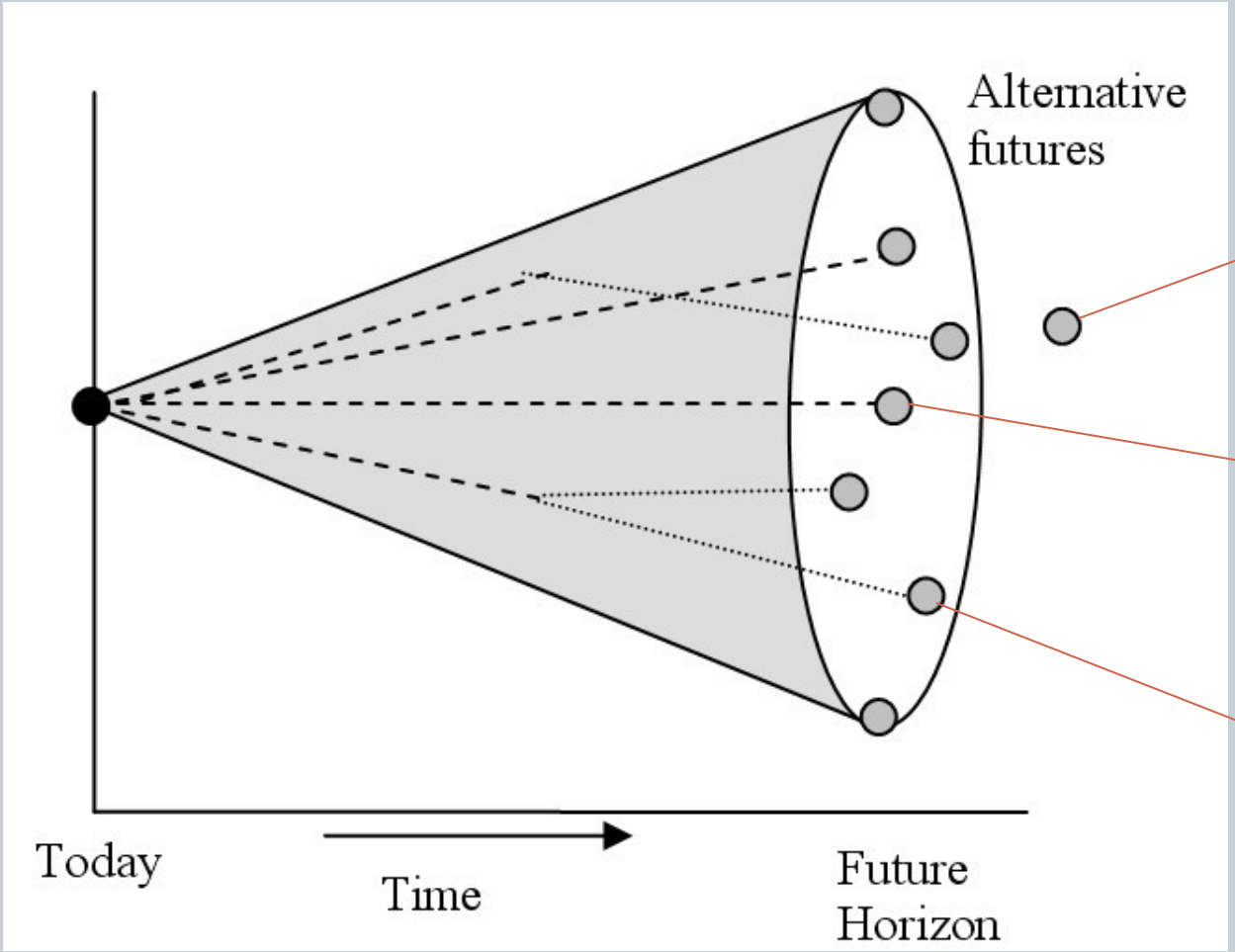
Photo by Steve S. Meyer, TNC.

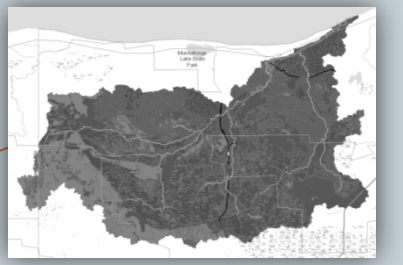
Scenario Analysis

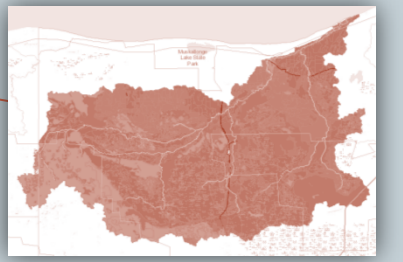


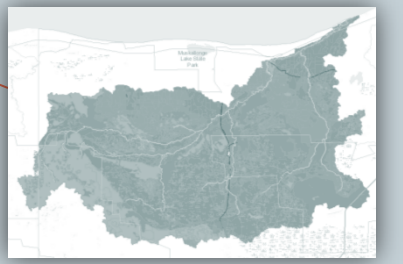
Mahmoud et al. 2009, adapted from Timpe and Scheepers 2003.

Scenario Analysis + Landscape Modeling









Mahmoud et al. 2009, adapted from Timpe and Scheepers 2003.

Scenario Analysis: Zombie Apocalypse Edition

Zombies attack (like we all knew they would), what are your possible courses of action?

Scenario Analysis: Zombie Apocalypse Edition

Scenario 1

Scenario Analysis: Zombie Apocalypse Edition

Scenario 1

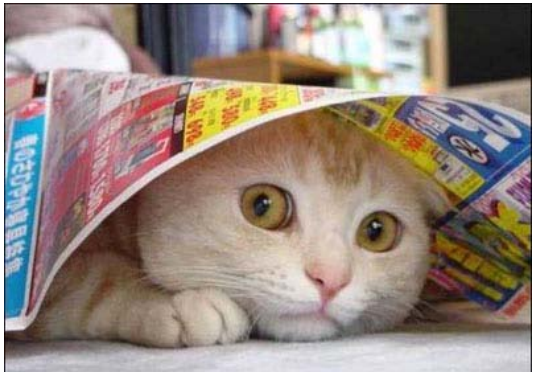
Scenario 2

Scenario Analysis: Zombie Apocalypse Edition

Scenario 1

Scenario 2

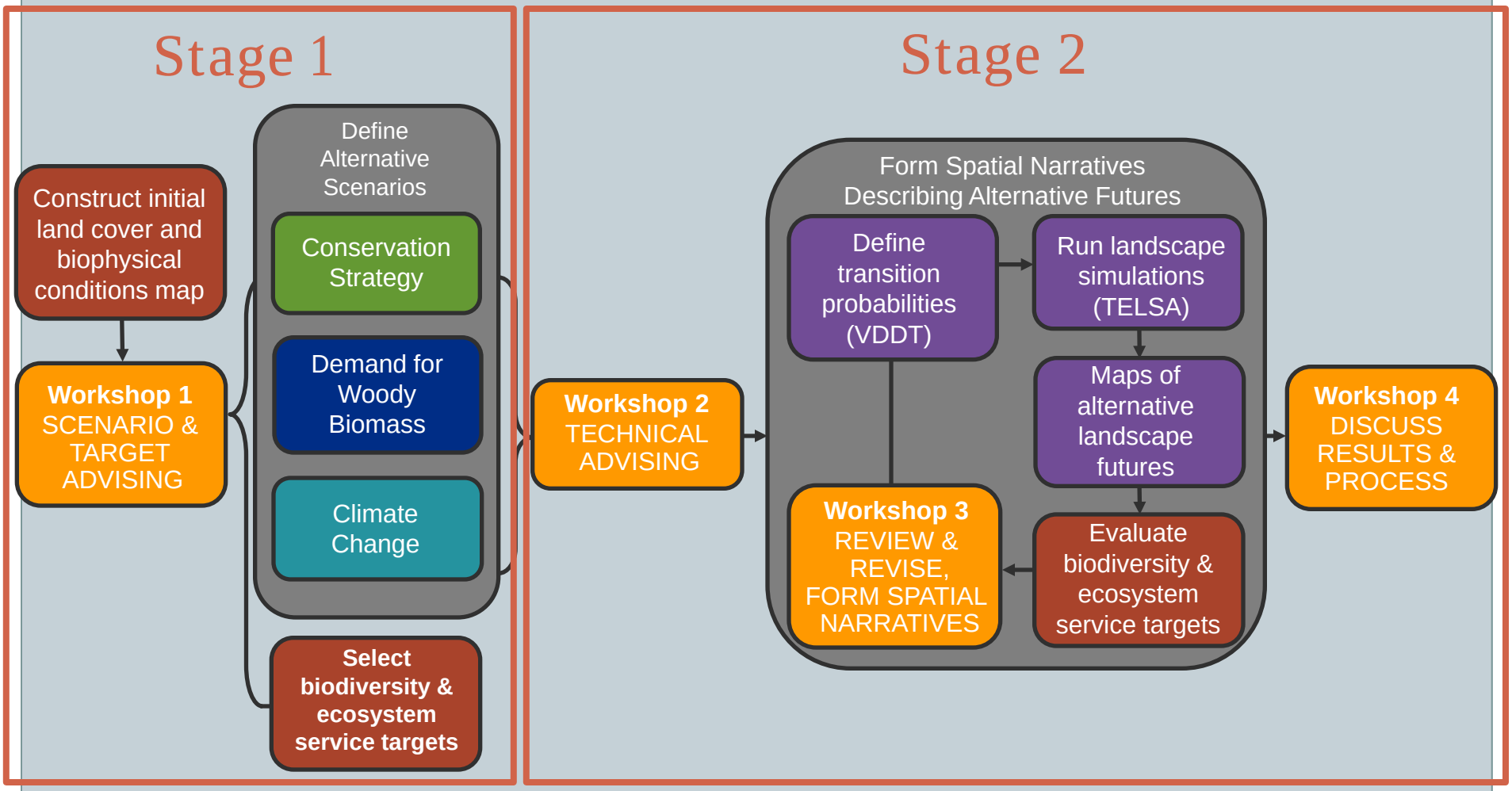
Scenario 3



Scenario Analysis: Zombie Apocalypse Edition

Scenario 4: Blend in.
(Derived from expert knowledge)

Approach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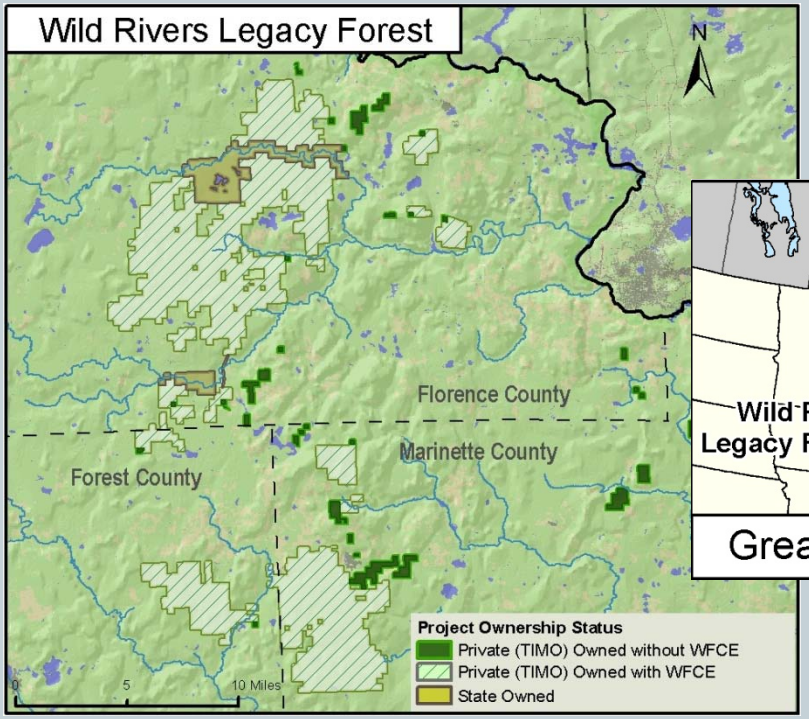
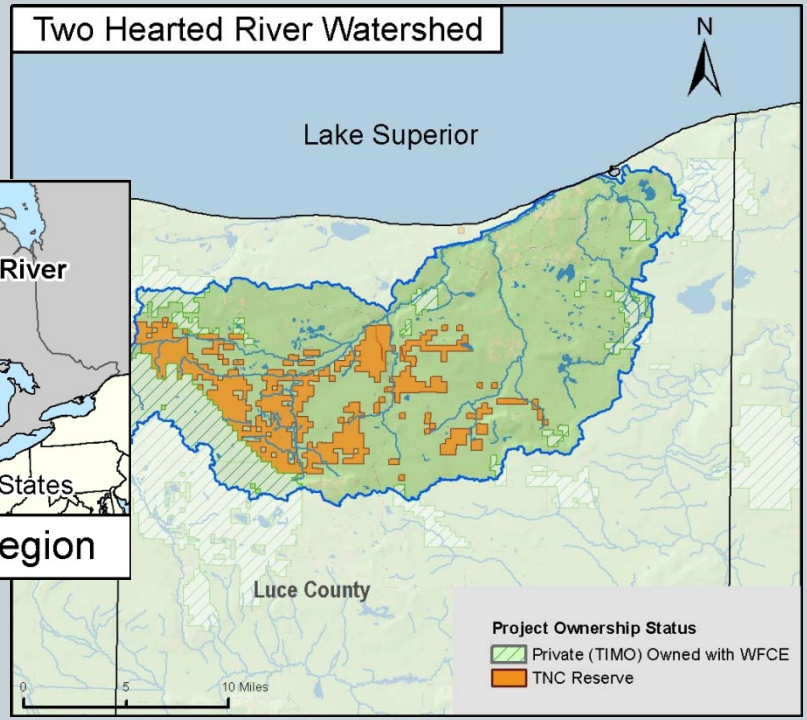
Study Sites

Wild Rivers Legacy Forest



26,300 hectares

Two Hearted River Watershed



46,500 hectares

Maps courtesy of John Wagner, Wisconsin TNC.

Landscape Scenarios

- Exploratory scenarios[1]
  - Extend past trends
  - Anticipate change different from past
- On-site workshop at each study location
- Local experts
  - Foresters
  - TIMO managers
  - DNR biologists and managers
  - TNC experts

[1] See scenario development and applications citations.

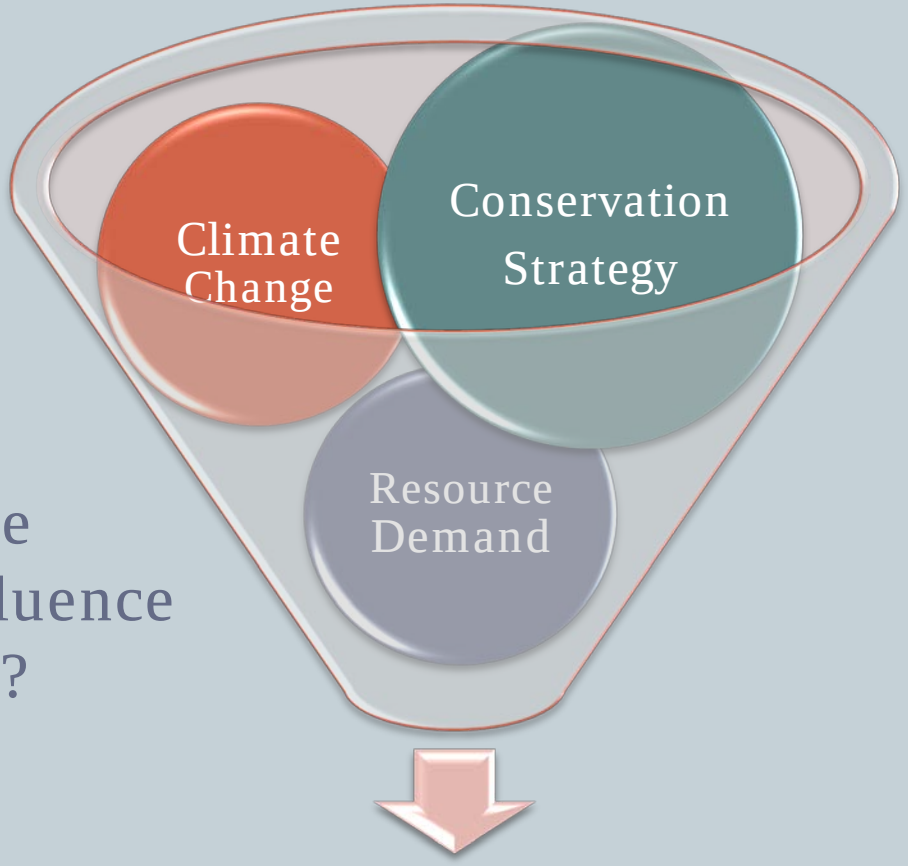
Photo by Jessica Price.

Scenario Development

Benefits of a collaborative approach

- Local knowledge fills in gaps
- Compensate for irreducible uncertainty
- Engages diverse set of experts and practitioners
- Balance multiple perspectives and goals
- Generates locally relevant, transferable outcomes
- Increased credibility and legitimacy of outcomes
- Sets the stage for continued cooperation

Scenario Development

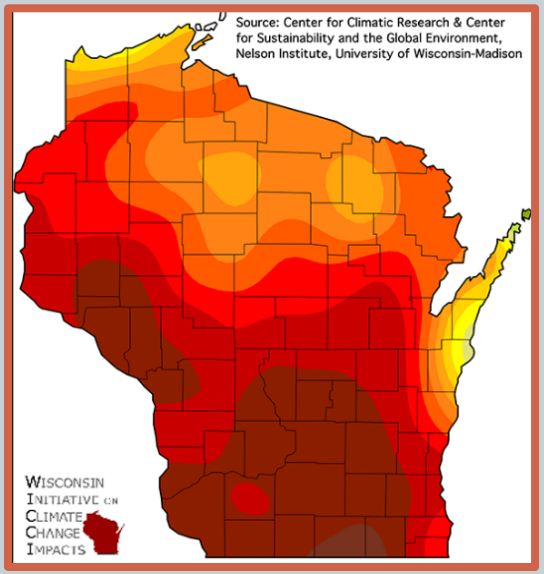


How might these components influence forest dynamics?

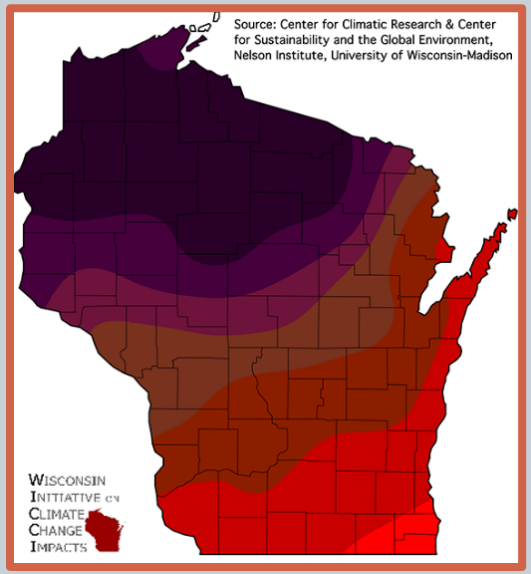
Landscape Scenario

Climate Change:
Which variables are most important?

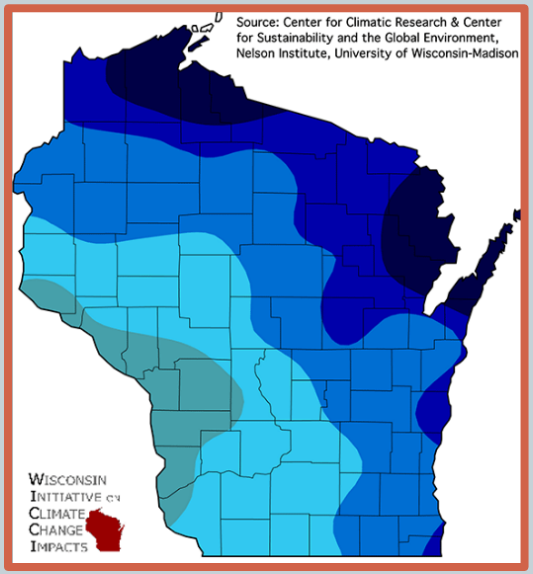
- Wisconsin Initiative on Climate Change (WICCI)
- 10.5-11.25°F Increase in Mean Annual Temperature from 1980 to 2090
  - More Frequent Extremes, Less Frequent Freezing
- Increase Precipitation Overall, Less in Winter



Δ Days Above 90°F



Δ Days Below 20°F



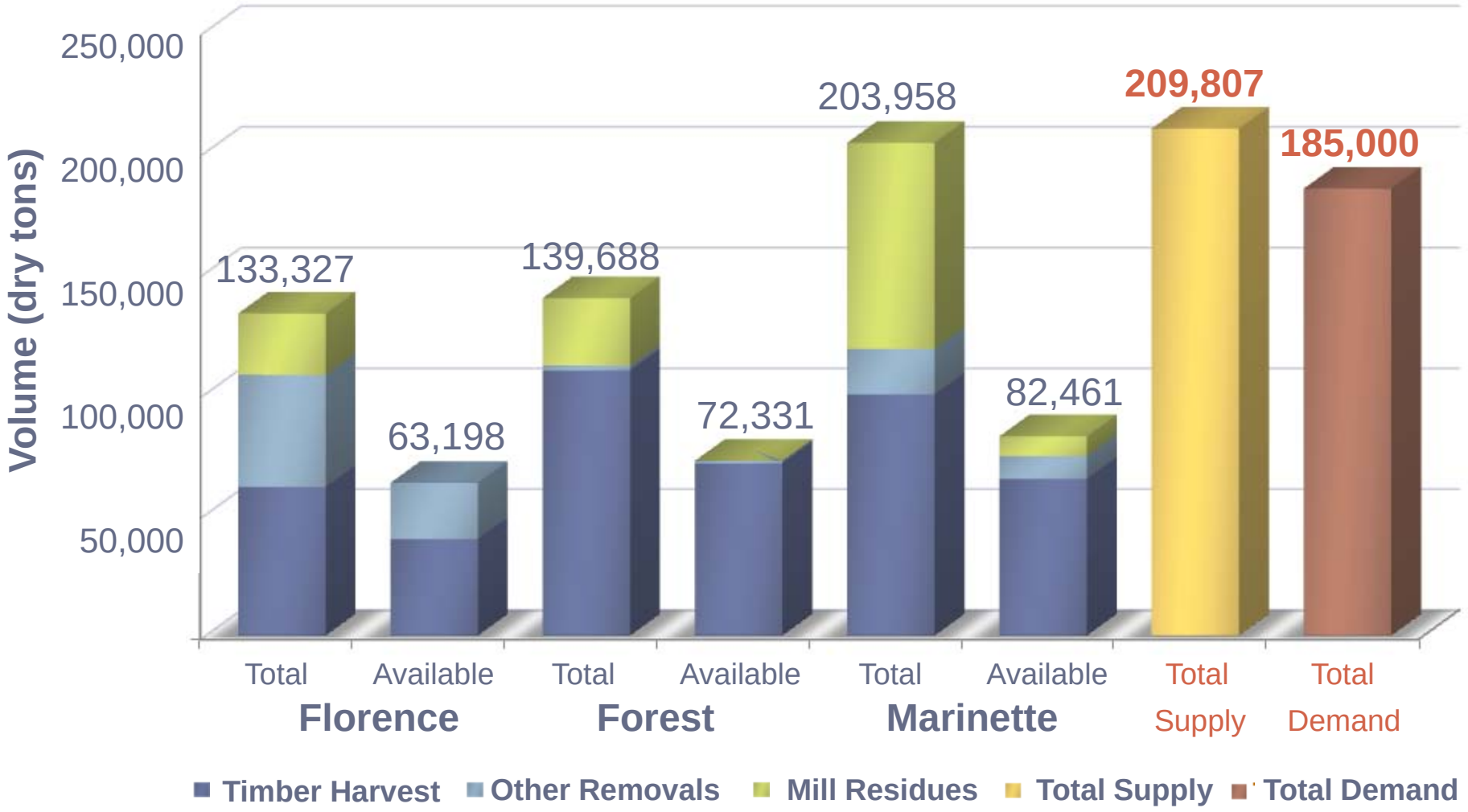
Δ Precipitation of 1”

Resource Demand: Will there be a demand for woody biomass for energy production?

- Co-firing with coal to generate electricity
- Advantages:
  - Compatible with existing coal-fired boilers
  - Renewable feedstock
  - Potential for rapid adoption
- Numerous coal-fired plants currently being converted
- Requires local source of biomass to be economical

Photo by Phillip J. Redman.

Rapid Assessment: Woody Biomass Supply and Demand



Biomass for Renewable Electricity Production

- If 7 utilities within 100 miles produced 5% of their electricity with biomass:
  - Demand = 333,348 dry tons/year
  - 123,631 dry tons more than is currently available

- Therefore, harvest of woody biomass residues from natural forests is a plausible driver of landscape change in the future!

Scenario Summary

Conservation Strategies

- No conservation action
- Current management
- Current management without certification
- All managed areas under working forest conservation easement
- All managed areas under cooperative ecological forestry

Drivers of Landscape Change

- Climate Change
  - Single emissions scenario
  - Regeneration, harvest, pathogen outbreaks
- Harvest of Woody Biomass
  - Binary
  - 25 yr time horizon
  - Decreased residue, changes in harvest

Conservation Targets

Ecological Targets

Target species

- Wide ranging—grey wolf
- Habitat specialists—pine marten
- Landscape matrix—red shouldered hawk

Target communities

- Cedar swamp, hemlock forest

Ecosystem Services

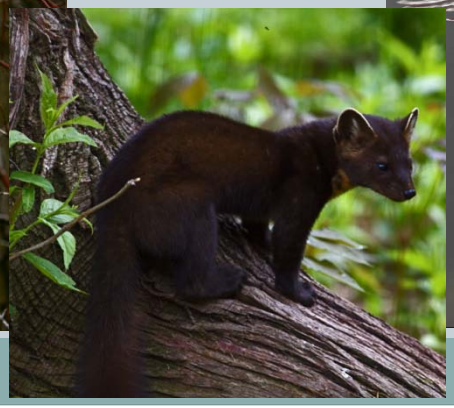
'Provisioning' ecosystem services

- Woody biomass for energy production
- Trout fishing

Cultural services

- North Woods lifestyle

Determine landscape structure requirements for each

Special Considerations

- Selection of participants
- Past experiences of participants
- Drawing boundaries
- Careful mediation
- Continued participation

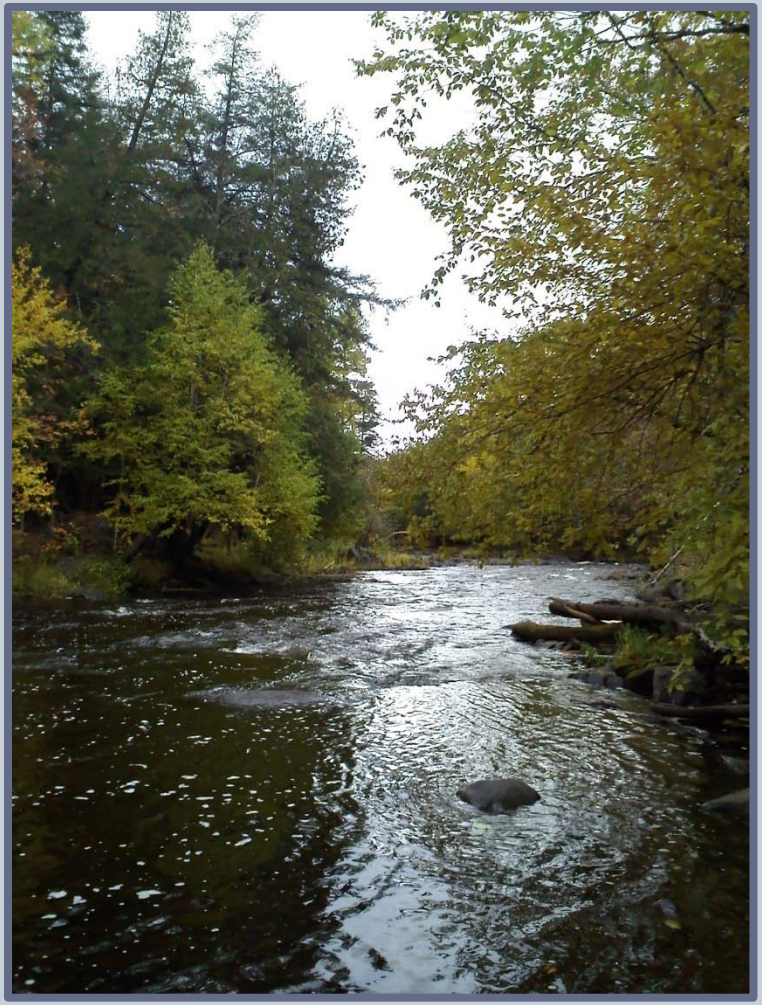
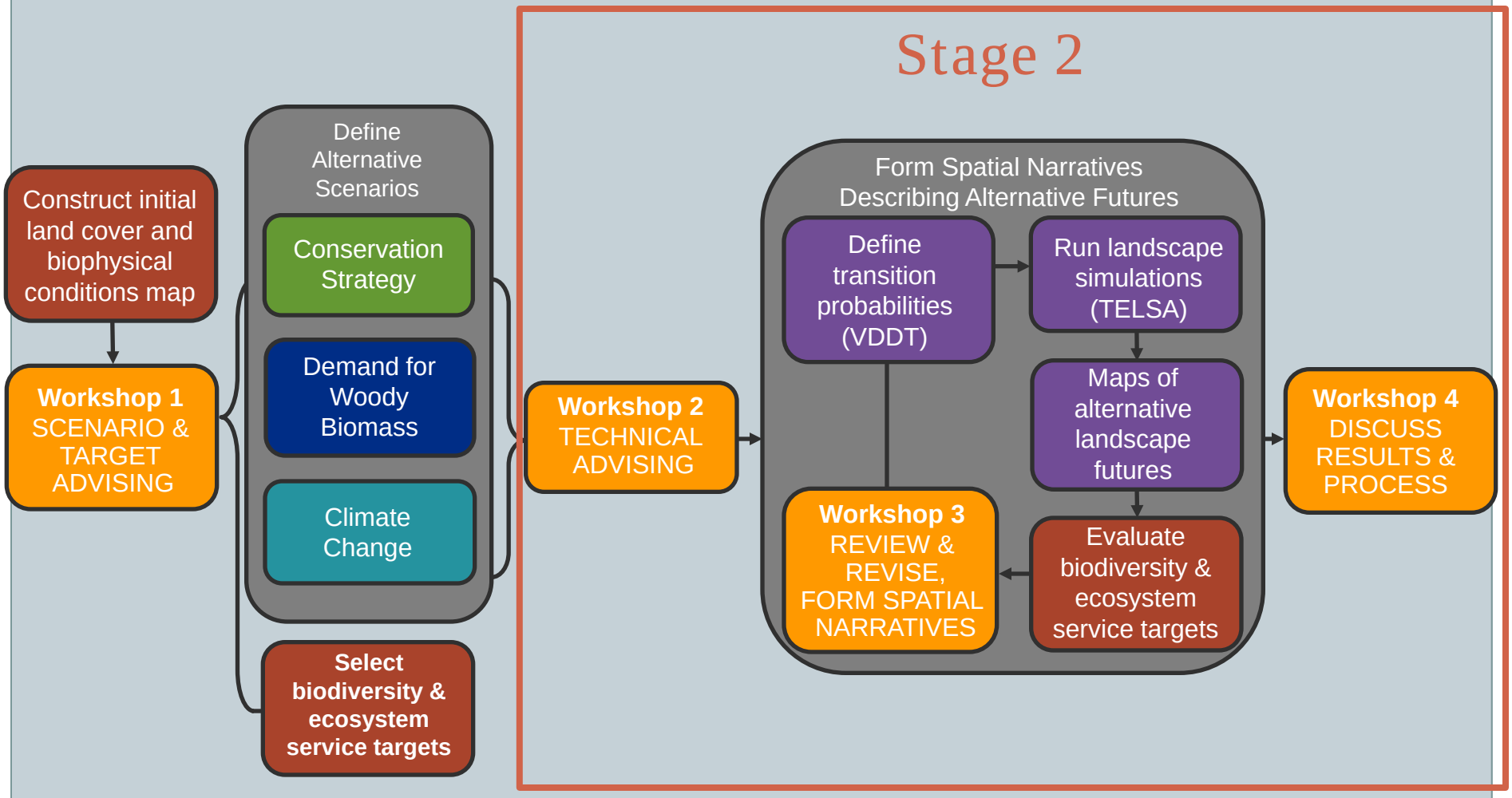


Photo by Jessica Price.

Next Steps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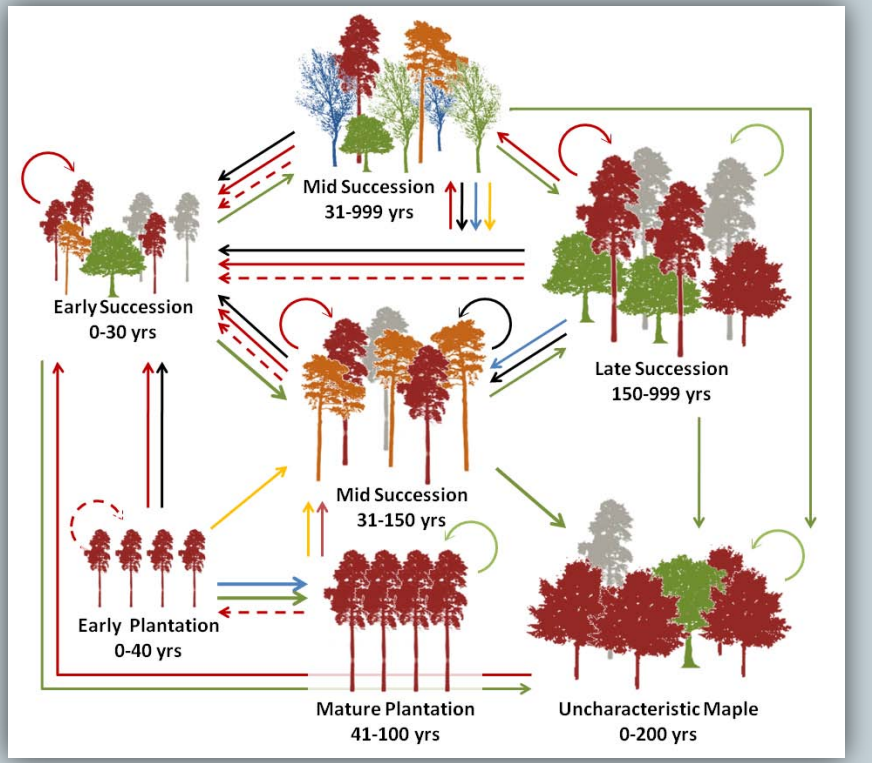
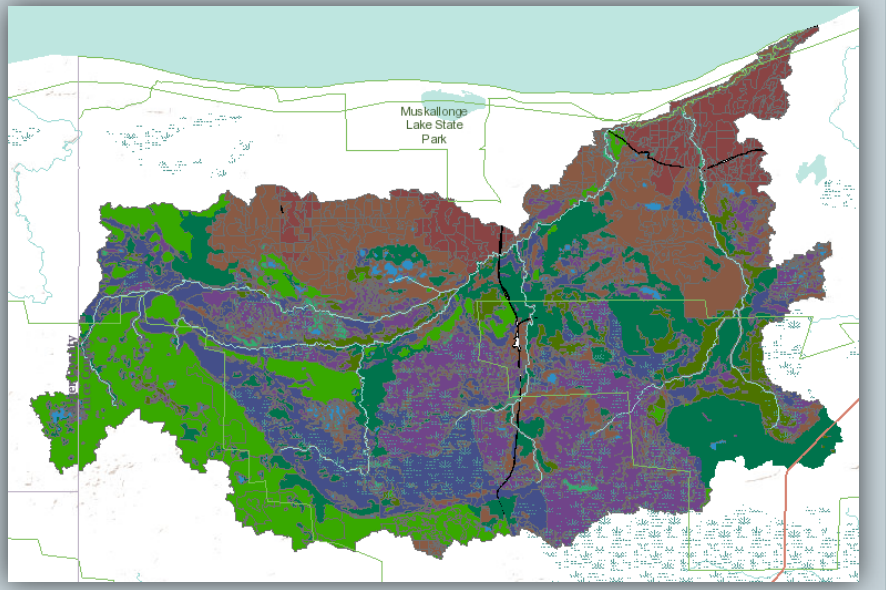
Forest Landscape Modeling

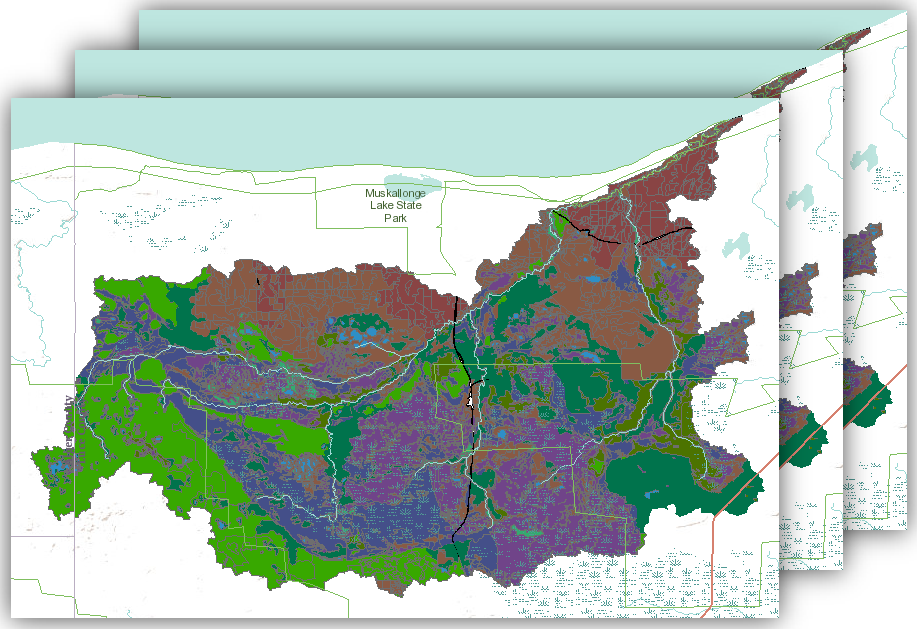
Vegetation Dynamics Development Tool (VDDT) → **Tool for Exploratory Scenario Analysis TELSA**





Next Steps: Integrating Scenarios and Modeling

Model landscape scenarios



Generate land cover maps for alternative scenarios

Expert evaluation and feedback

Anticipated Outcomes

- Enable comparison of conservation strategies
- Complement long-term monitoring
- Enable adjustment of strategies to anticipated future conditions
- Inform ongoing and future conservation opportunities
- Useful tool for pre-assessing landscape scale conservation strategies

Questions?

Special thanks to...

- Janet Silbernagel, Nicholas Miller, & Randy Swaty
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- The University of Wisconsin—Madison
- USDA Forest Service, State and Private Forestry Redesign

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