

Climate Change and the Boundary Waters



Leslie Brandt



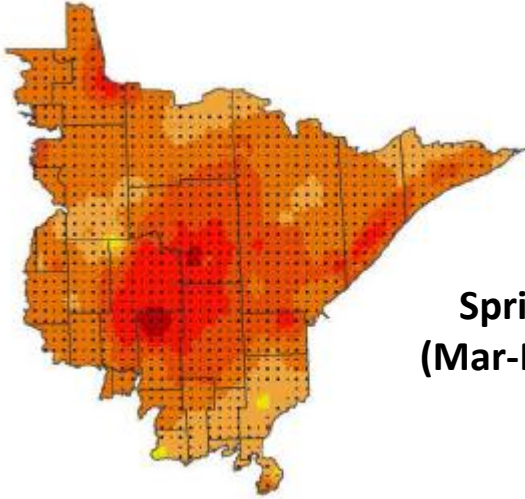
*Wolf Ridge Environmental Learning
Center*

March 20, 2013

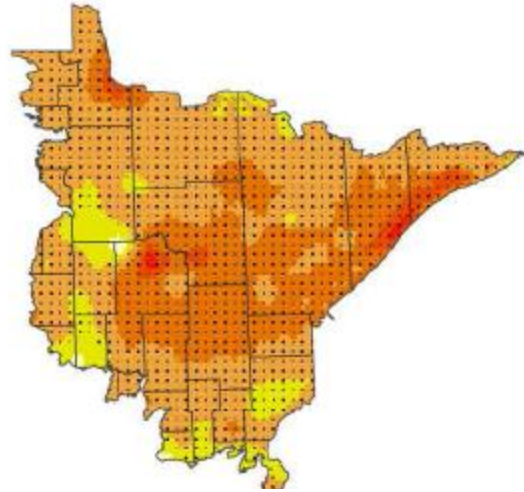
It's getting warmer

1901 - 2011
Temperature
change (°F)

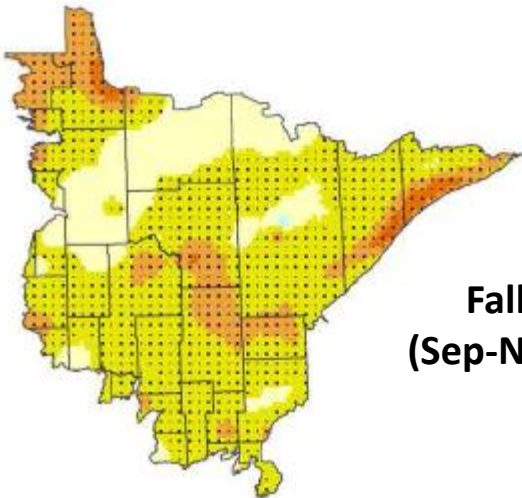
Winter
(Dec-Feb)



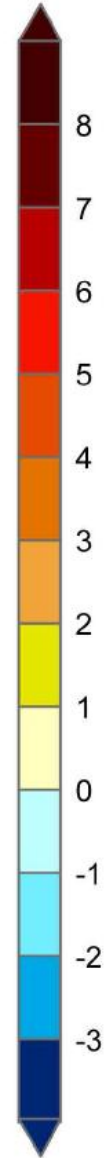
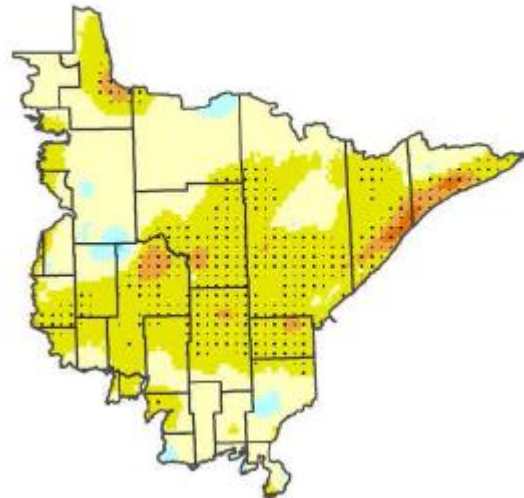
Spring
(Mar-May)



Summer
(Jun-Aug)

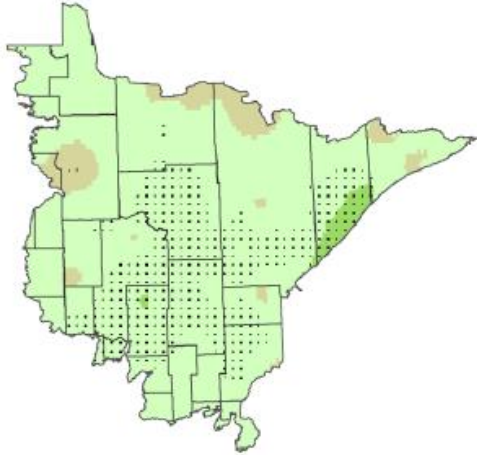


Fall
(Sep-Nov)

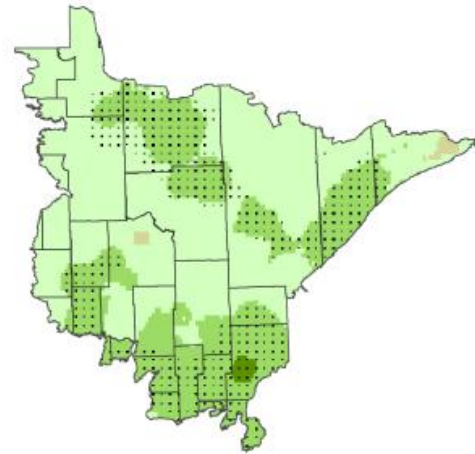


It's getting wetter

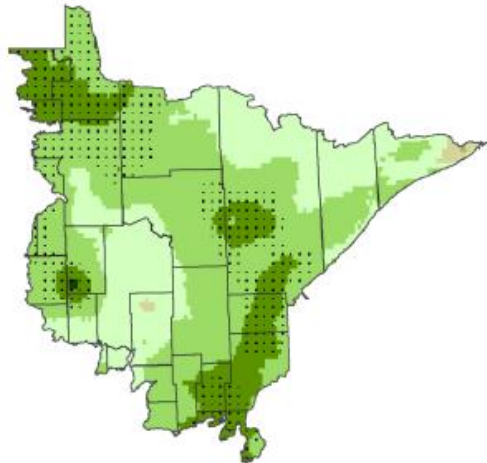
Winter
(Dec-Feb)



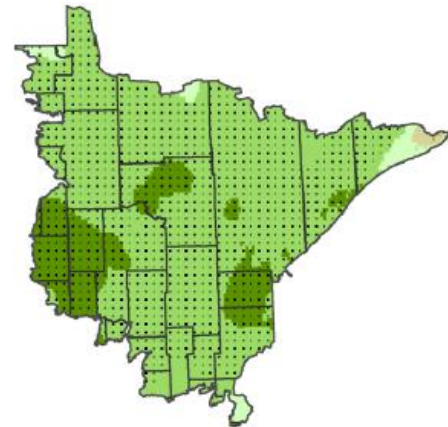
Spring
(Mar-May)



Summer
(Jun-Aug)



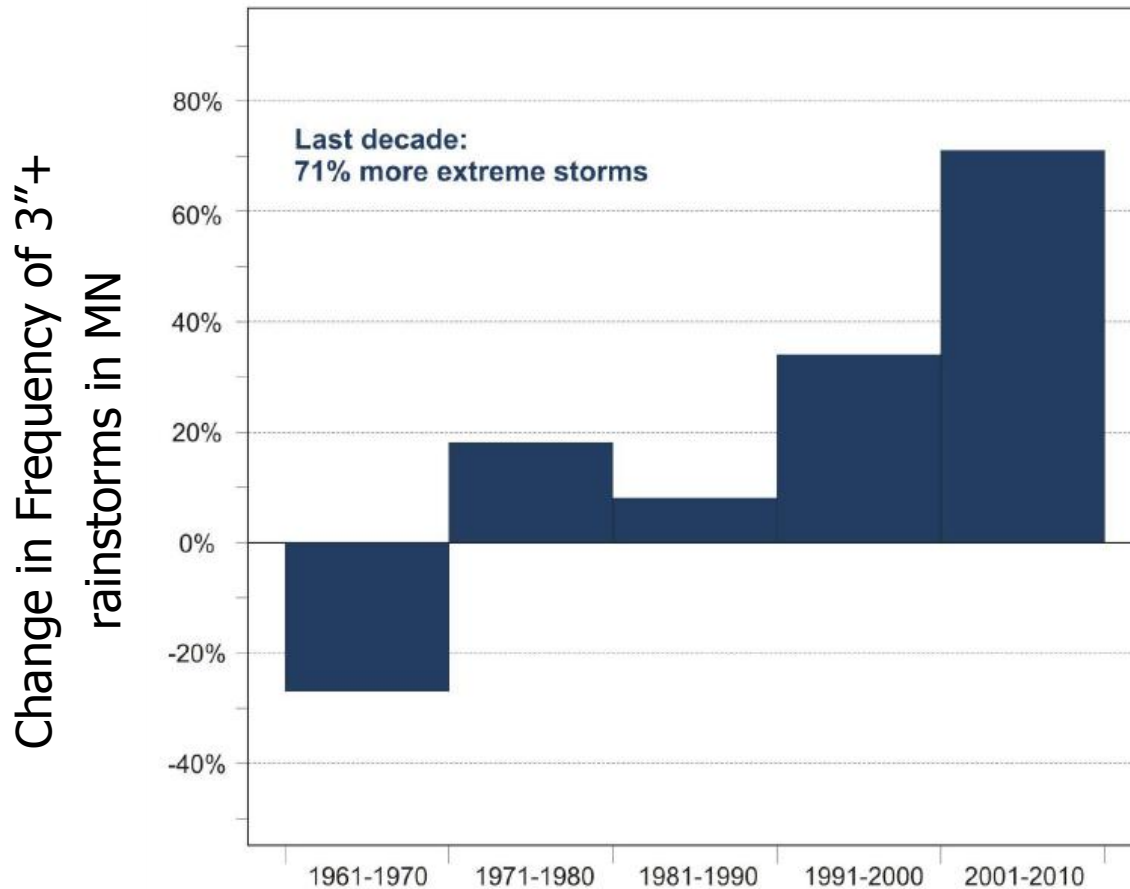
Fall
(Sep-Nov)



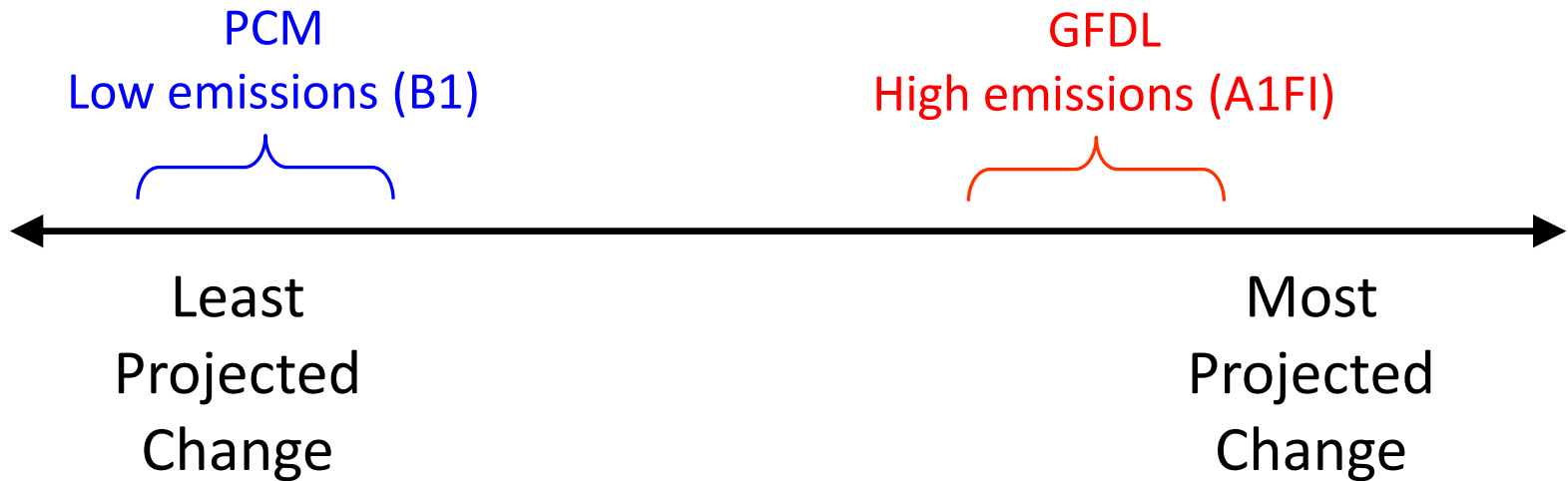
1901 - 2011
Change in seasonal
precipitation (inches)



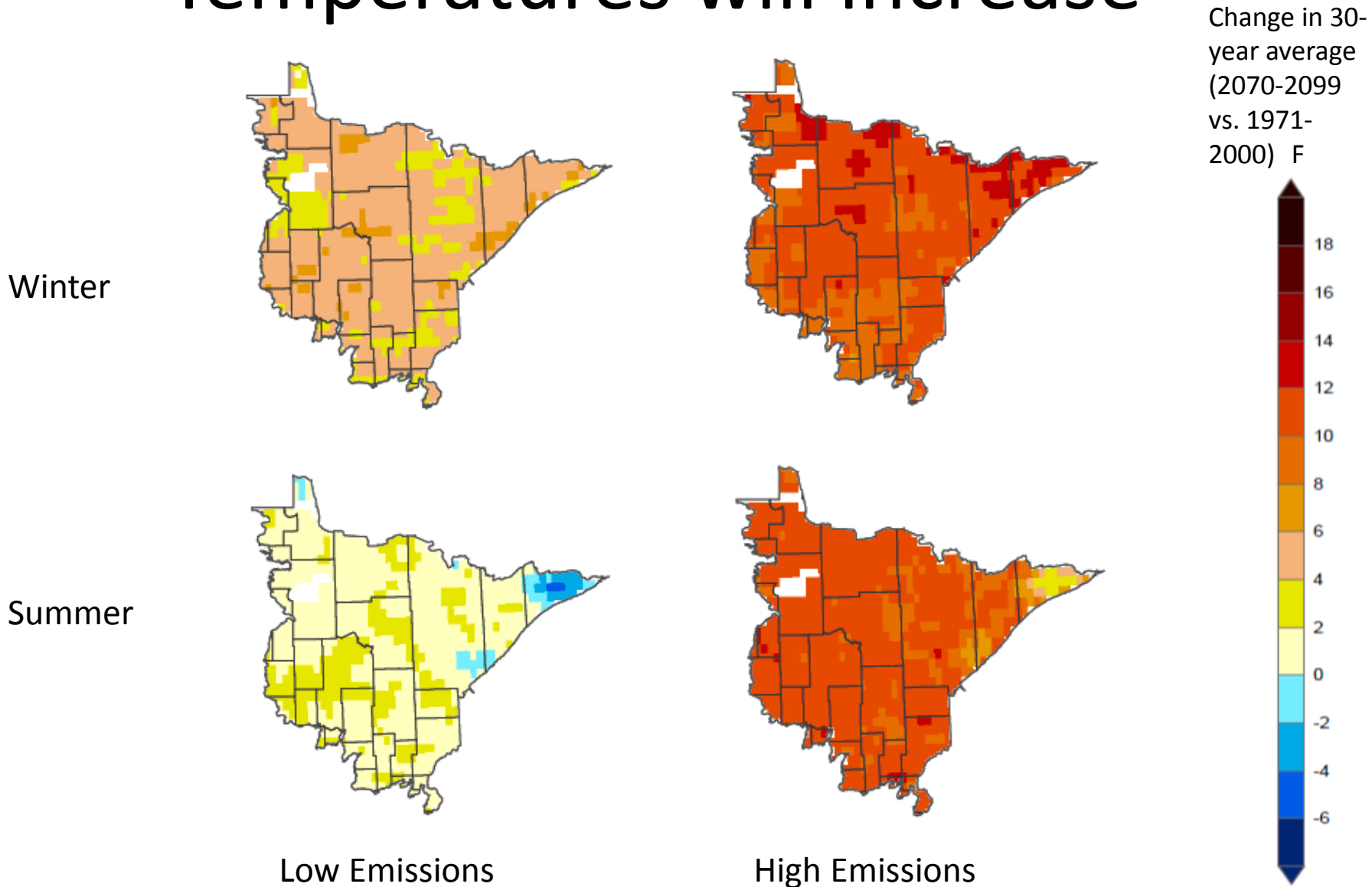
Heavy rain events are increasing



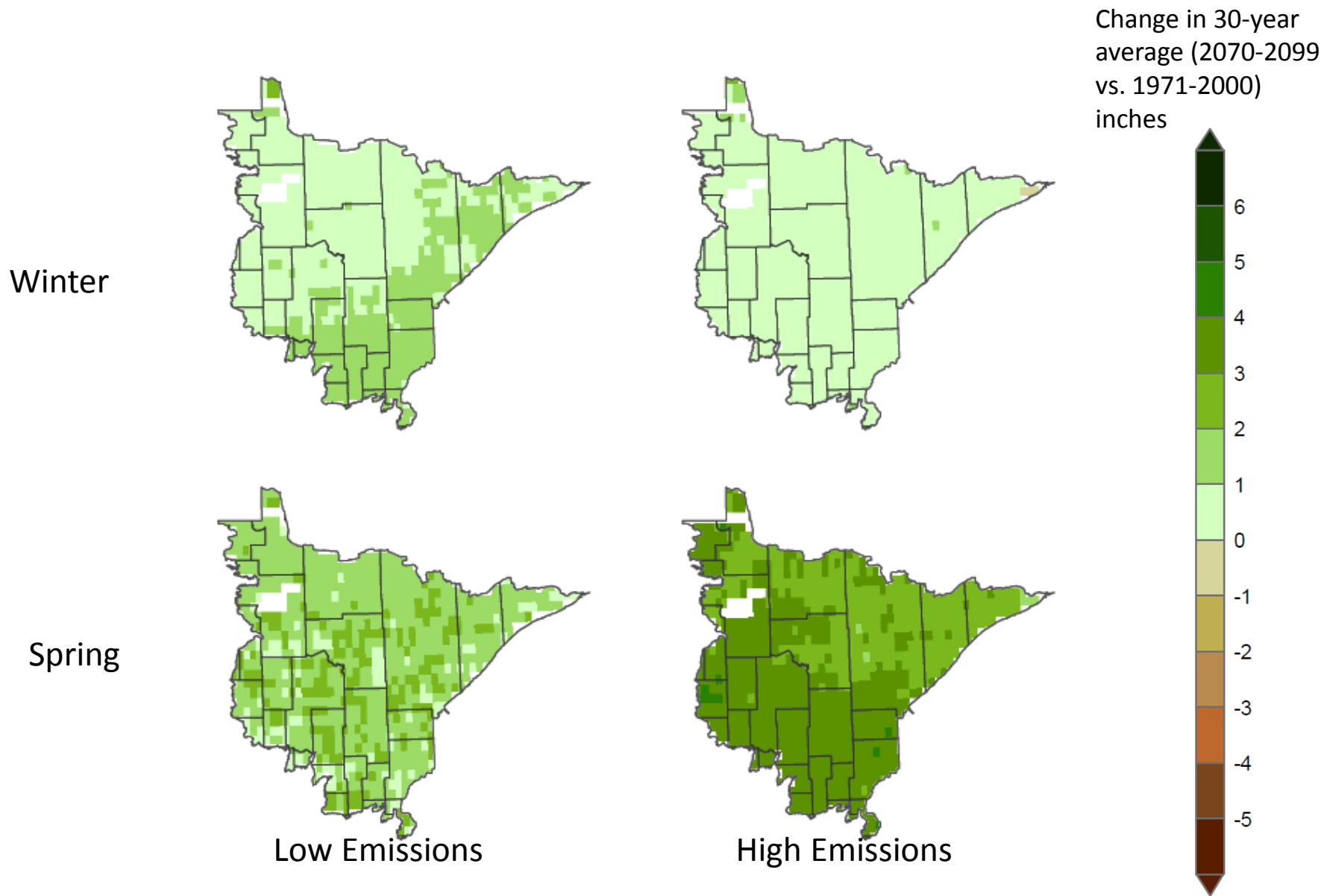
Projecting the Future



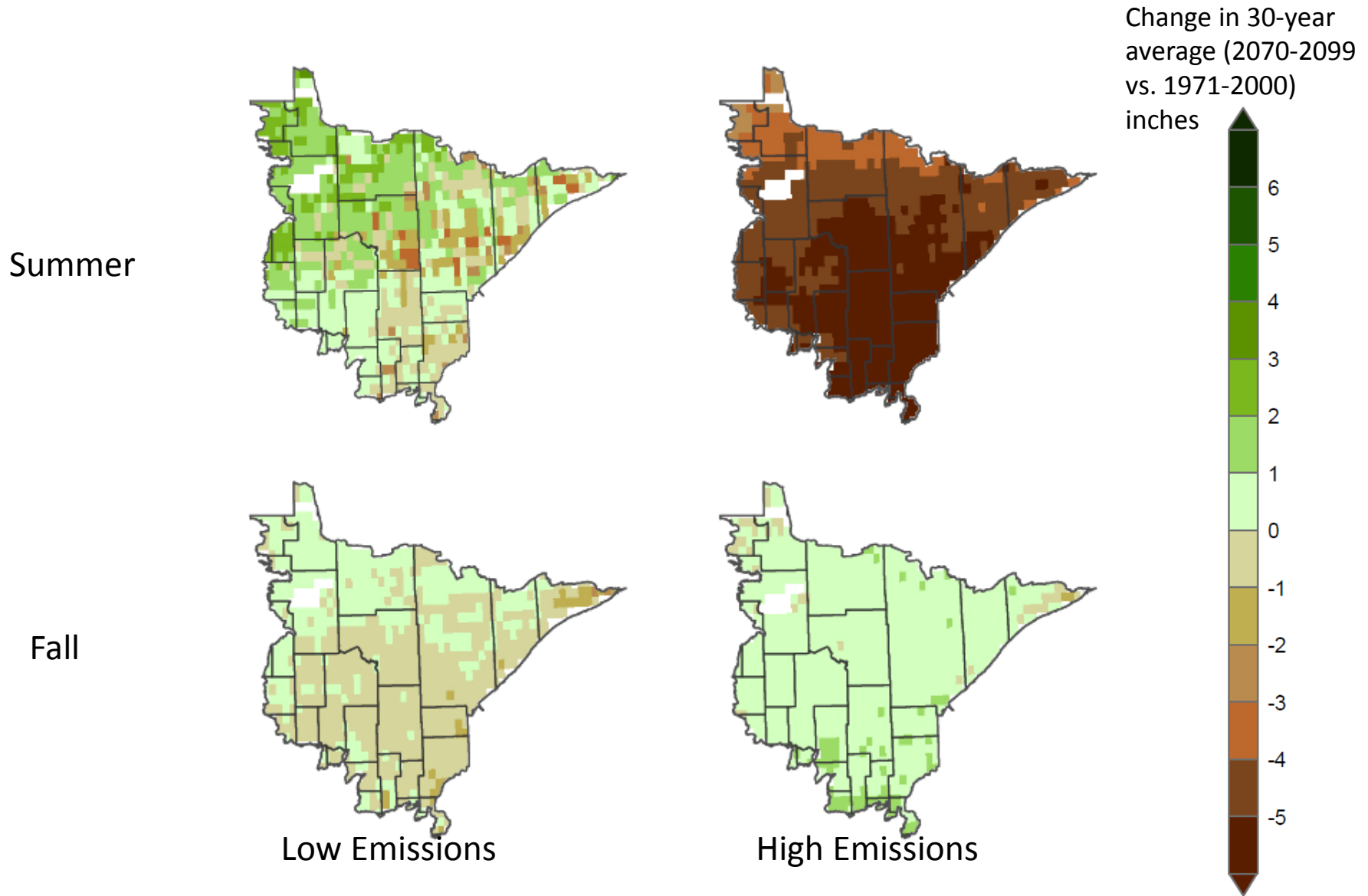
Temperatures will increase



Winter and spring will likely be wetter



Uncertainty about summer and fall

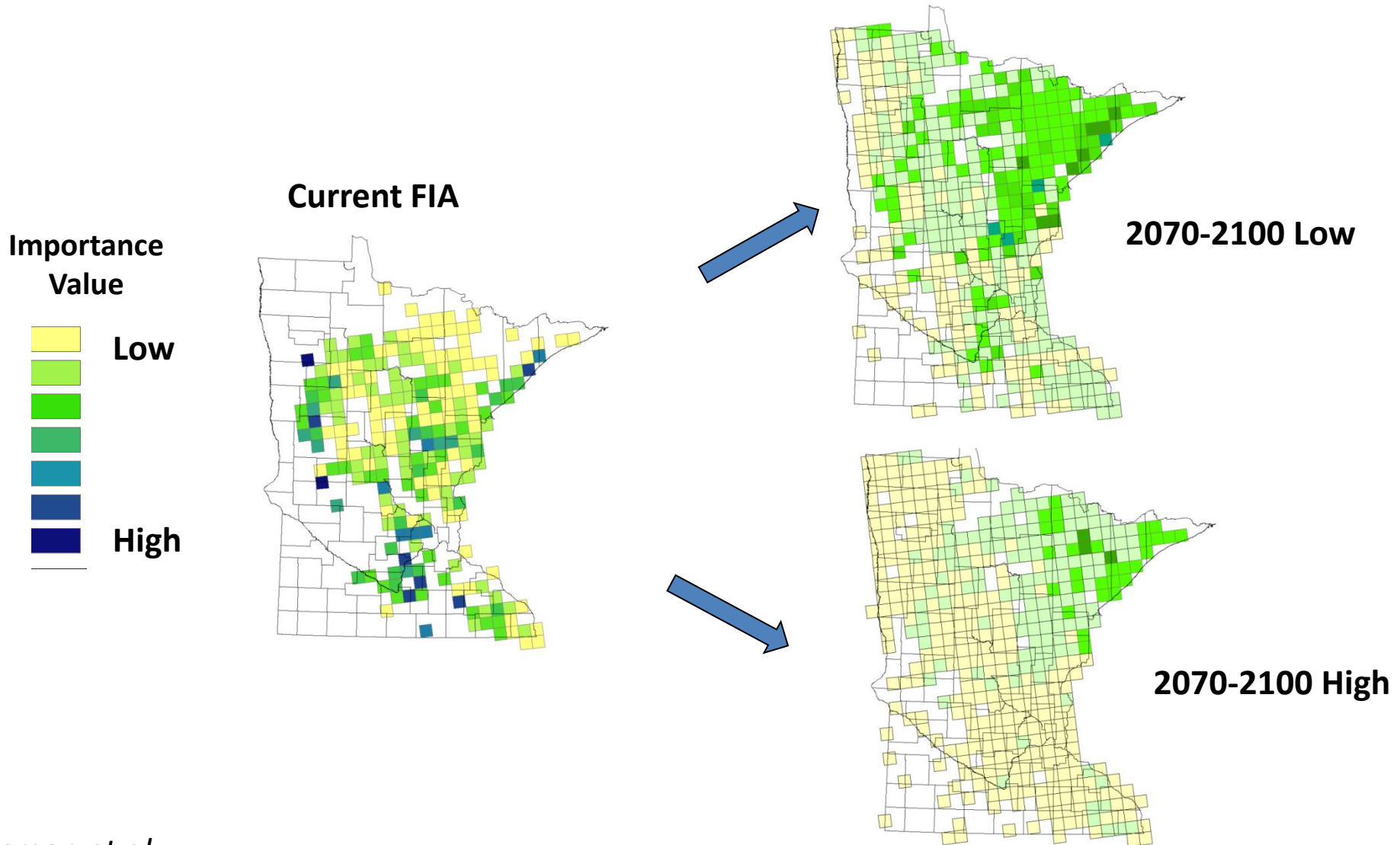


Impacts on Forests

Positive






- 👉 Carbon dioxide fertilization
- 👉 Longer growing/breeding season
- 👉 More water in some seasons/locations
- 👉 Reductions in a few pests/diseases
- 👉 Better conditions for maple, oak, white pine

Sugar Maple









Impacts on Forests

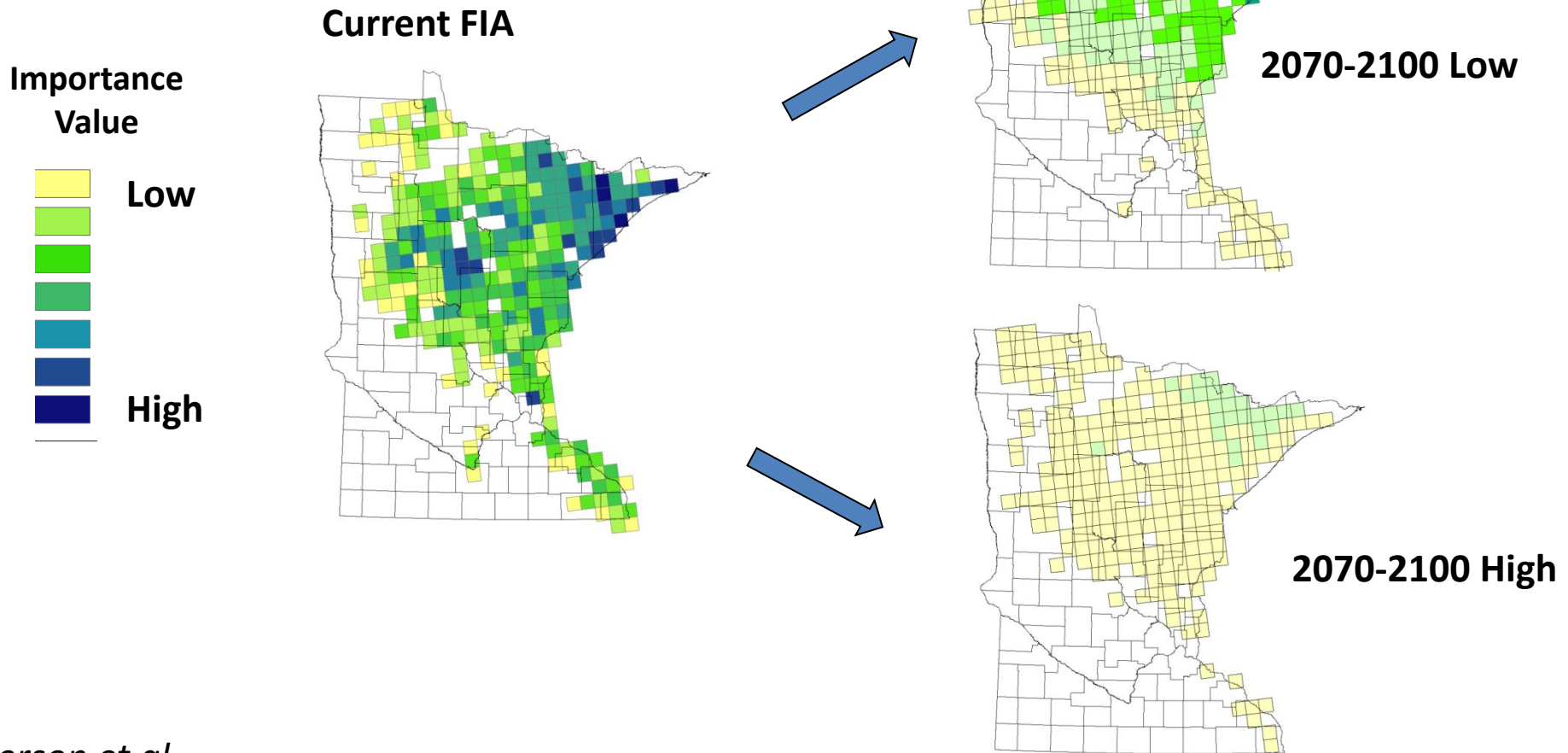
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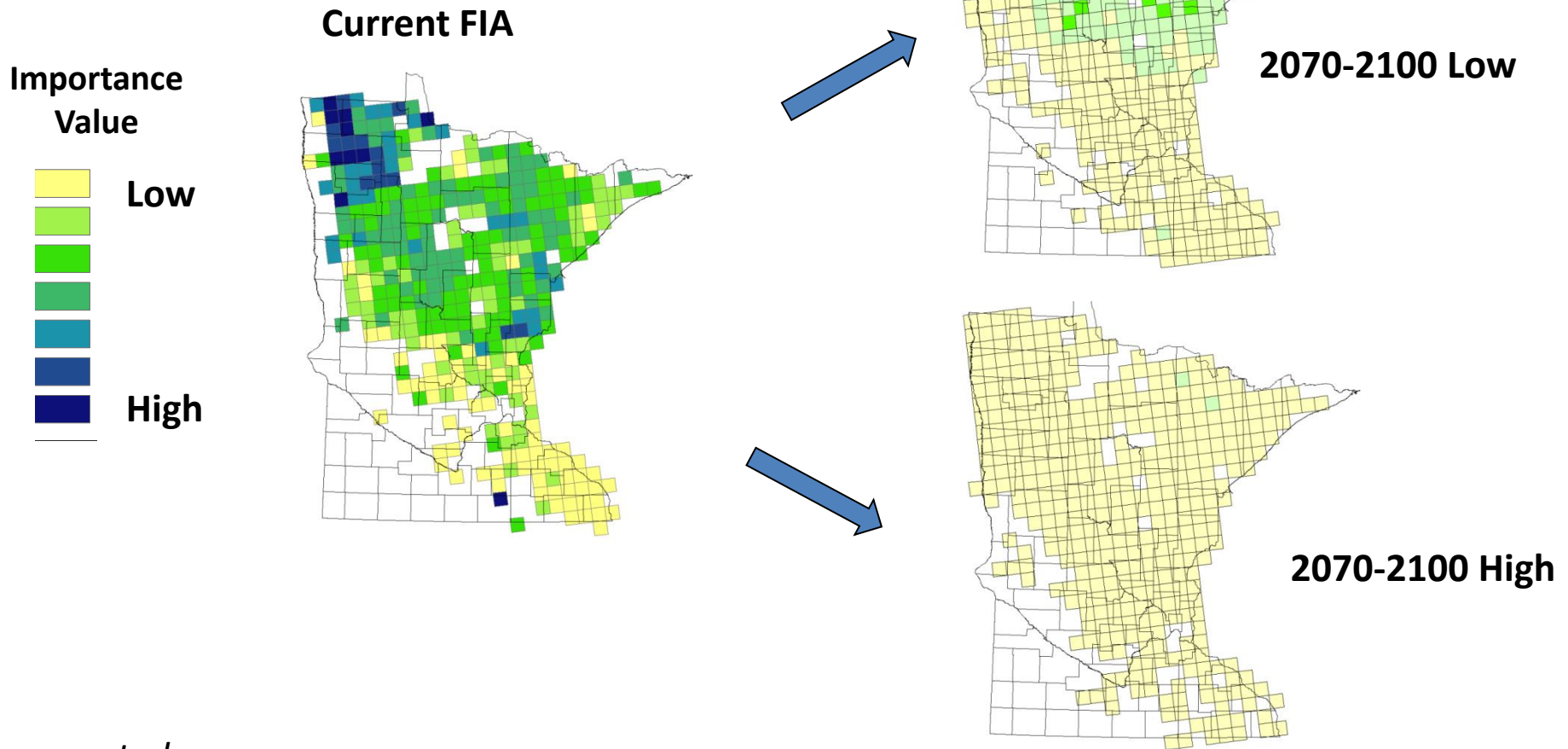
Negative

-  Acclimation to CO₂ fertilization
-  Water stress in late-season
-  Decreased snow pack
-  Increased pests and diseases
-  Increased frequency and severity of wildfire
-  Declines in some iconic boreal species

Paper Birch



Aspen



Native Plant Community Vulnerability

Community Type	Potential Impacts	Adaptive Capacity	Vulnerability
Fire-Dependent Forest	Negative	Moderate-High	Moderate
Mesic Hardwood Forest	Moderate	Moderate-High	Moderate
Floodplain Forest	Moderate-Positive	Moderate	Low-Moderate
Wet Forest	Negative	Low	High
Forested Rich Peatland	Negative	Low	High
Acid Peatland	Negative	Low	High
Managed Aspen	Moderate-Negative	Moderate	Moderate-High
Managed Red Pine	Moderate-Negative	Moderate-Low	High-Moderate

Discussion

How may the impacts of climate change affect the ecosystems and management of the Boundary Waters?

WHAT CAN MANAGERS DO?

ADAPT

Adaptation is the adjustment of human or natural systems in response to climate change.

builds on:

- sustainable management
- conservation
- restoration

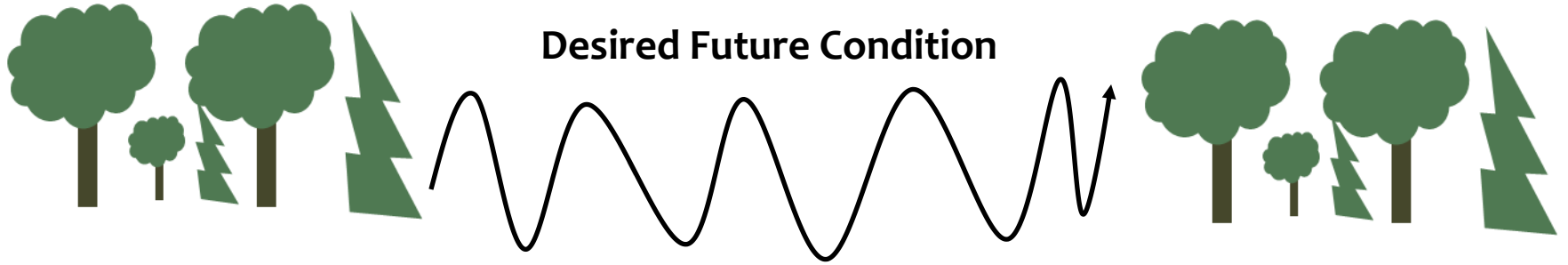


Desired Future Condition

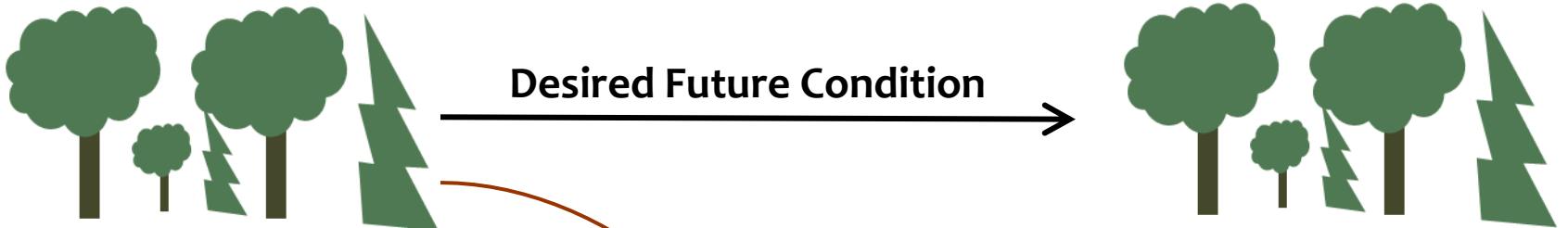


TIME





TIME →



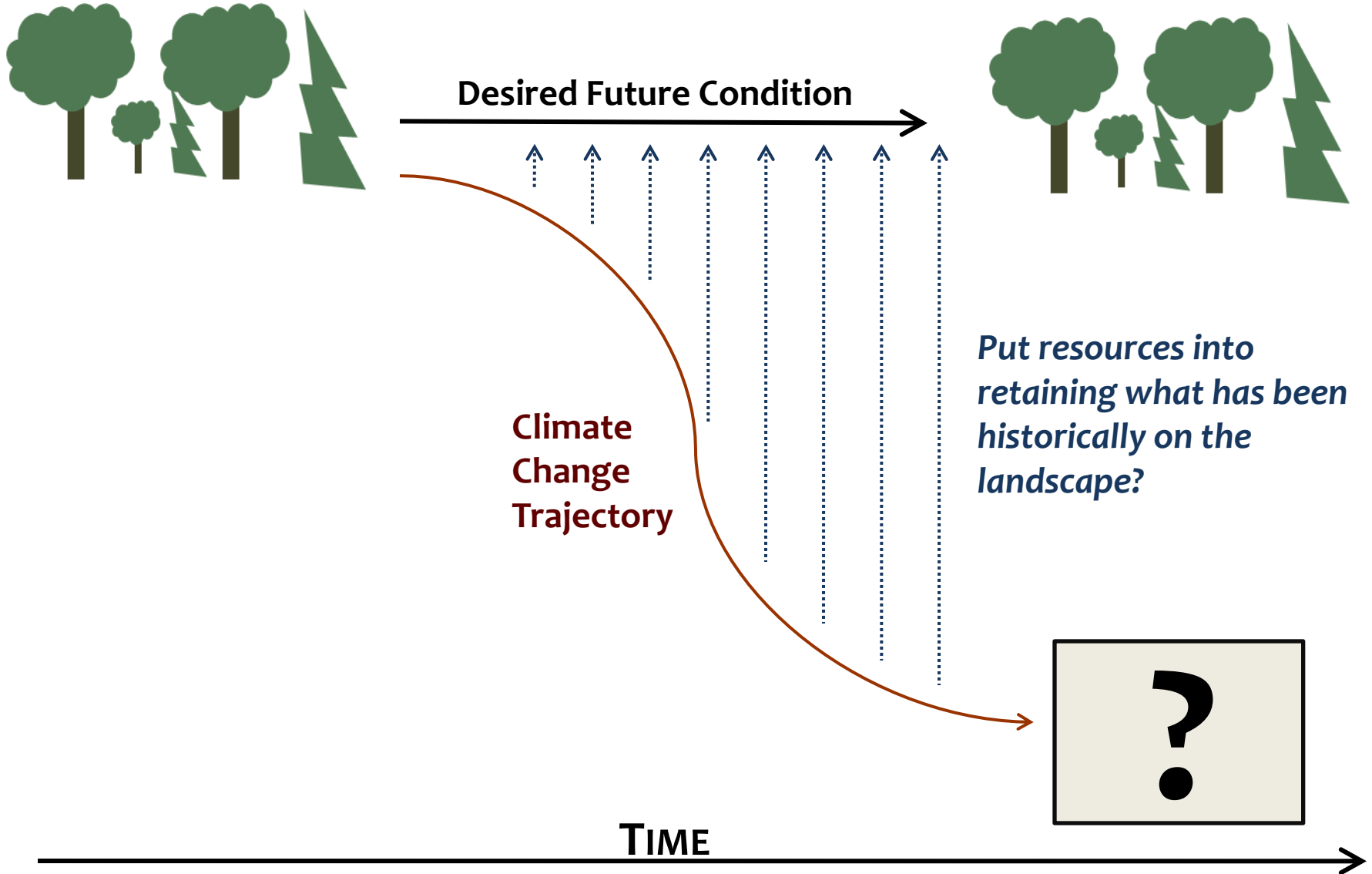
Climate
Change
Trajectory



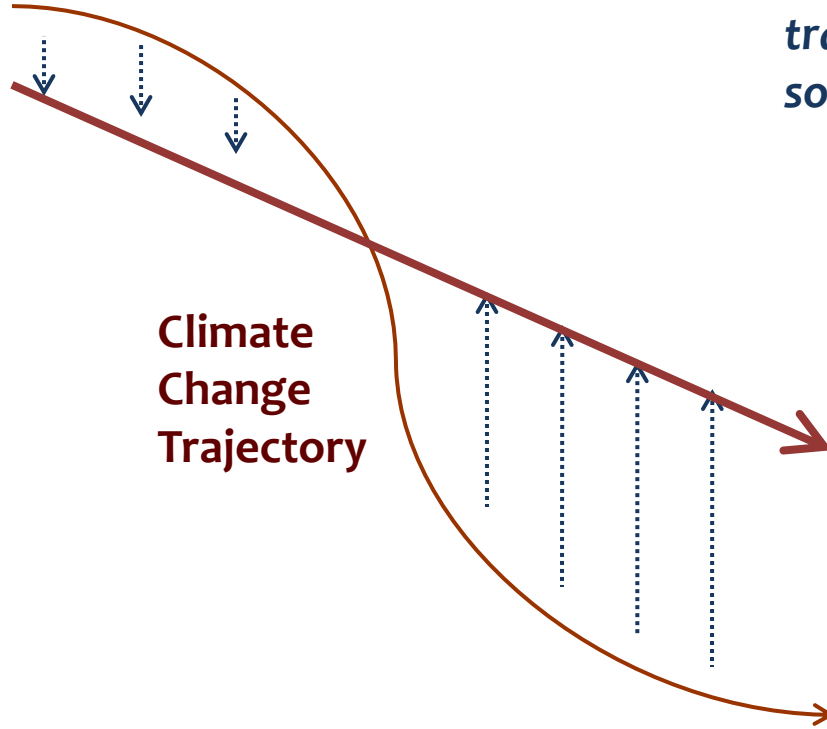
TIME



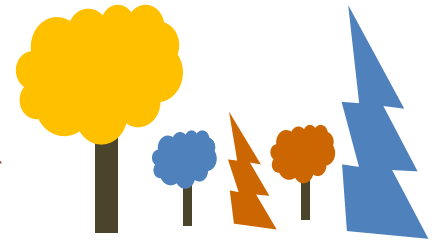
Adaptation



Adaptation



Put resources into transitioning into something new?



TIME



Adaptation Options: Four R's

1. Resistance
2. Resilience
3. Response
4. Realignment

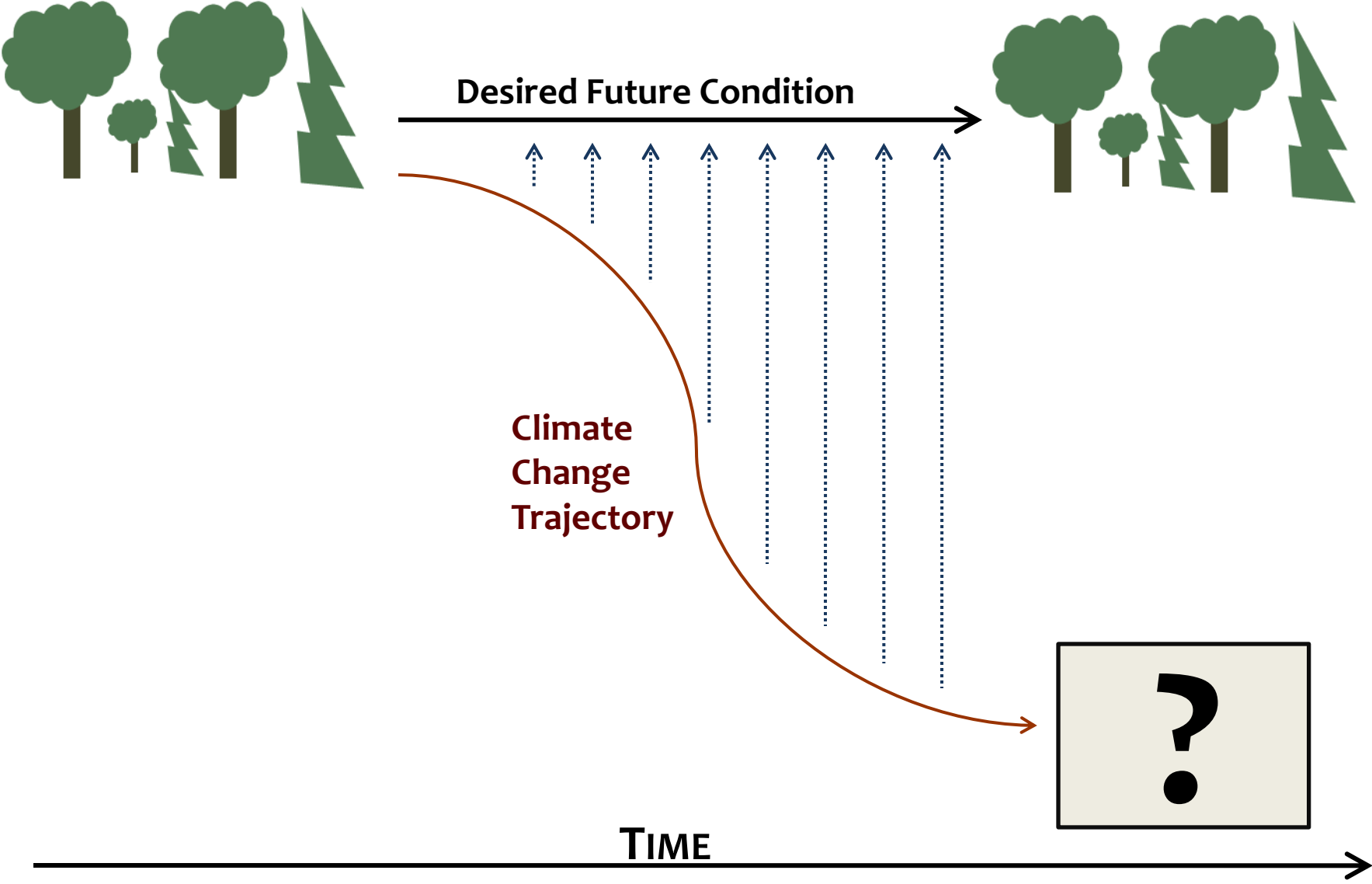
Option 1: Resistance

Improve the defenses of the forest against effects of change.

- Short-term
- High-value



Option 1: Resistance



Resistance Examples

- Installing fuelbreaks
- Preventing the spread of invasive species, pests, diseases

Option 2: Resilience

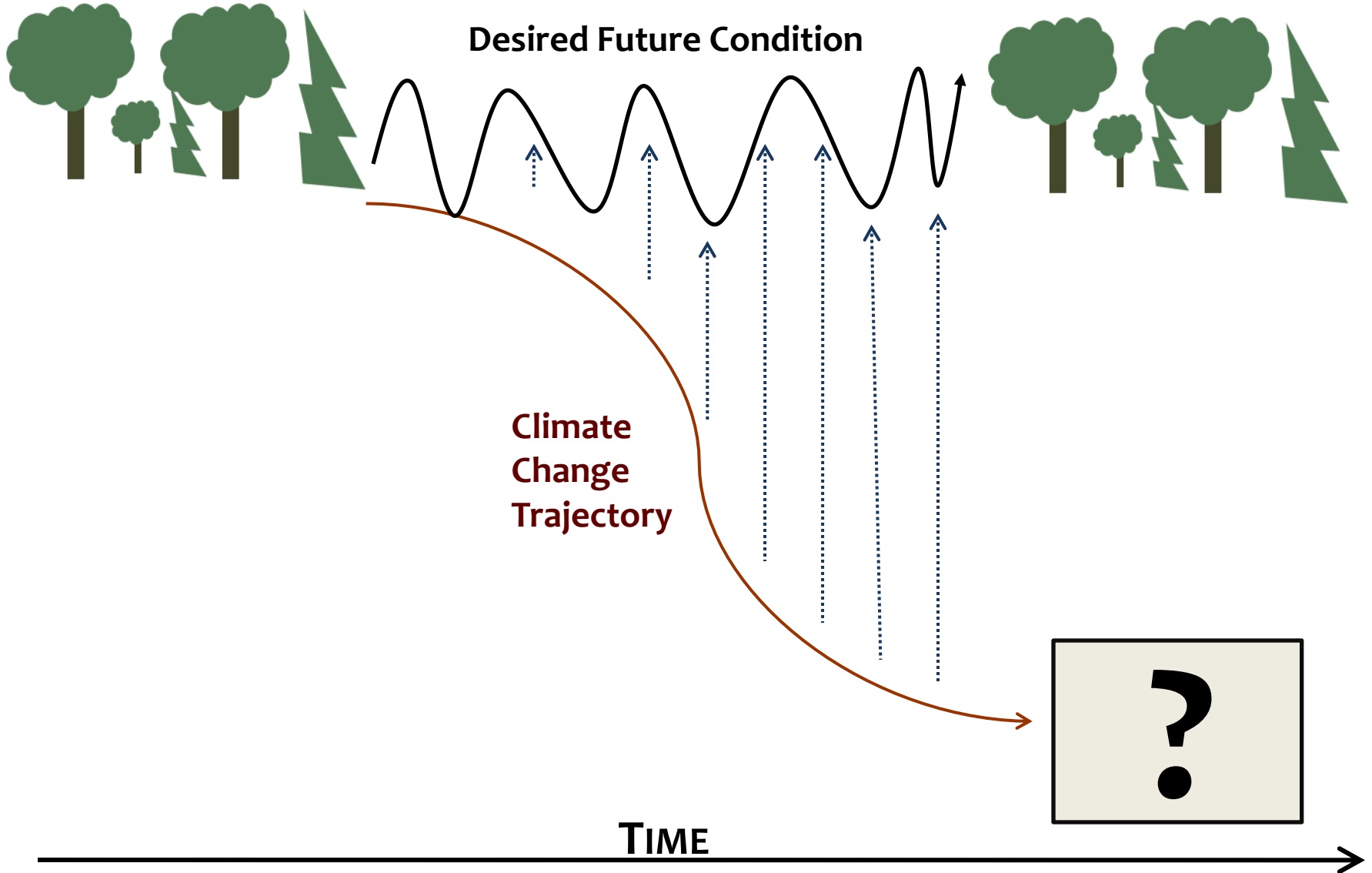
Accommodate gradual change, usually returning to a prior condition after disturbance



Photo: USFS

Millar et al. 2007

Option 2: Resilience

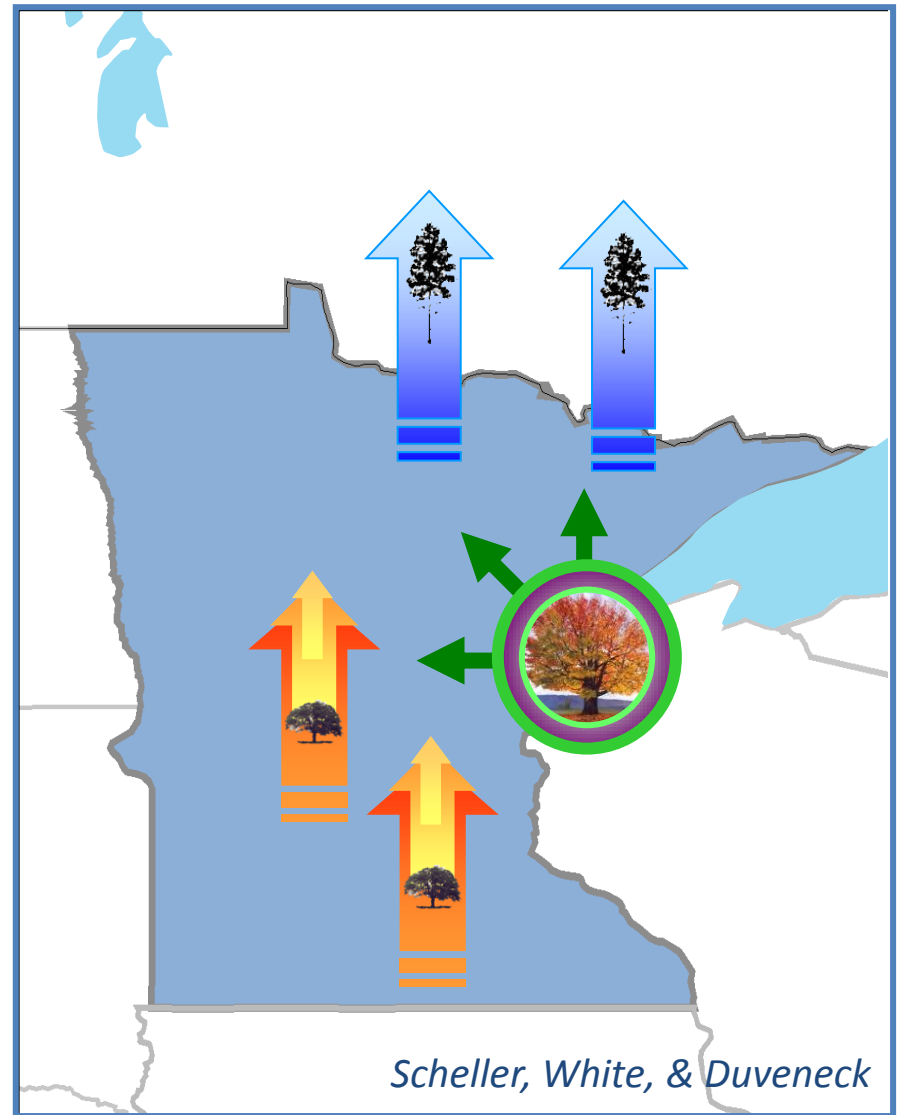


Resilience Examples

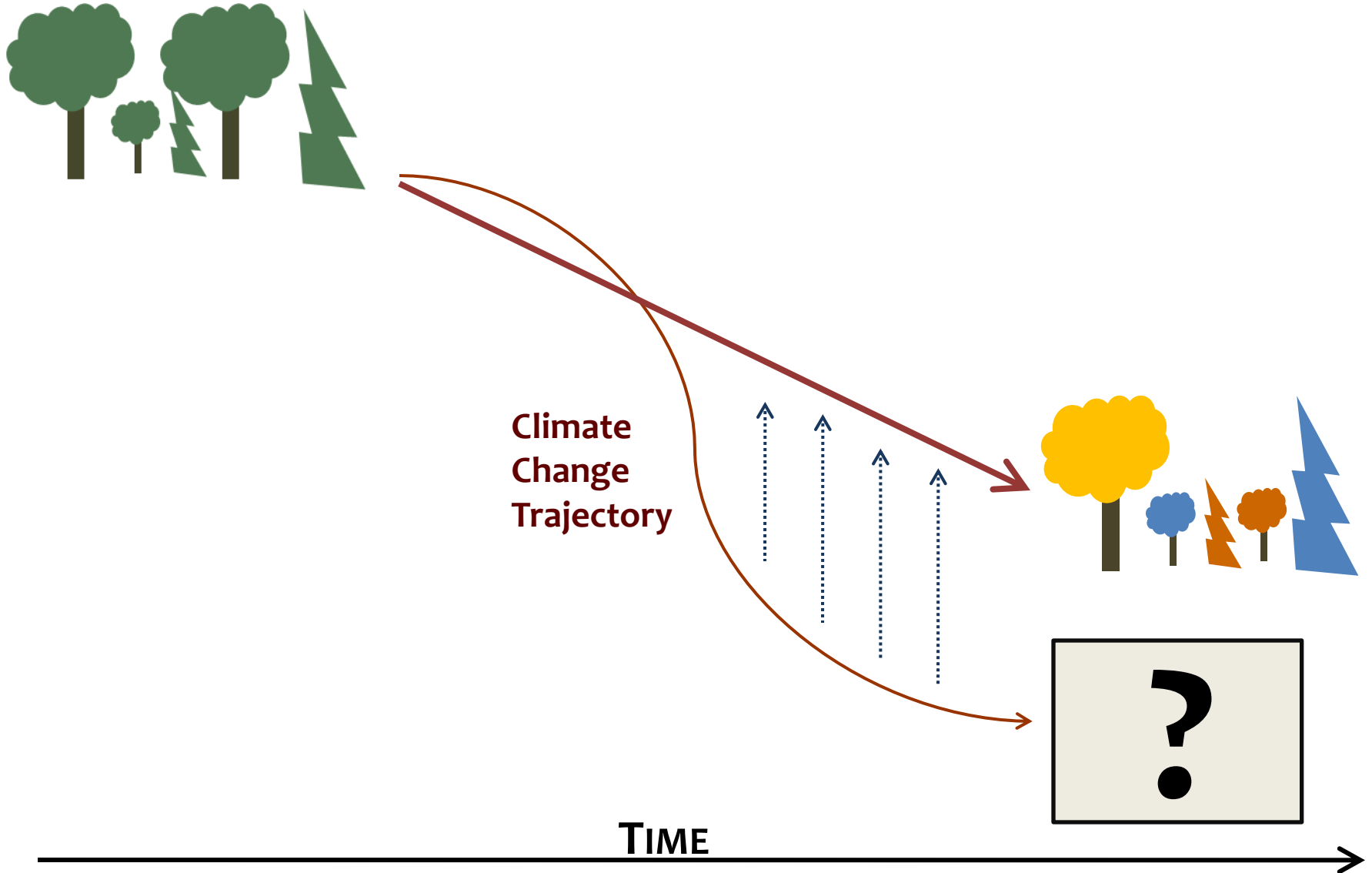
- Conducting prescribed burns and thinning
- Removing dead/dying trees following pest outbreak, fire, or blowdown
- Revegetating areas after disturbance

Option 3: Response

Intentionally accommodate change, enabling ecosystems to adaptively respond

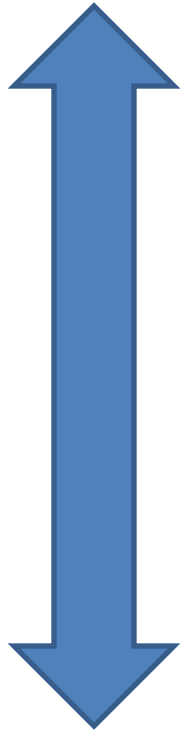


Option 3: Response



Response Examples

safer



risky

- Planting a mix of species that are most likely to do well under projected change
- Increased connectivity for migration
- Planting seeds/seedlings of genotypes from one seed zone south
- Planting /relocating species that currently reside south of the area
(CAUTION)

Option 4: Realignment

move heavily-
disturbed systems
into alignment with
current and future
conditions



Option 4: Realignment



Climate
Change
Trajectory



TIME



Examples?

- Wait and see...

Climate Change Response Framework

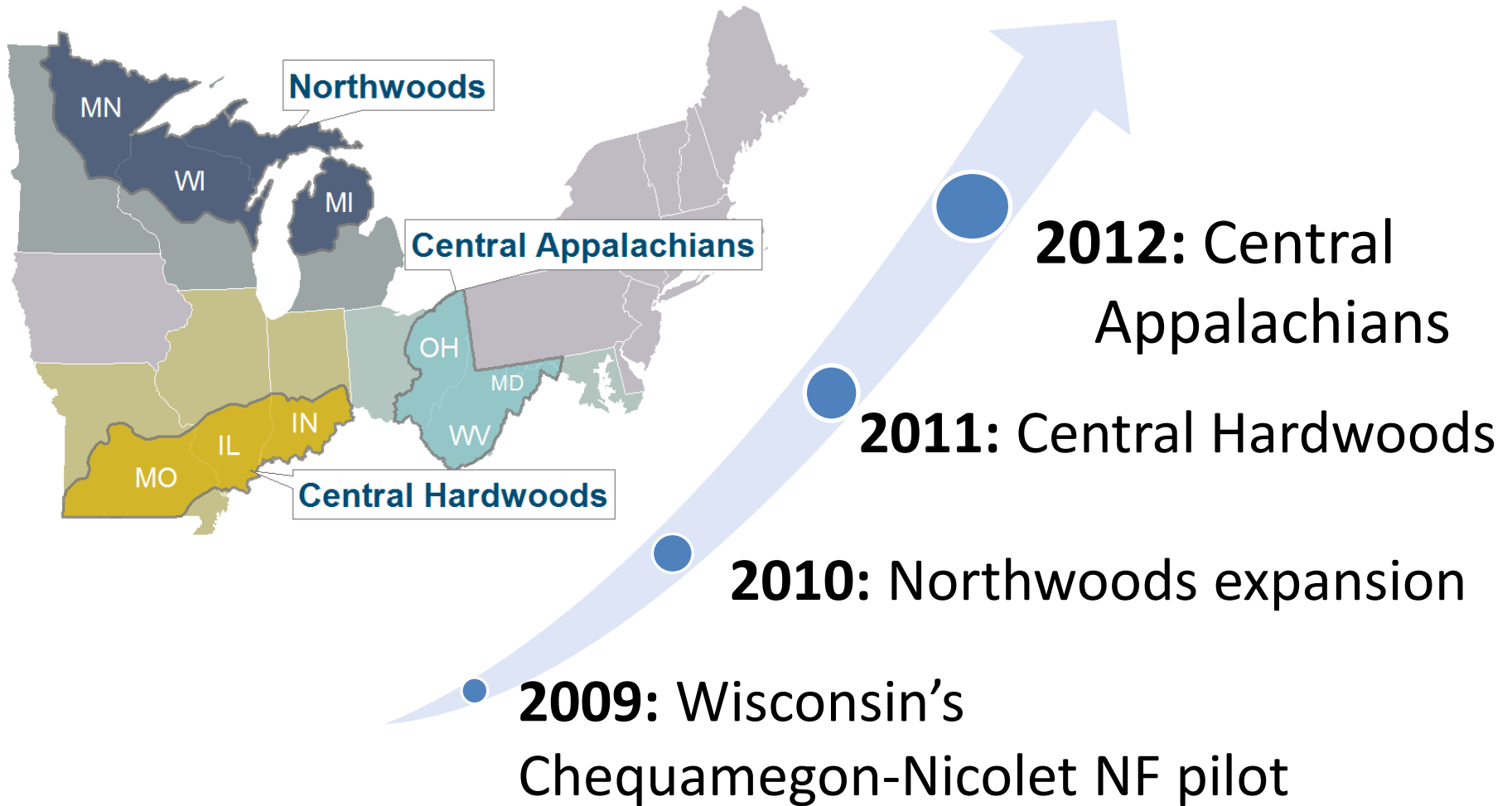
Summary:

A collaborative approach among scientists, managers, and landowners to incorporate climate change considerations into forest management.

Outcomes:

An integrated set of tools, partnerships, and actions to support **climate-informed** conservation and management.

Climate Change Response Framework



Climate Change Response Framework

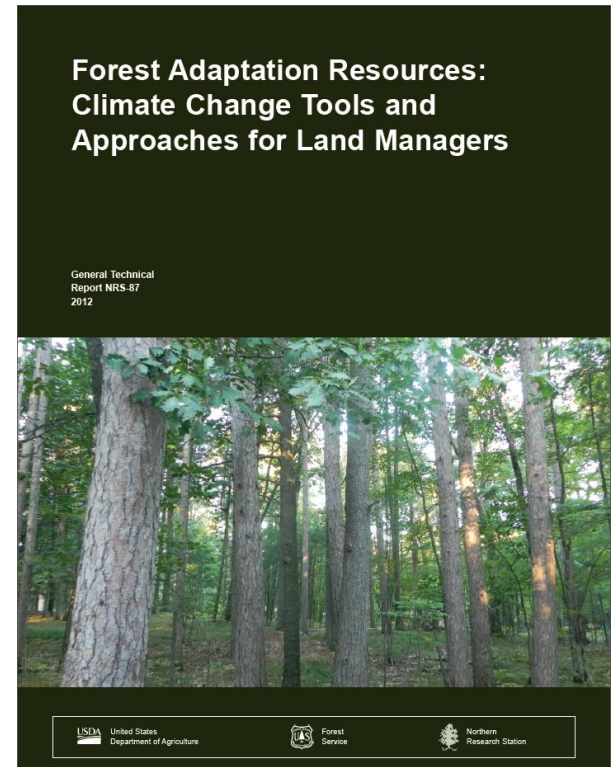
Key Deliverables and Products:

- Partnerships
- Forest Ecosystem Vulnerability Assessment
- Climate Change Adaptation Resources
- Demonstration Projects



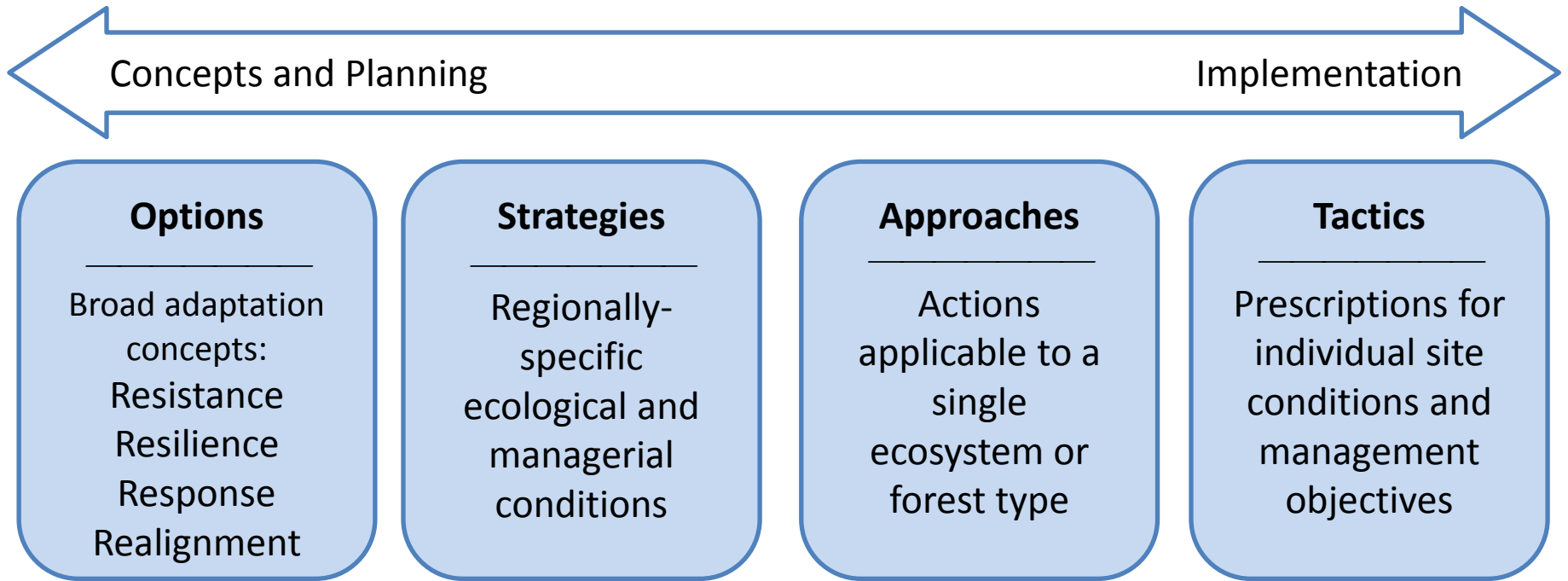
Forest Adaptation Resources

- Designed for a variety of land managers with **various goals** and **objectives**
- Tailored to **eastern forest types**; the first version is now in revision
- **Does not make recommendations**
- Menu of adaptation **strategies & approaches** for forest ecosystems
- www.nrs.fs.fed.us/pubs/40543



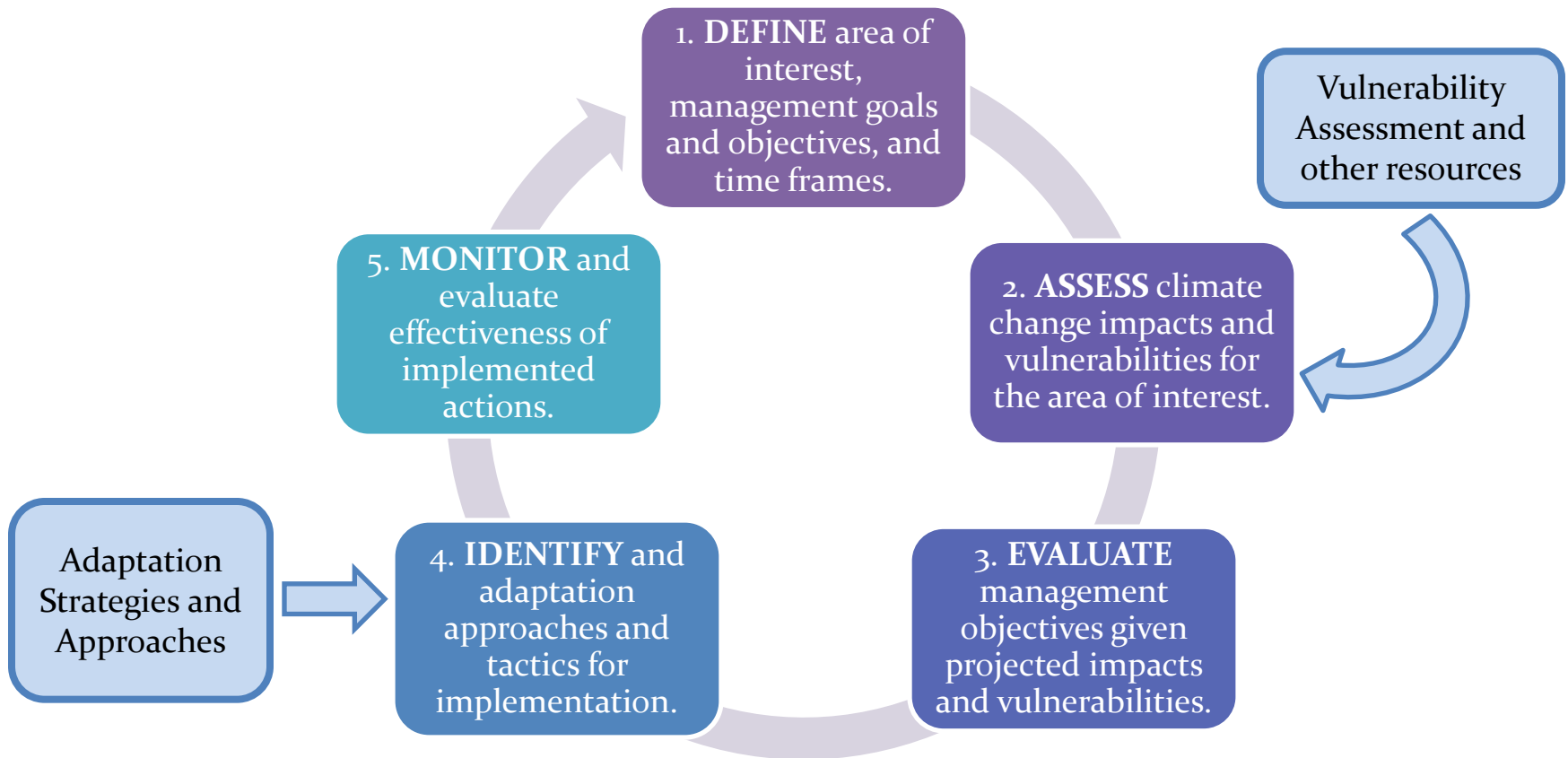
Forest Adaptation Resources

Menu of strategies and approaches:



Forest Adaptation Resources

- Workbook process incorporates climate change into management
- Flexibility to fit into existing decision-making processes



Example

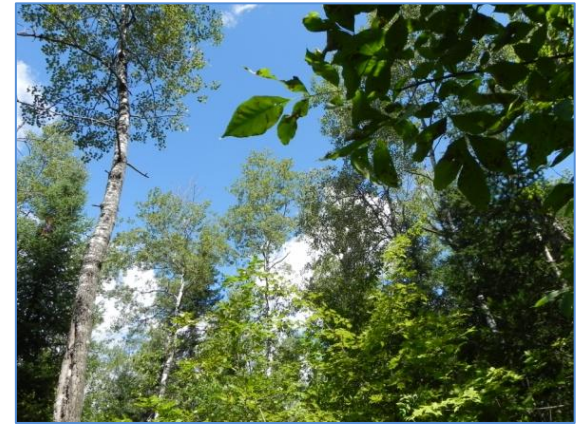
Mature aspen stand on the Chequamegon-Nicolet National Forest



Aspen stand

Management Goals/Objectives:

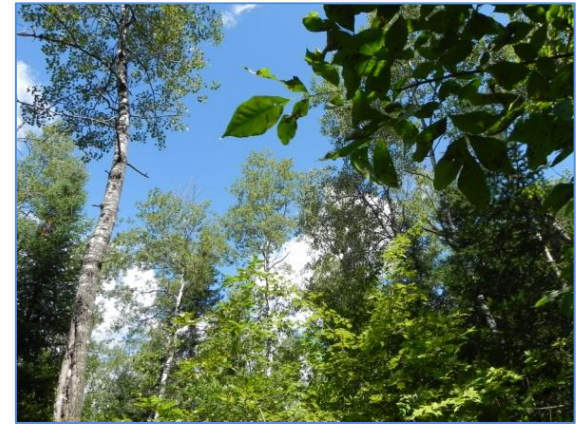
- Regenerate mature aspen to
 - Enhance stand vigor
 - Achieve age class distribution
 - Provide wood
- Provide scenic integrity



Aspen stand

Climate Change Challenges:

- Warmer temps, altered precipitation, drier summers
- Projected declines in many common northern species



Aspen stand

Adaptation Options:

- **Resistance:**



- Regenerate aspen, keep as long as possible

- **Resilience:**



- Retain diversity: reserve trees, islands

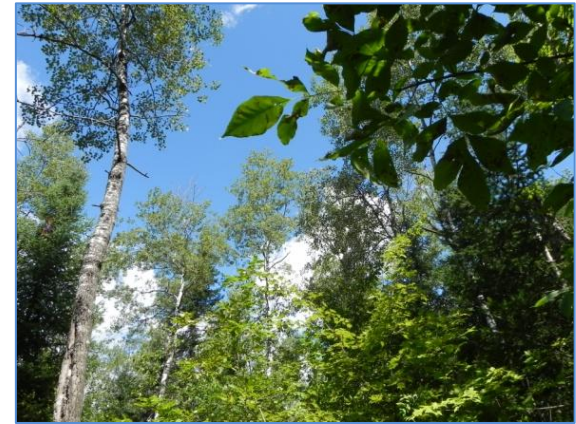
- **Response:**

- Increase local, native species that are expected to fare better under warmer and drier conditions (red oak, white pine)

- Use planting stock from populations that are better adapted to anticipated future conditions.

- **Realignment:**

- Large-scale conversion of aspen to other forest types.



Implications-Boundary Waters

- Wildlife, fisheries management
- Recreation
 - Seasonal use
 - Reducing risk to the public
 - Preventing pest/invasive species spread
- Fuels management
- Invasive species management

Learn More

www.forestadaptation.org

The screenshot displays the website's navigation menu with 'Projects' highlighted. The main content area features three large vertical panels for 'Central Appalachians', 'Northwoods', and 'Central Hardwoods'. To the right, a vertical list of project categories includes 'Partnerships', 'Vulnerability Assessment', 'Forest Adaptation Resources', and 'Demonstration Projects'. Below this is a detailed section for the 'Northwoods' project, including a descriptive paragraph, a list of objectives, and a map of Minnesota, Wisconsin, and Michigan. A sidebar on the left contains 'Northwoods News & Events' with a featured article titled 'Forest Management in the Face of Climate Change' dated February 21, 2012. The NIACS logo is visible in the bottom left corner, and a 'Terms and Conditions' link is in the bottom right.

Climate Change Response Framework

Home Our Approach **Projects** Products Partners Contact

Central Appalachians

Northwoods

Central Hardwoods

Partnerships

Vulnerability Assessment

Forest Adaptation Resources

Demonstration Projects

Northwoods

The Northwoods Climate Change Response Framework covers 64 million acres of northern Minnesota, Wisconsin, and Michigan within Ecological Province 212 (Laurentian Mixed Forest) of the National Hierarchical Framework of Ecological Units. Provinces are broad geographic areas that share similar coarse features, such as climate, glacial history, and vegetation types. The shaded area on the map shows Ecological Province 212, a rich mosaic of water features and forests characterized by past glacial activity and Great Lakes climate. This diverse landscape is also a transition between the northern boreal forests and the southern hardwood forests. The unshaded areas are outside the scope of the Northwoods Framework.

To meet the challenges brought about by climate change, a team of federal and state land management agencies, private forest owners, conservation organizations, and others have come together to accomplish three objectives:

1. Provide a forum for people working across the region to meet, communicate, and efficiently share...

Forest Management in the Face of Climate Change
February 21, 2012

NIACS

Terms and Conditions

A photograph of a lush green forest. In the foreground, a large stack of cut logs is piled up on the grass. The logs are stacked in a neat, rectangular pile, with the ends of the logs facing the viewer. The forest in the background is dense with tall, thin trees and a thick canopy of green leaves. The sky is visible through the trees, appearing bright and overcast. The overall scene is a natural, outdoor setting.

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