Climate Change and the Boundary Waters

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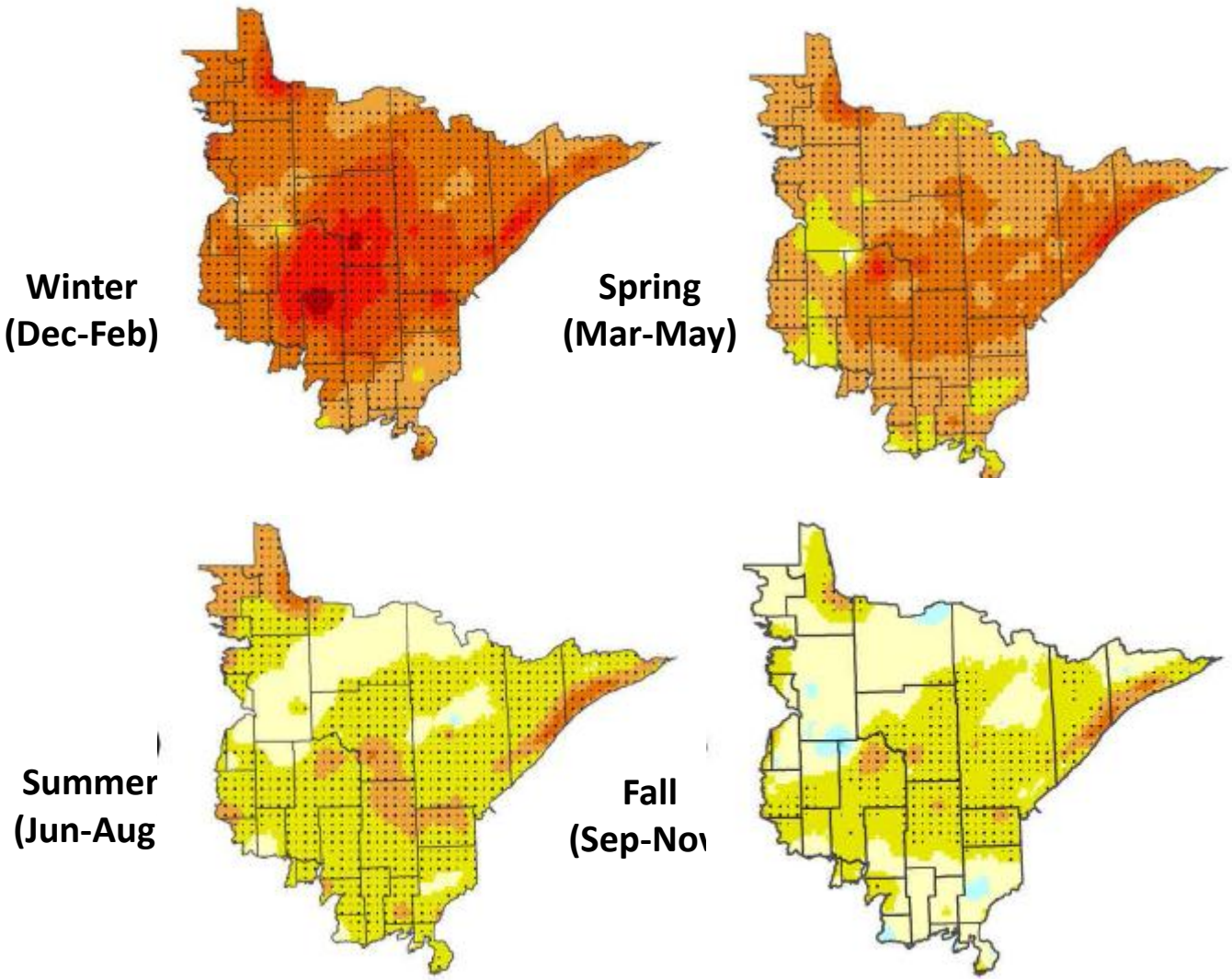
March 20, 2013

NIACS
Northern Institute of Applied Climate Science

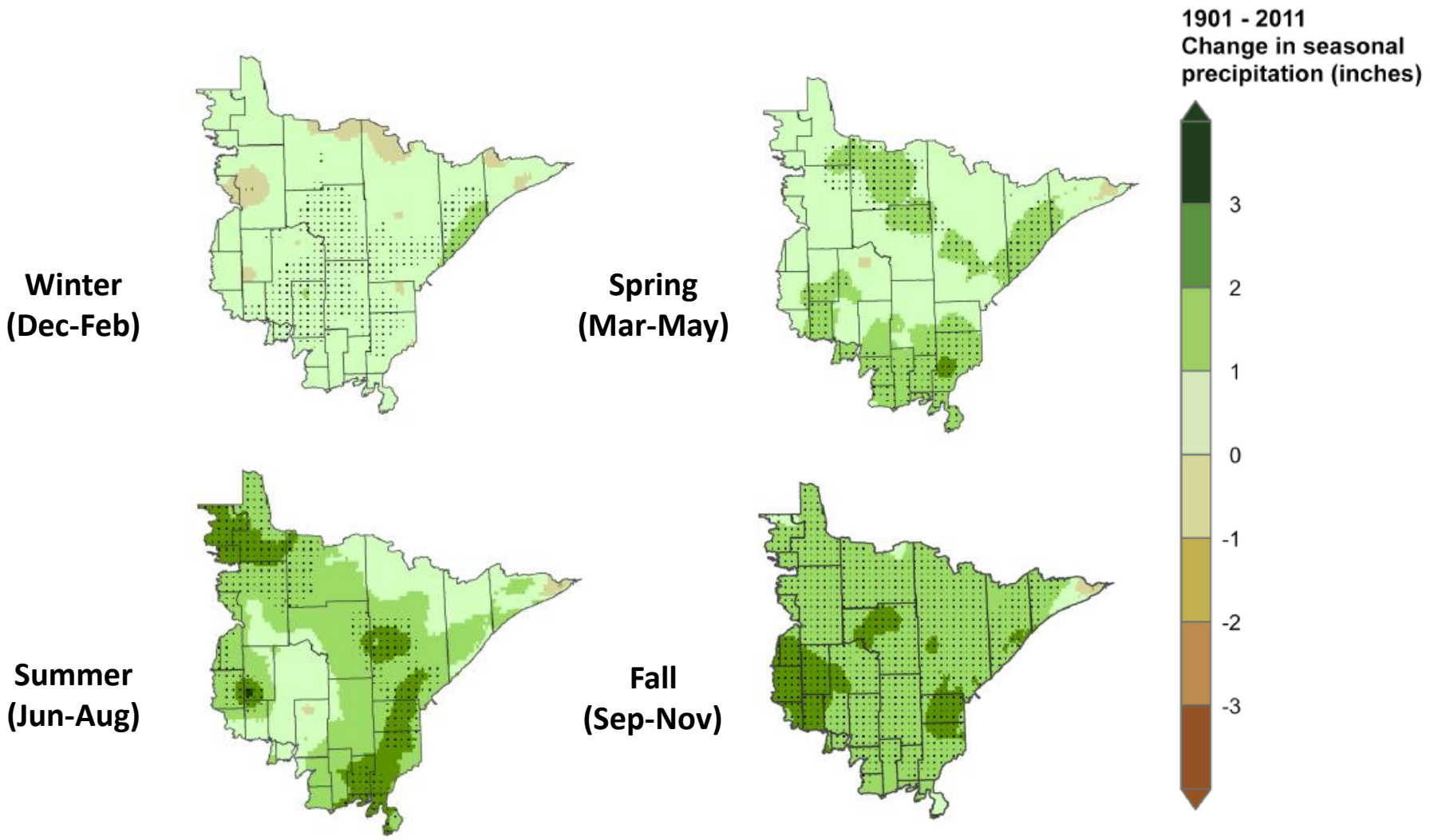
NORTHWOODS
CLIMATE CHANGE RESPONSE FRAMEWORK

It's getting warmer



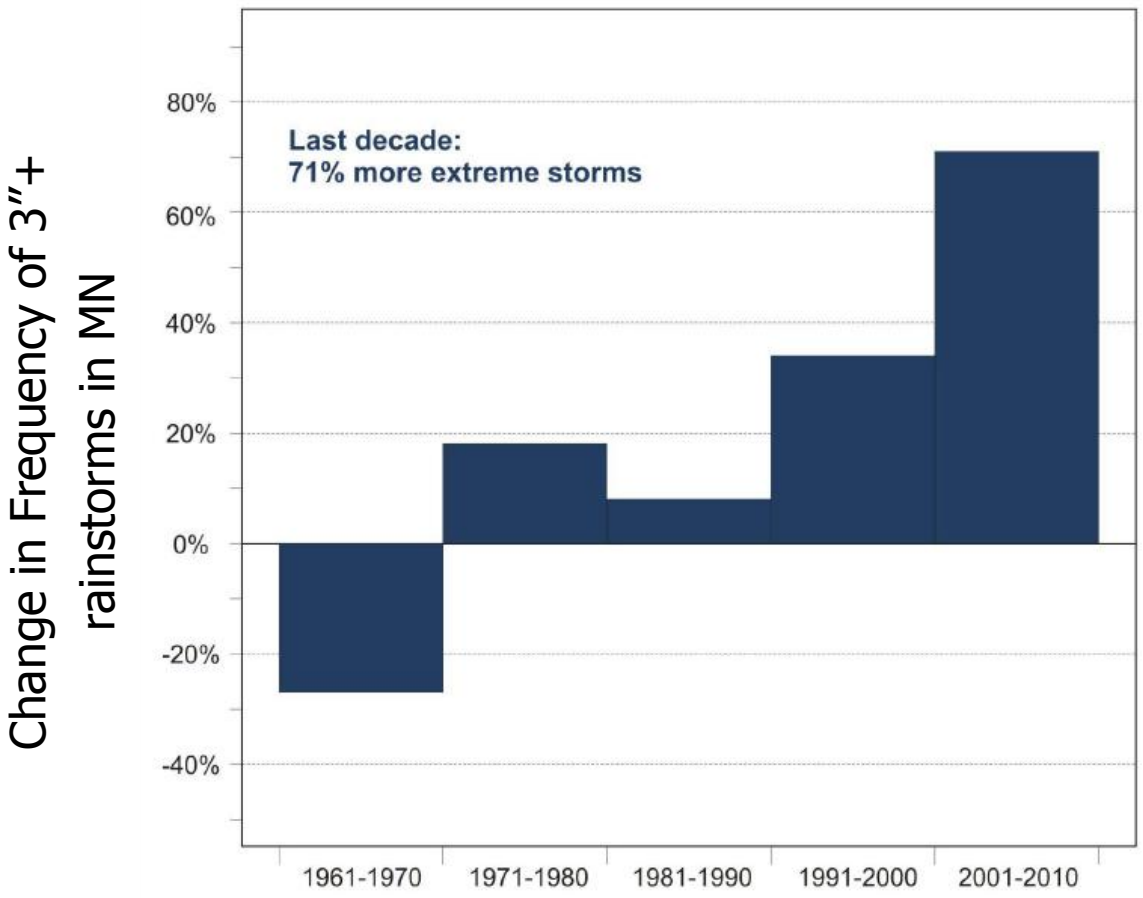
www.climatewizard.org

It’s getting wetter



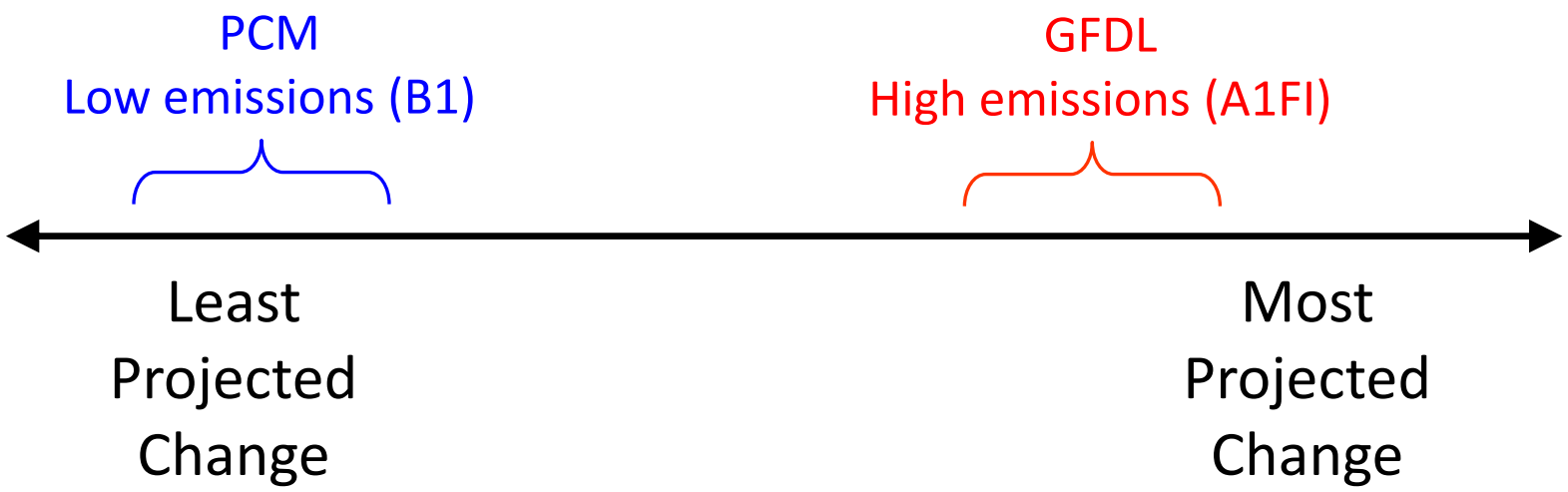
www.climatewizard.org

Heavy rain events are increasing



Saunders 2012

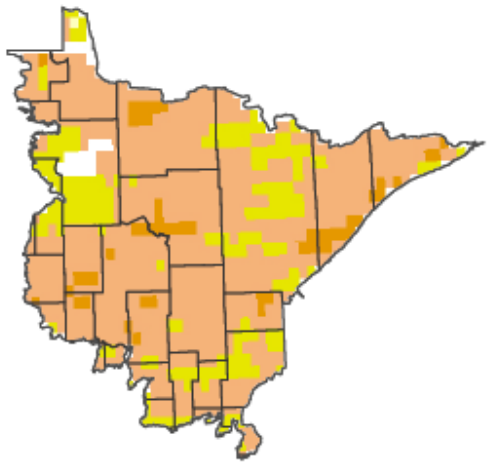
Projecting the Future

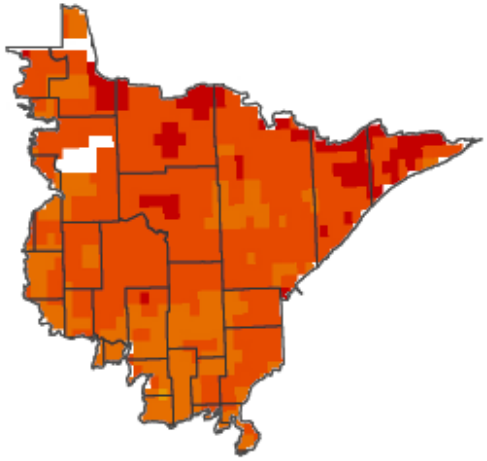


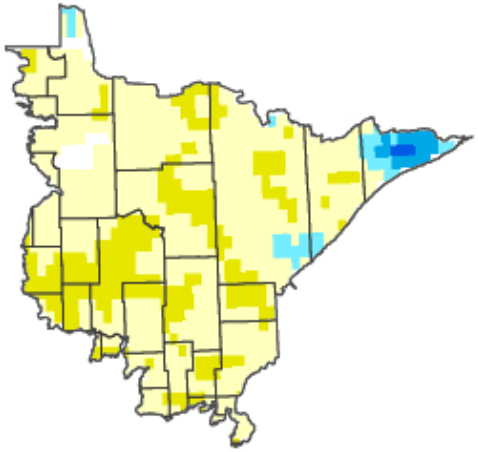
Temperatures will increase

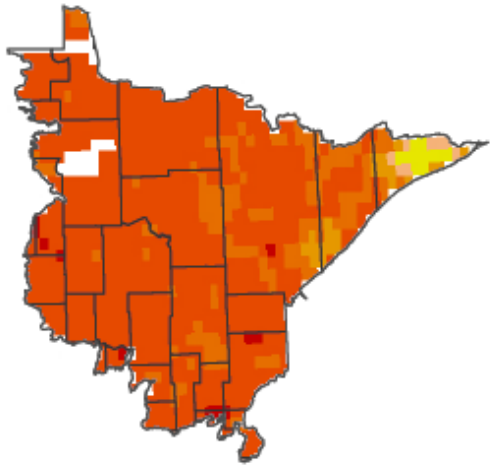
Winter

Summer





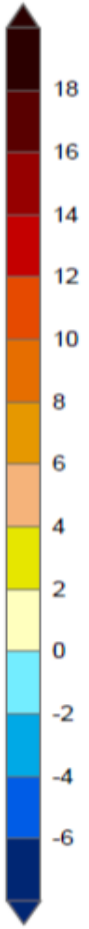




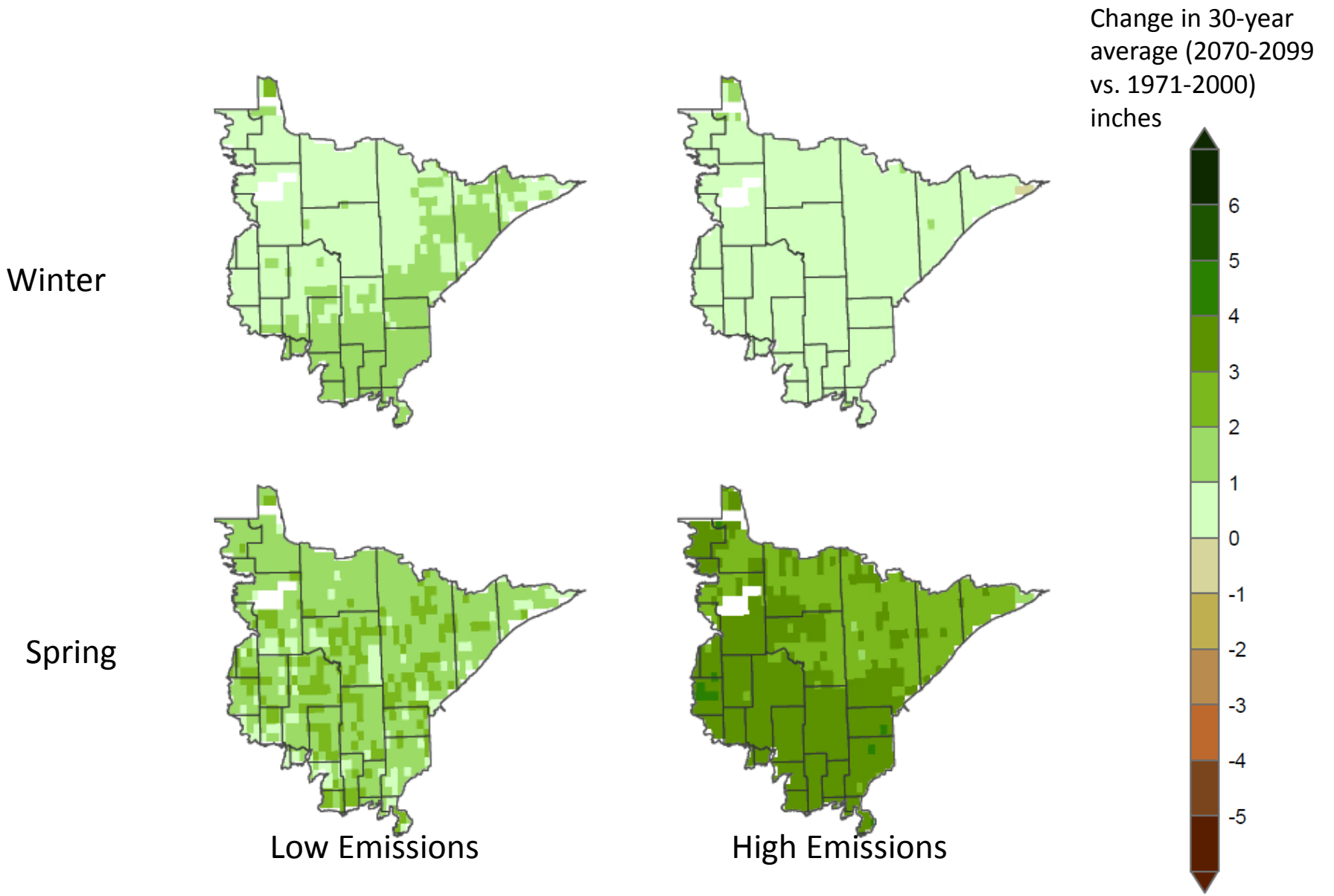
Low Emissions

High Emissions

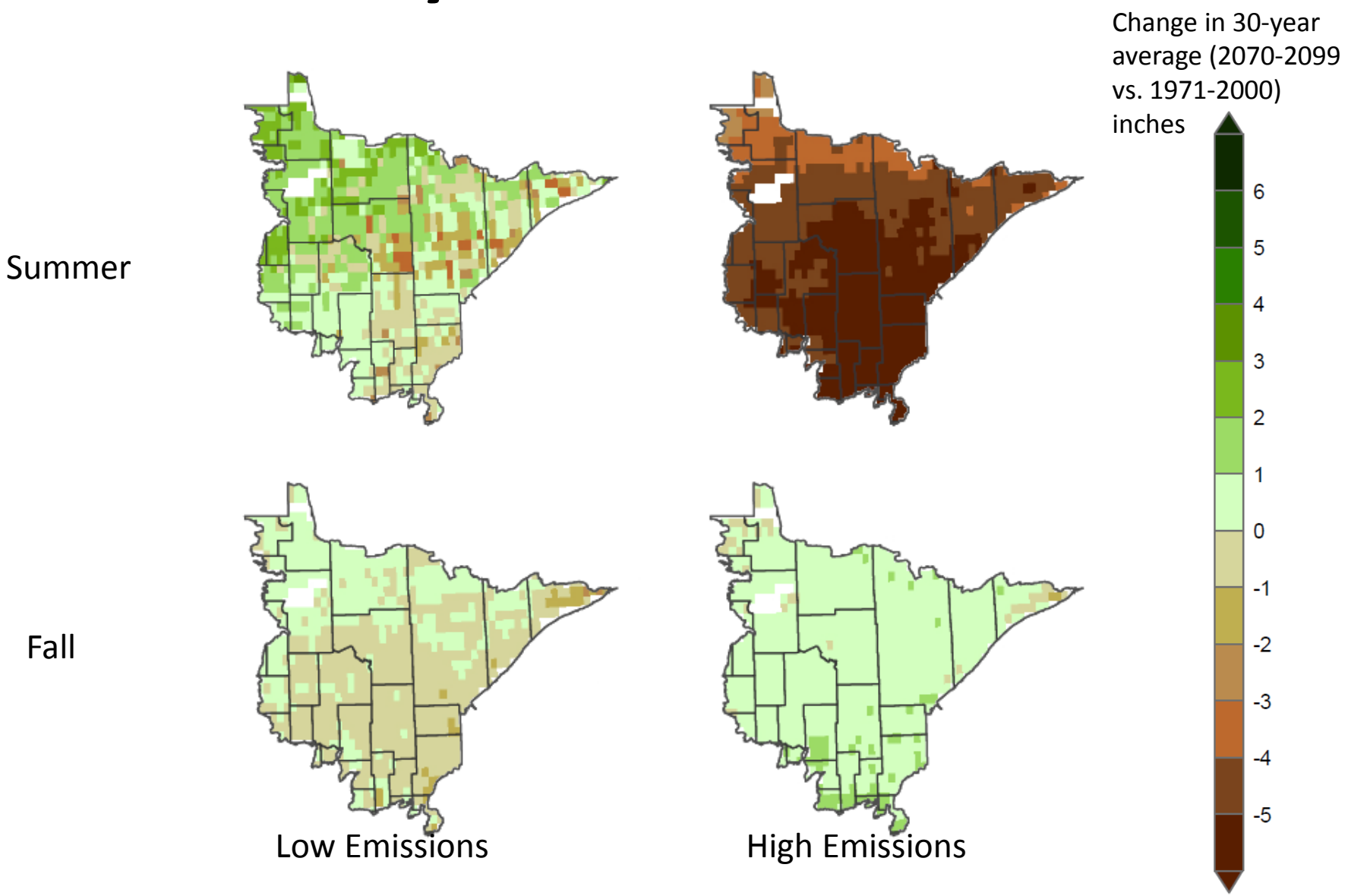
Change in 30-year average (2070-2099 vs. 1971-2000) F



Winter and spring will likely be wetter



Uncertainty about summer and fall

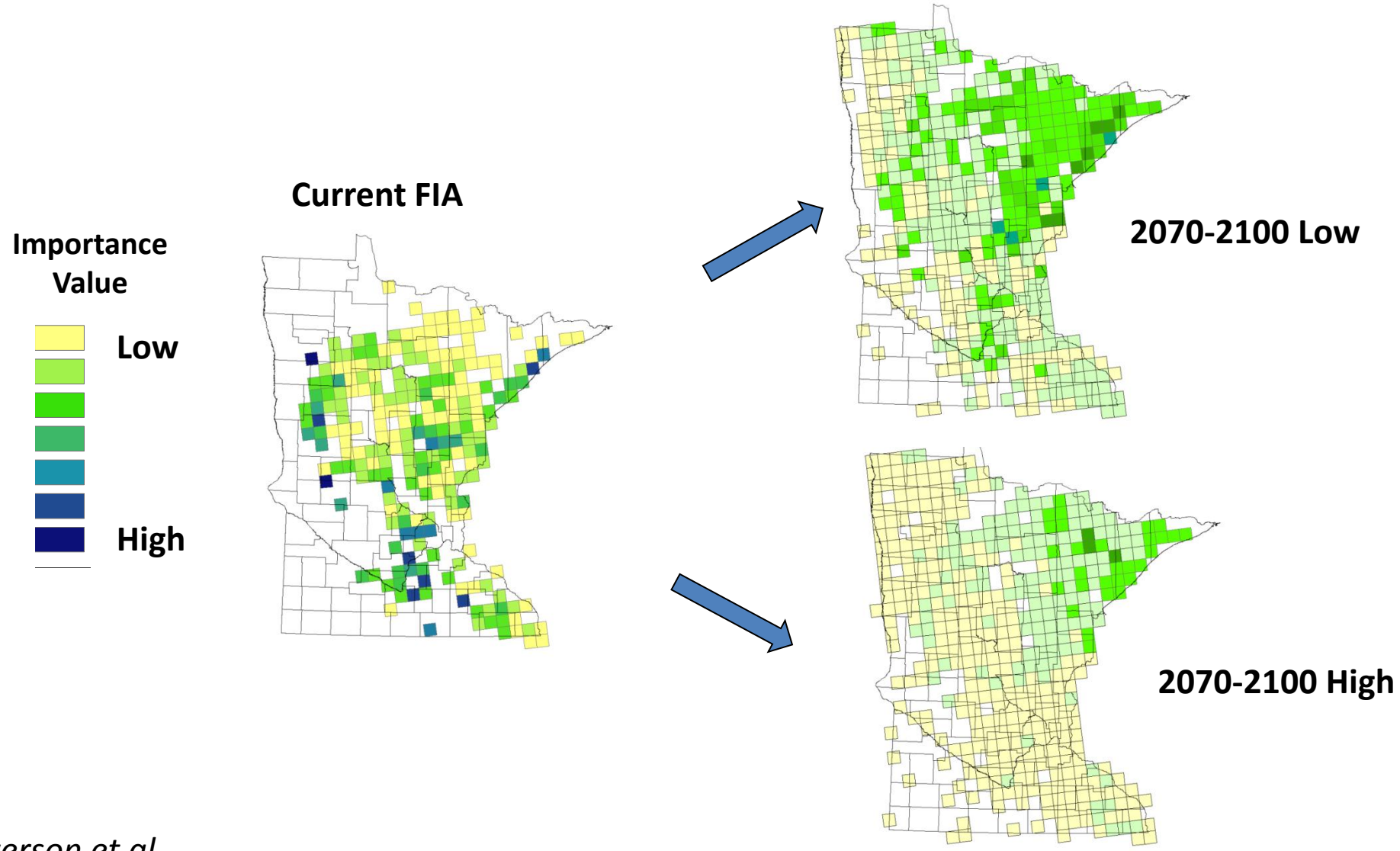


Impacts on Forests

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



Iverson et al.

Impacts on Forests

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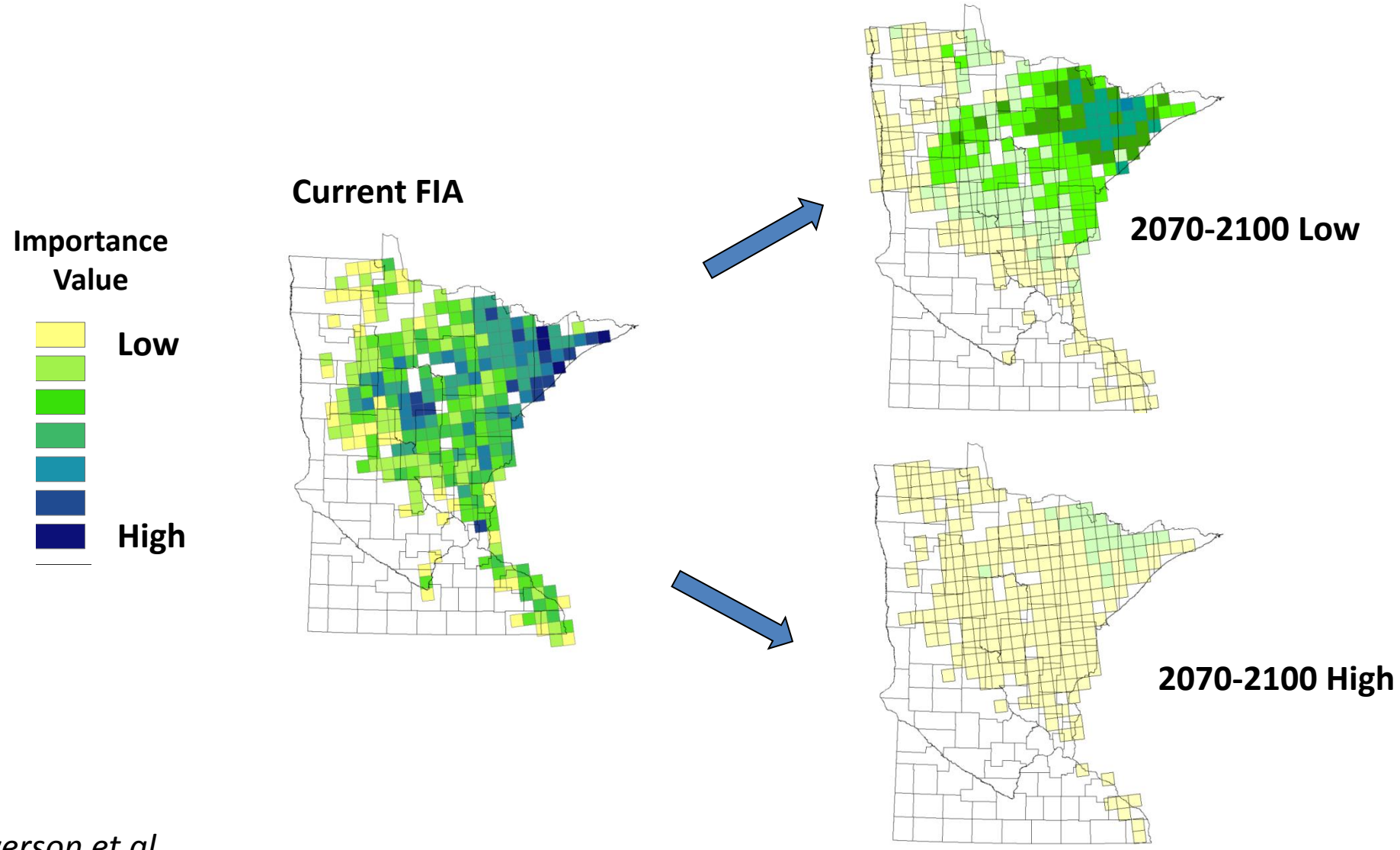
Negative

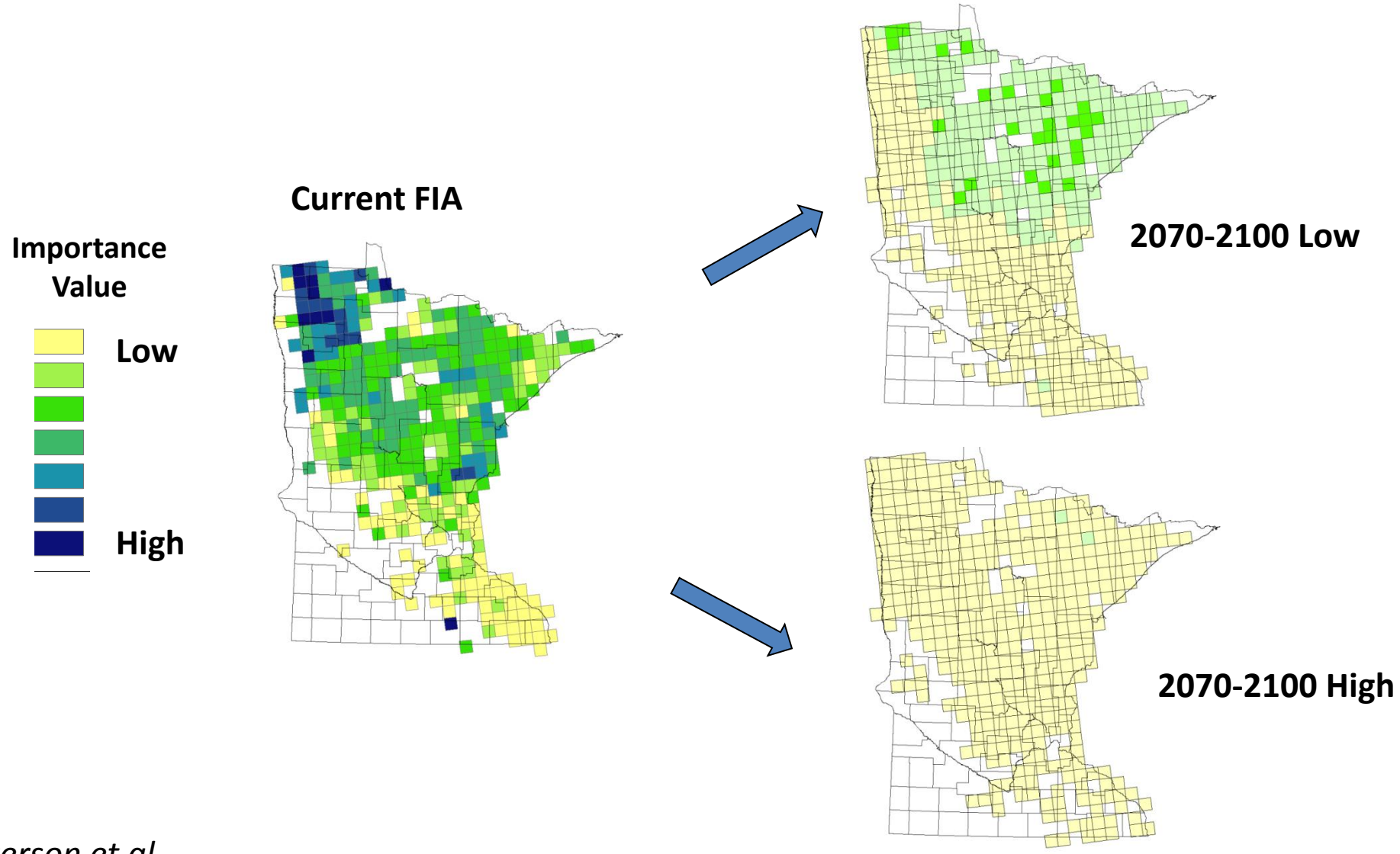
- Acclimation to CO_2 fertilization
- Water stress in late-season
- Decreased snow pack
- Increased pests and diseases
- Increased frequency and severity of wildfire
- Declines in some iconic boreal species

Paper Birch



Iverson et al.

Aspen



Iverson et al.

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?

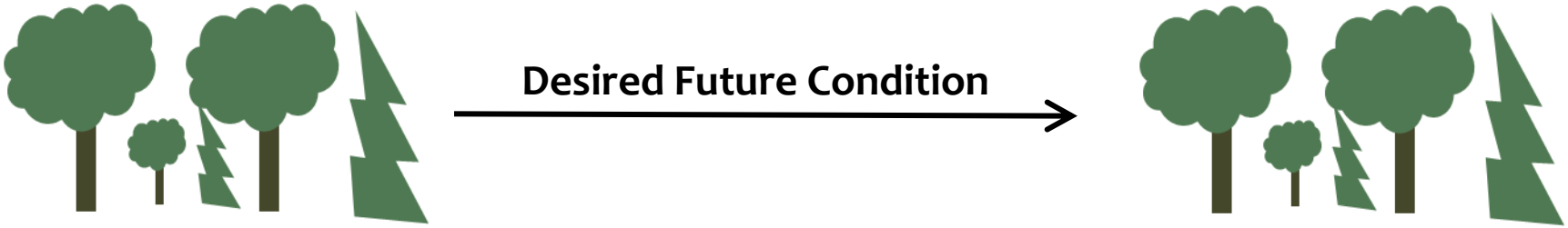
ADAPT

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

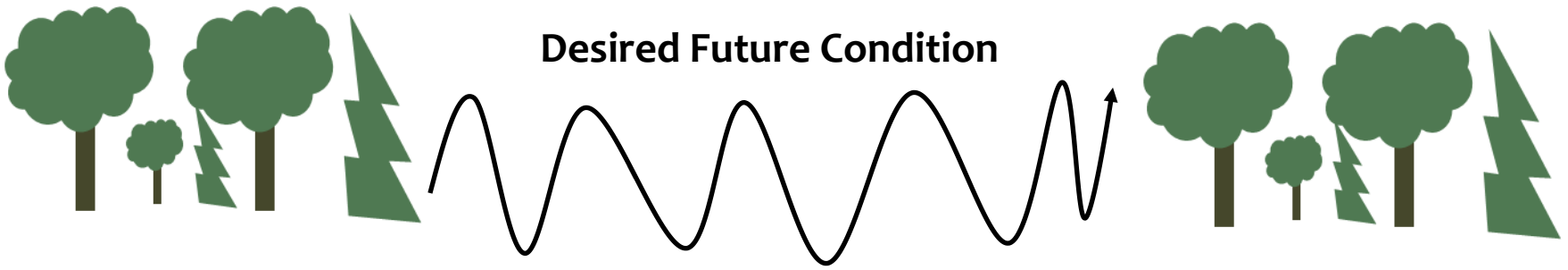
builds on:

- sustainable management
- conservation
- restoration

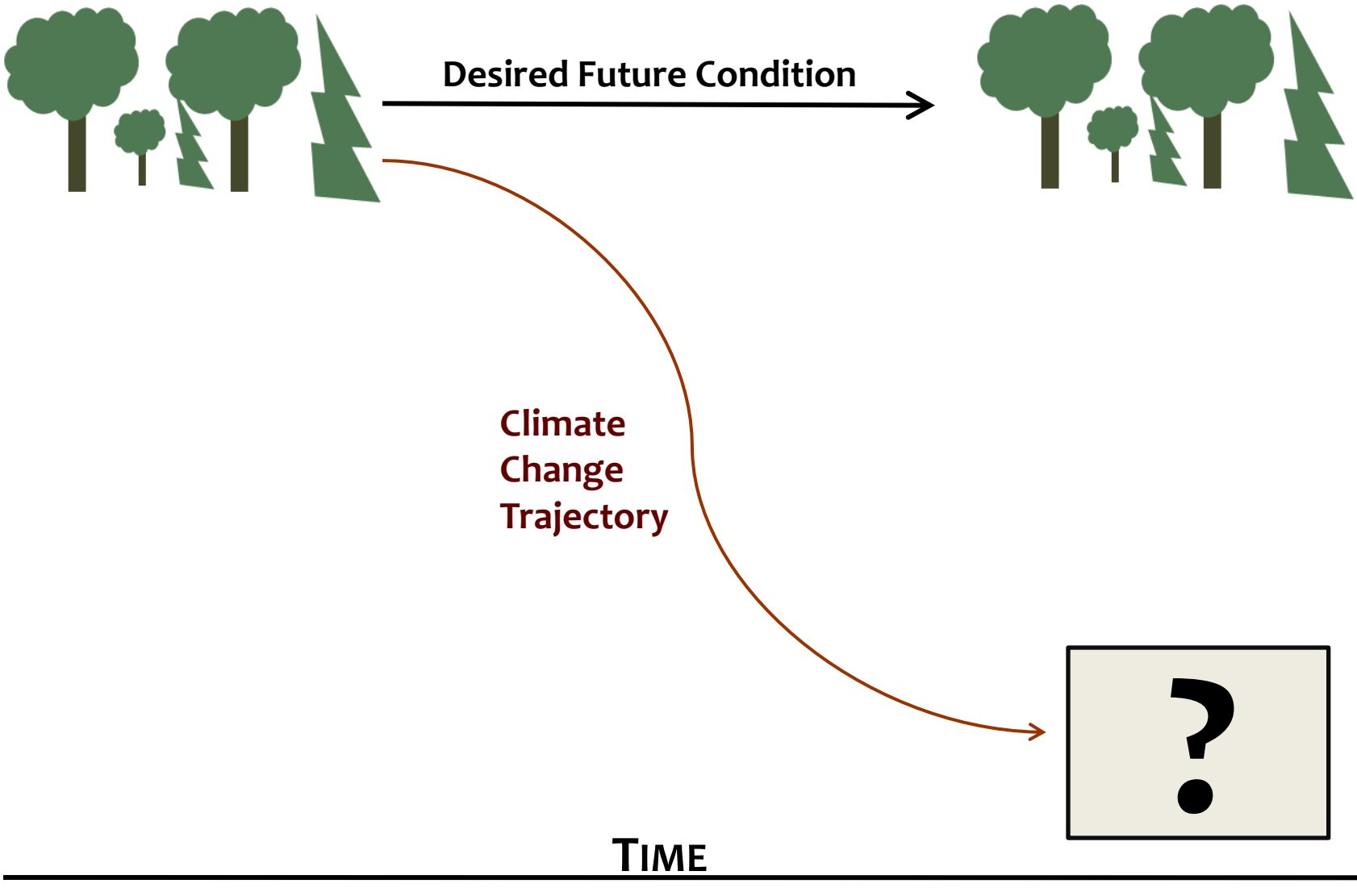
Parry et al. 2007, SCBD 2009, Groves et al. 2010



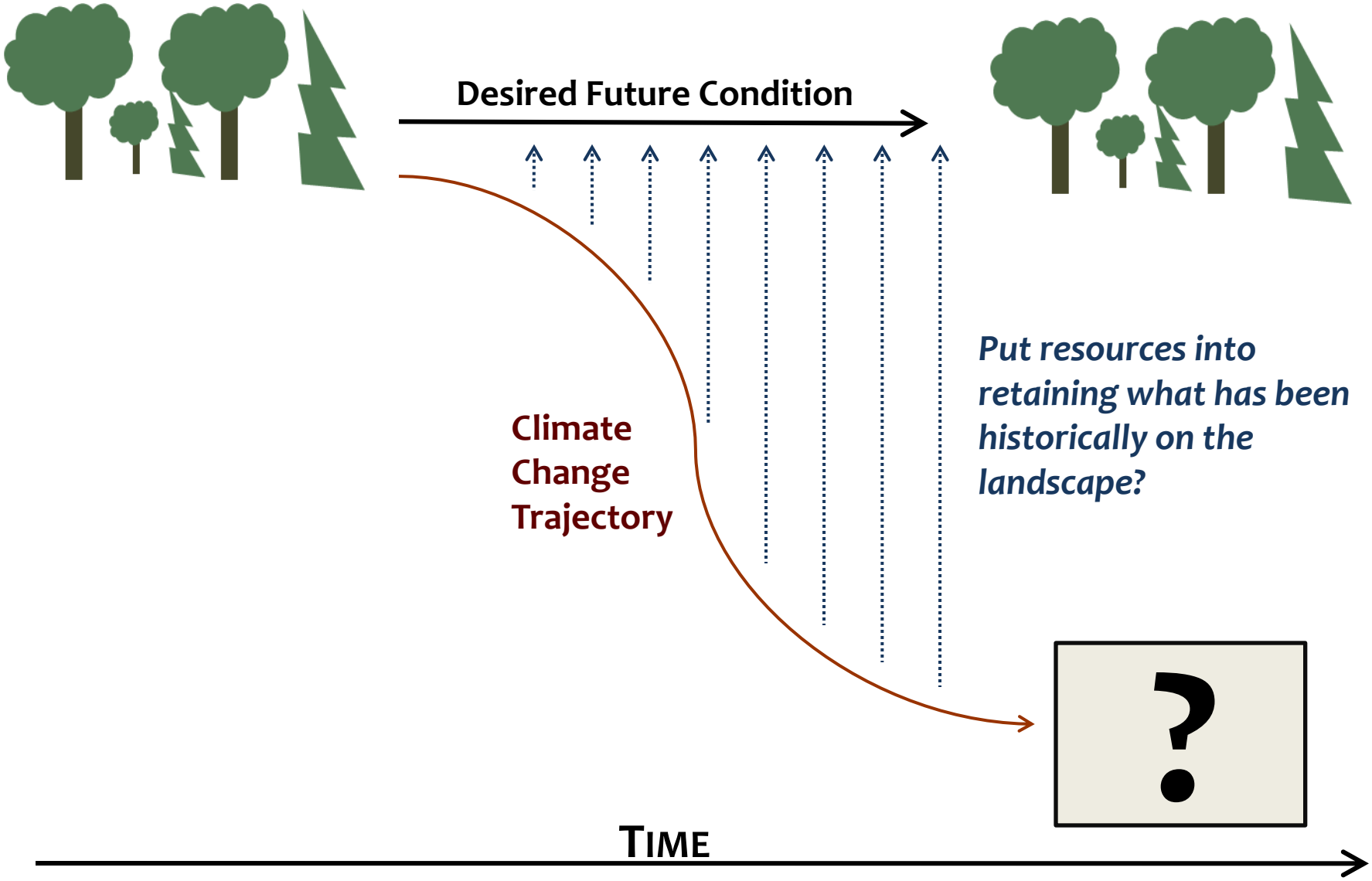
TIME



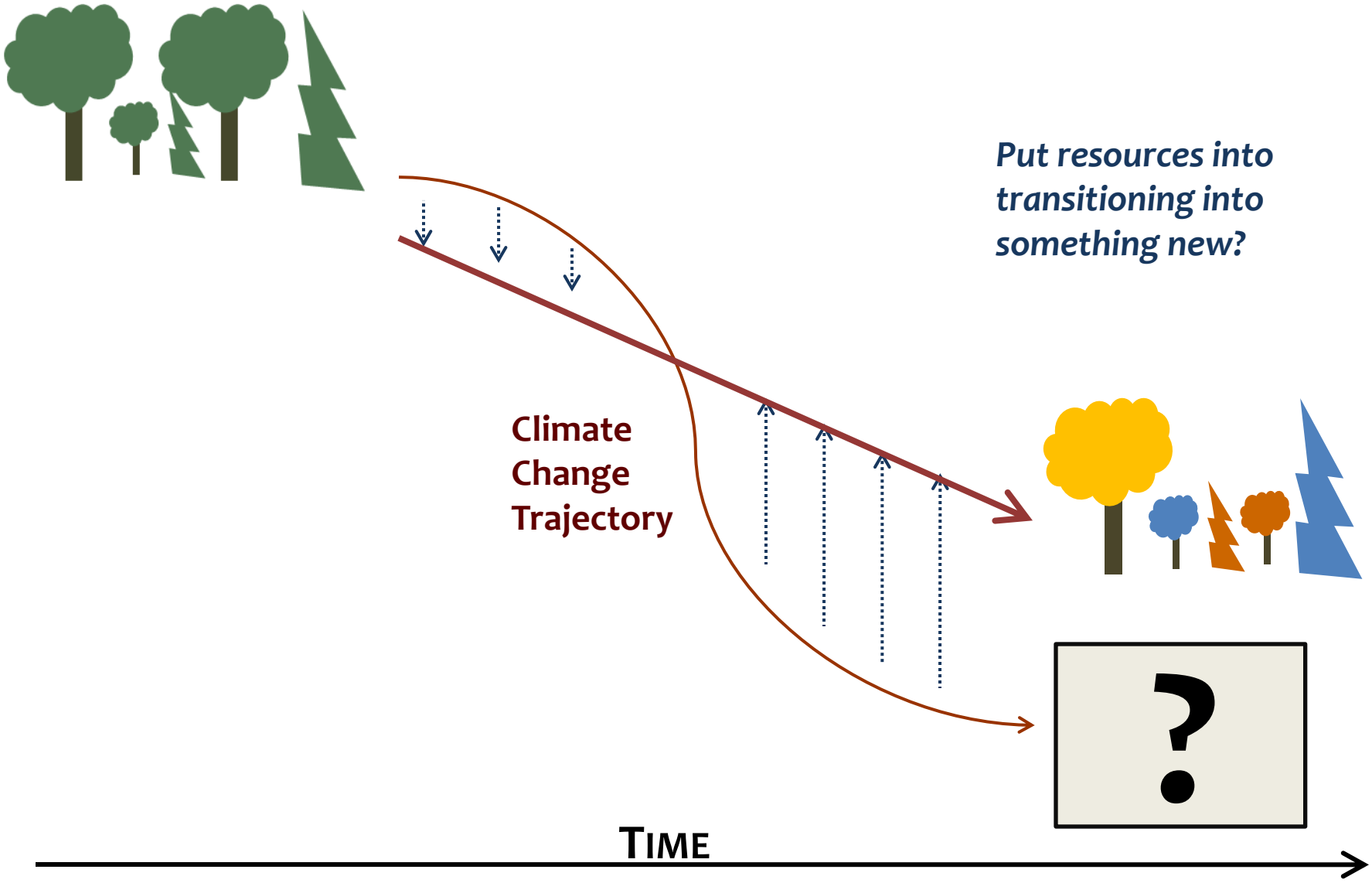
TIME


Desired Future Condition
Climate
Change
Trajectory
?
TIME

Adaptation


Desired Future Condition
Climate Change Trajectory
Put resources into retaining what has been historically on the landscape?
?
TIME

Adaptation


Put resources into transitioning into something new?
Climate Change Trajectory
?
TIME

Adaptation Options: Four R's

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

Millar et al. 2007

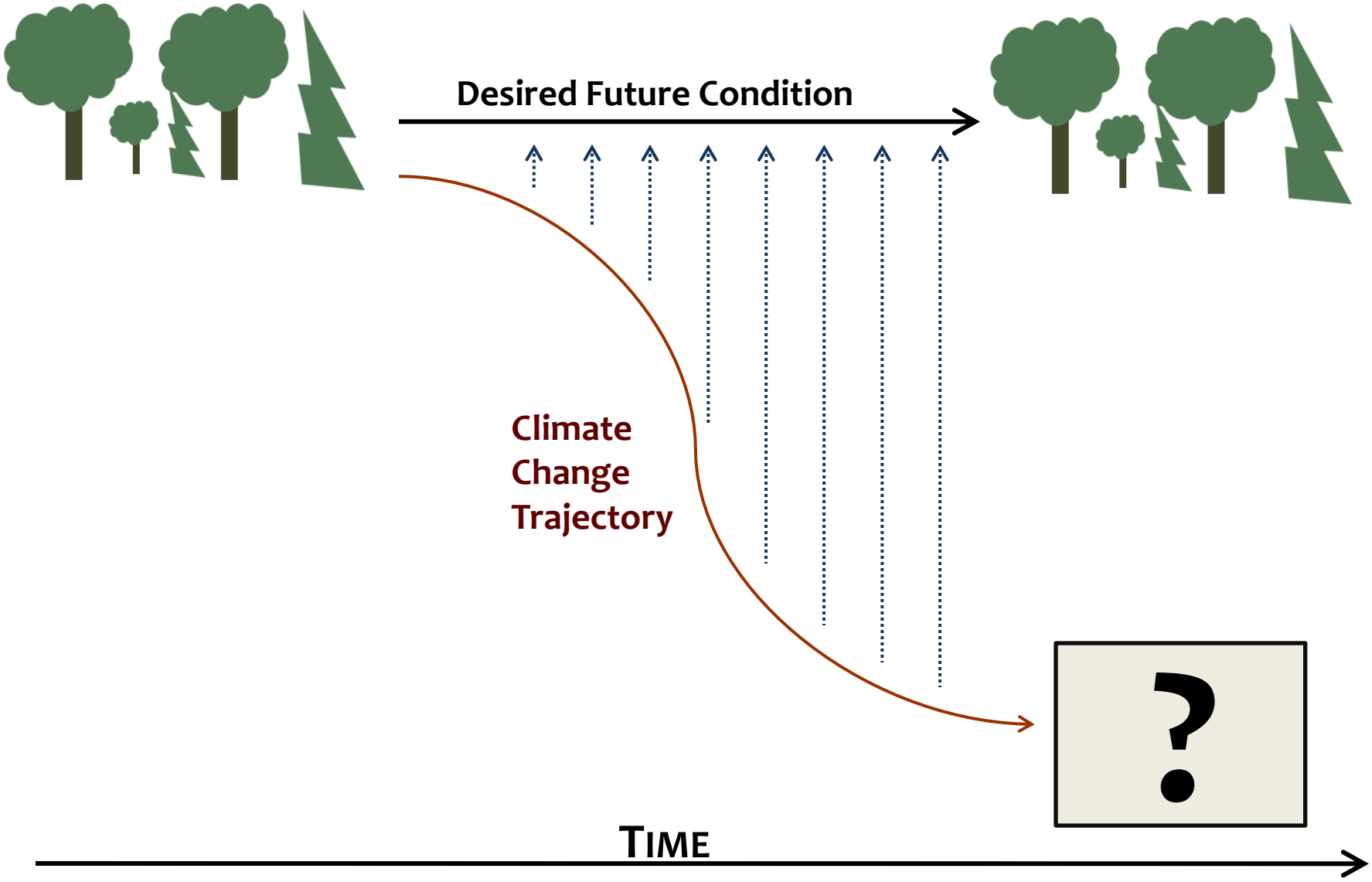
Option 1: Resistance

Improve the defenses of the forest against effects of change.

- Short-term
- High-value

Millar et al. 2007

Option 1: Resistance



Resistance Examples

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

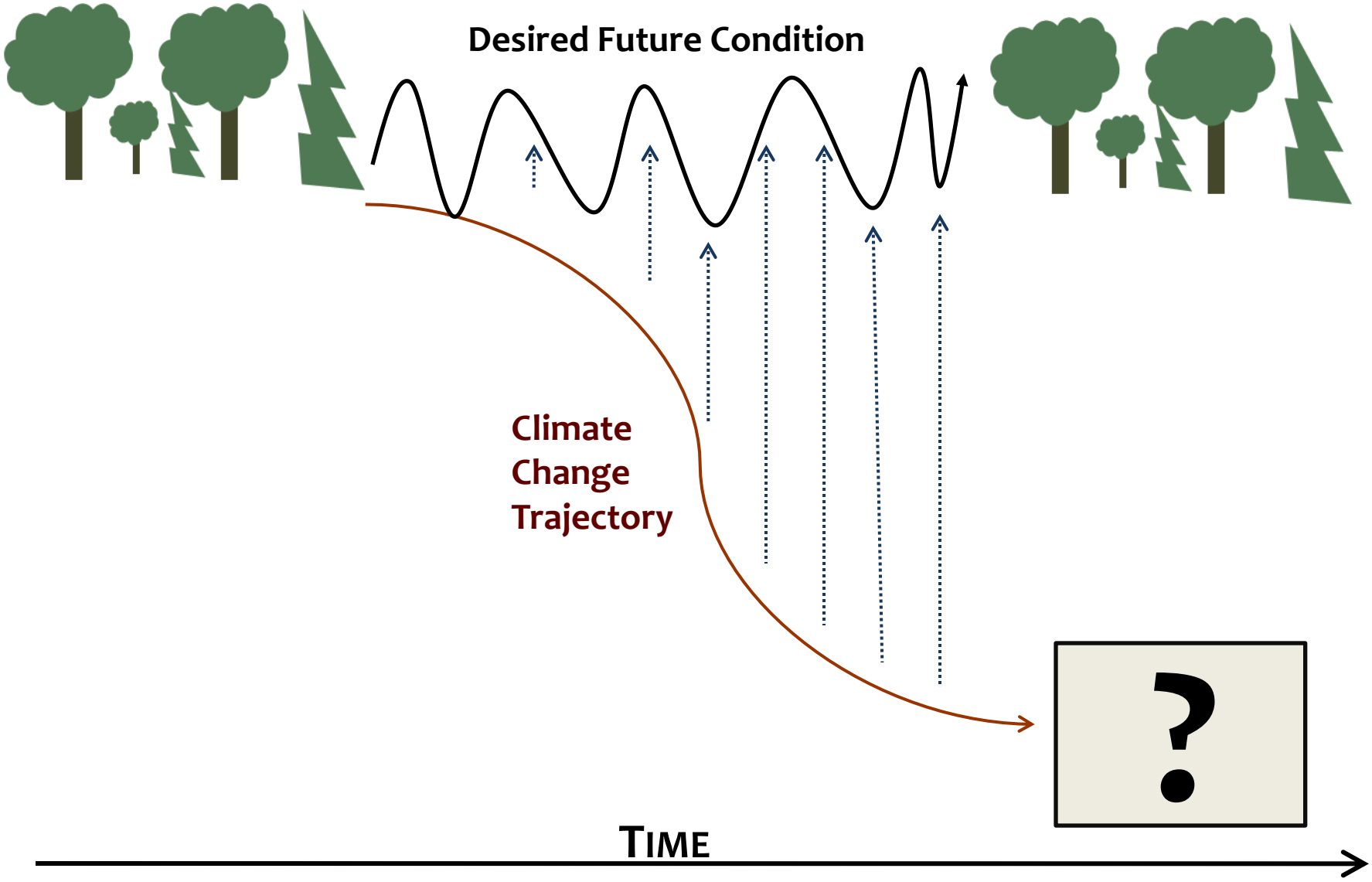
Option 2: Resilience

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

Photo: USFS

Millar et al. 2007

Option 2: Resilience

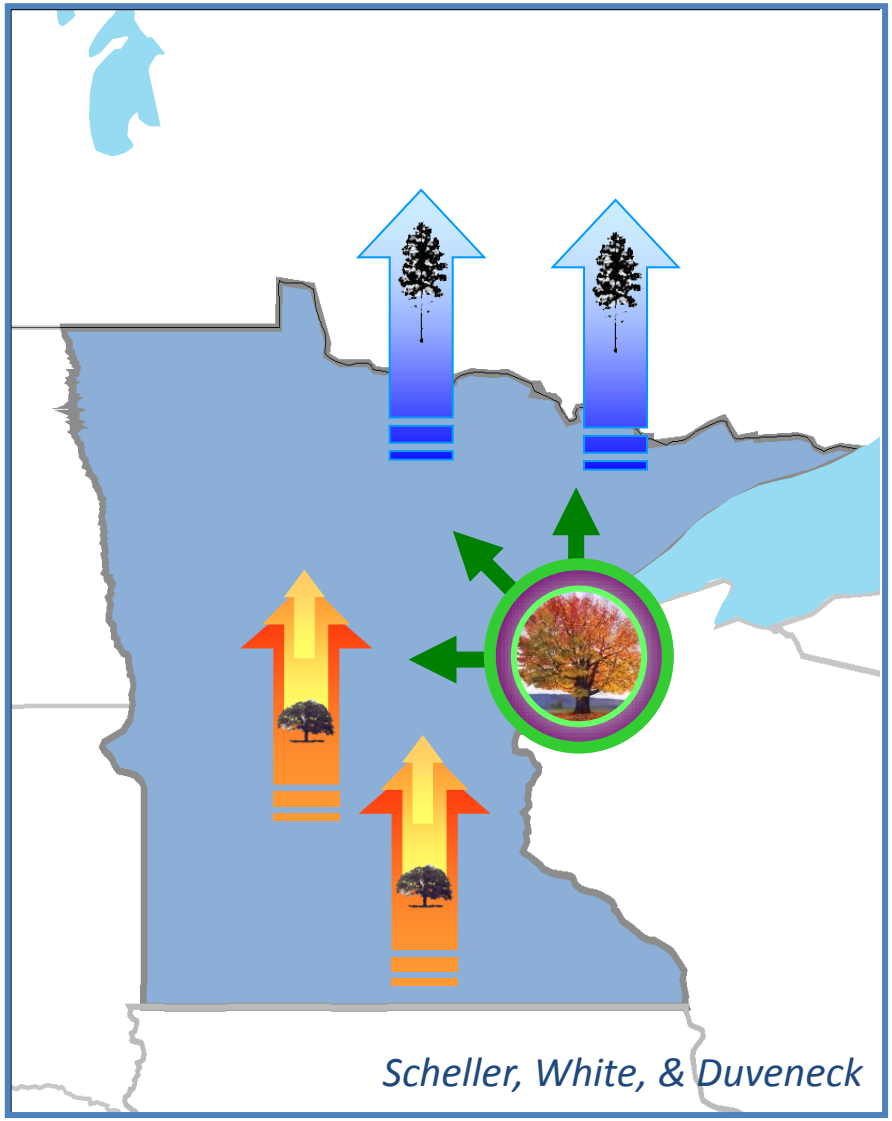


Resilience Examples

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

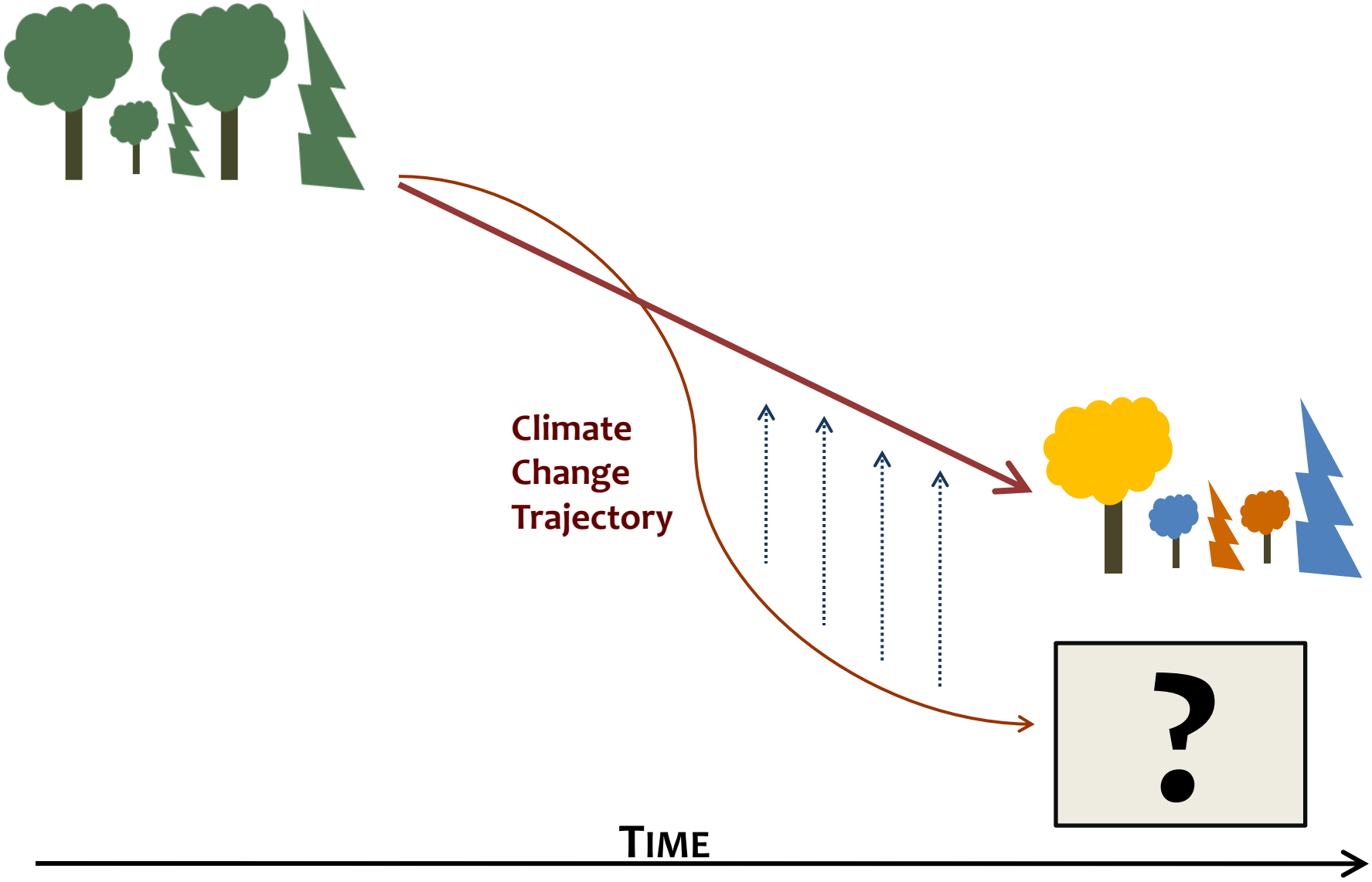
Option 3: Response

Intentionally accommodate change, enabling ecosystems to adaptively respond



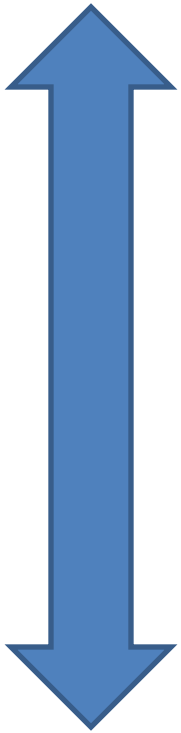
Millar et al. 2007

Option 3: Response



Response Examples

safer



risky

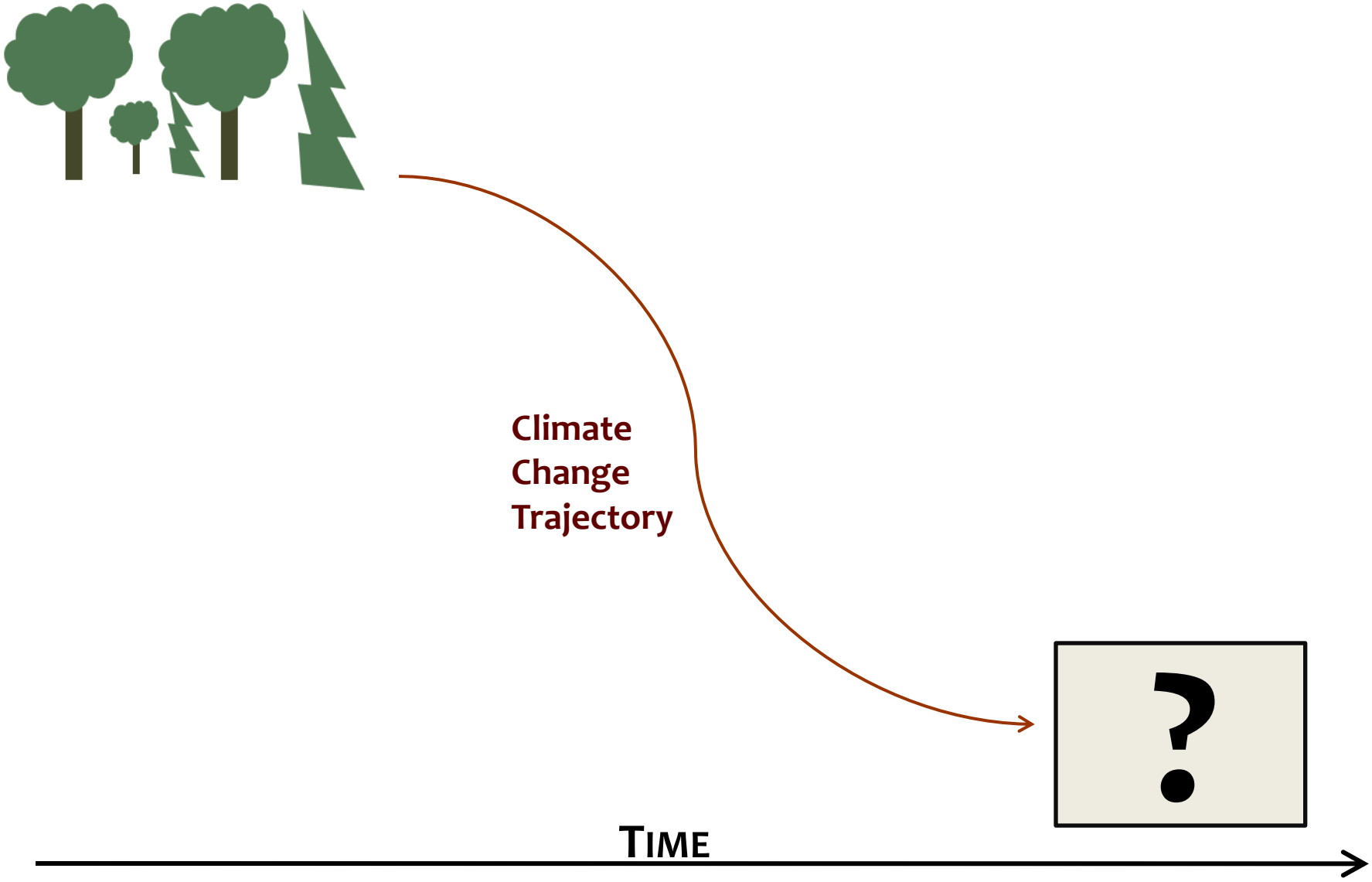
- Planting a mix of species that are most likely to do well under projected change
- Increased connectivity for migration
- Planting seeds/seedlings of genotypes from one seed zone south
- Planting /relocating species that currently reside south of the area (CAUTION)

Option 4: Realignment

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

Millar et al. 2007

Option 4: Realignment



Examples?

- Wait and see…

Climate Change Response Framework

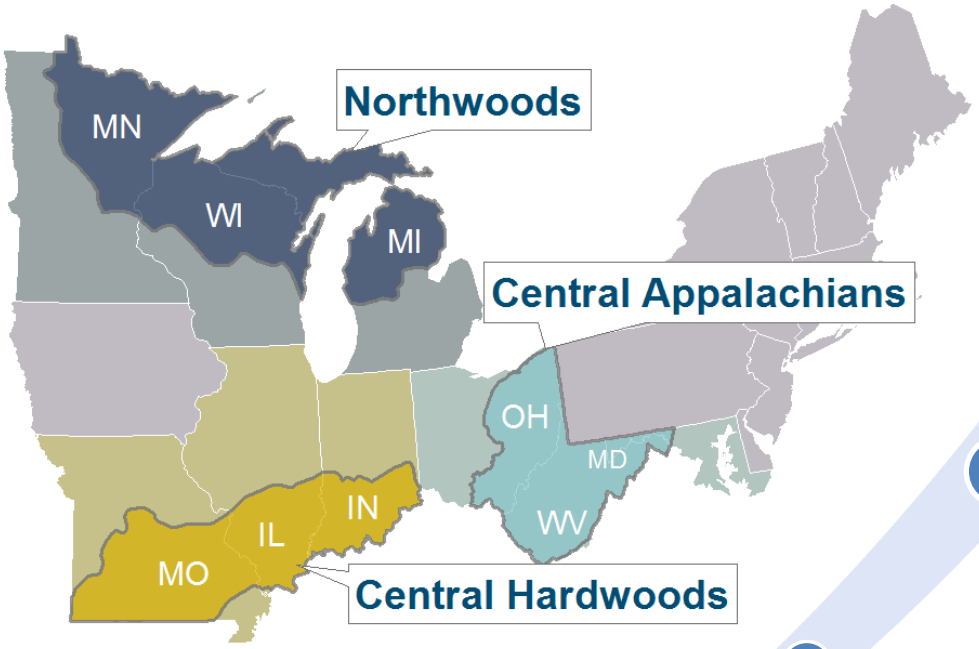
Summary:

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



2012: Central Appalachians

2011: Central Hardwoods

2010: Northwoods expansion

2009: Wisconsin's Chequamegon-Nicolet NF pilot

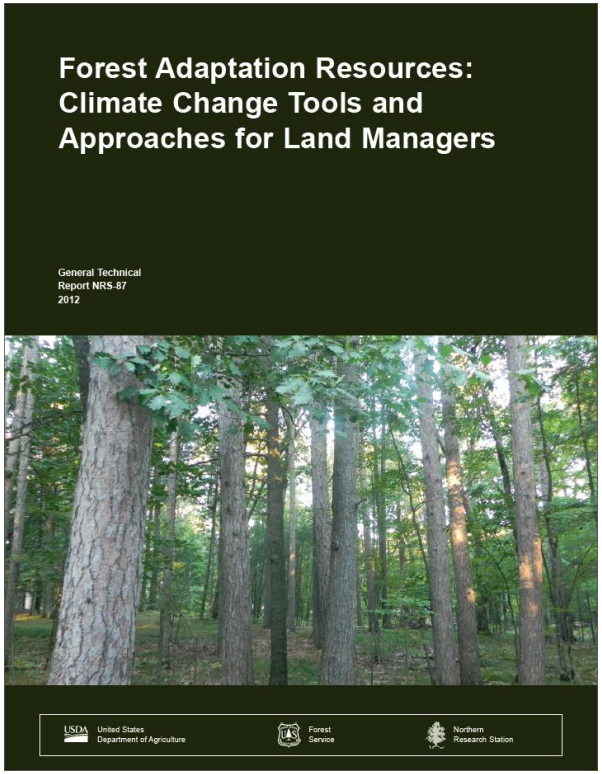
Climate Change Response Framework

Key Deliverables and Products:

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

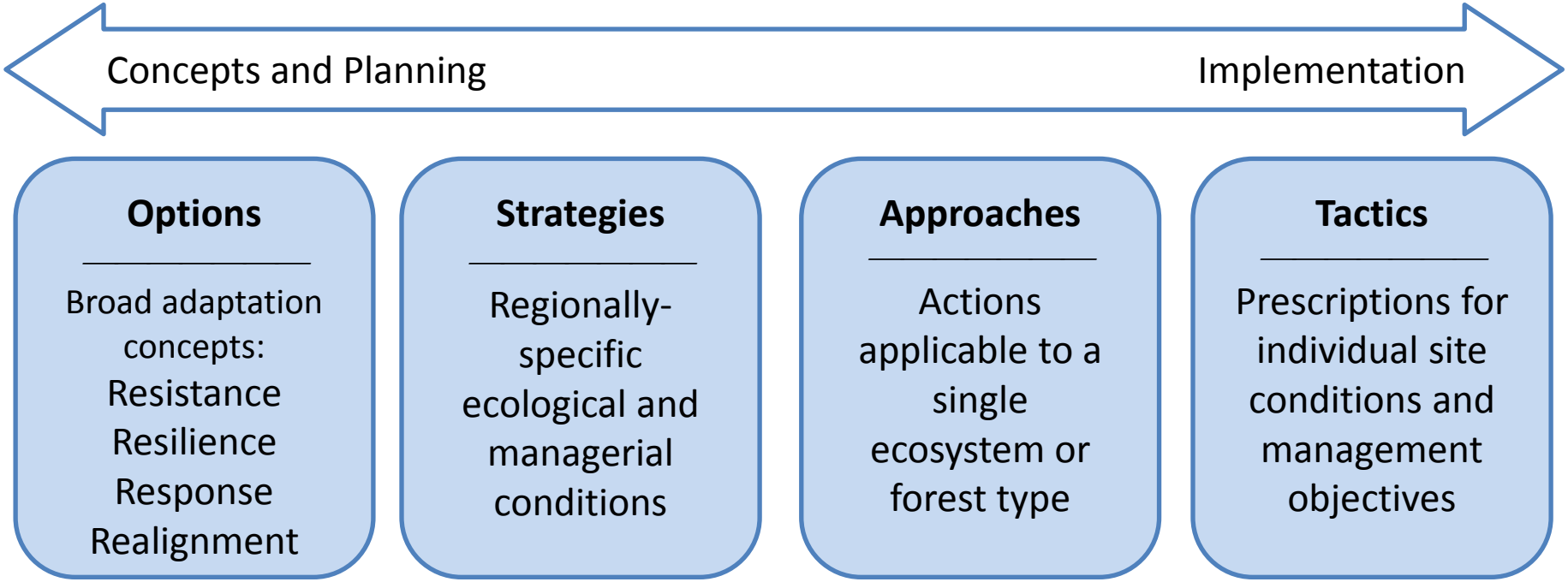
Forest Adaptation Resources

- 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



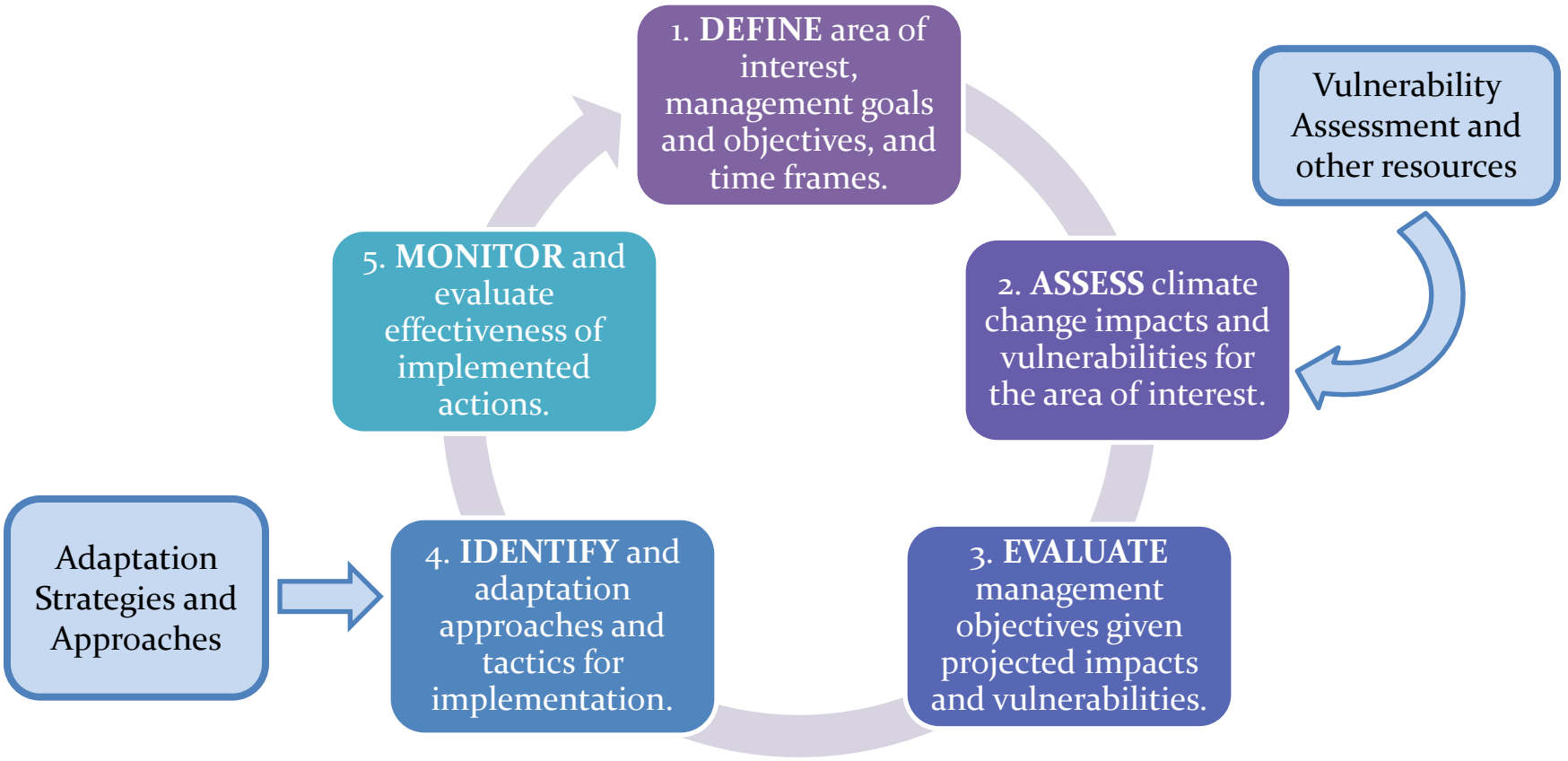
Forest Adaptation Resources

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

www.climateframework.org/node/218

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:

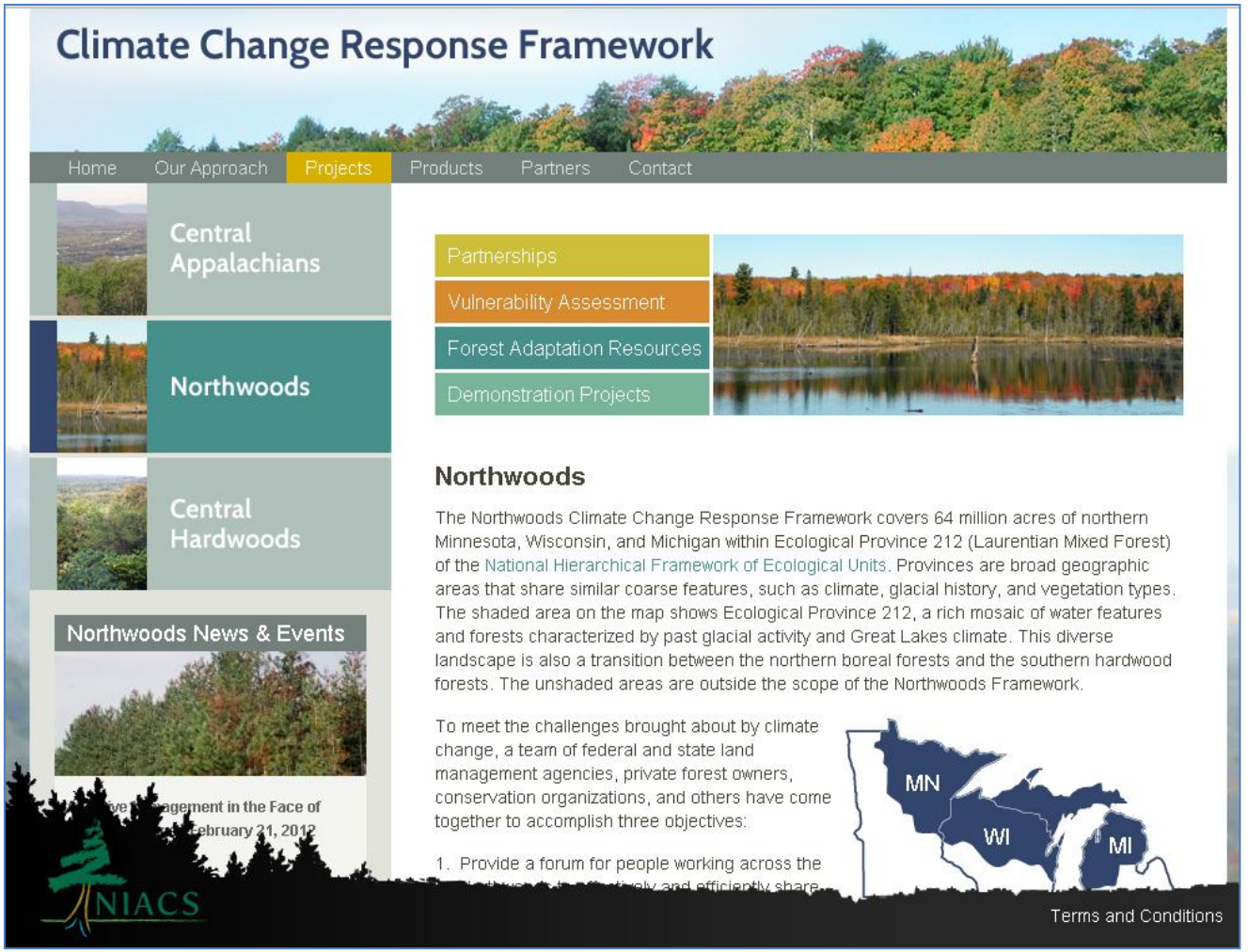
- **Resistance**:
  - Regenerate aspen, keep as long as possible
- **Resilience**:
  - Retain diversity: reserve trees, islands
- **Response:**
  - Increase local, native species that are expected to fare better under warmer and drier conditions (red oak, white pine)
  - Use planting stock from populations 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



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