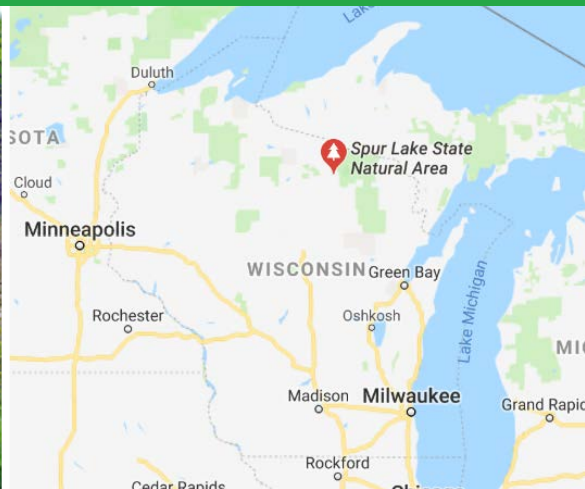




United States Department of Agriculture
Northern Forests Climate Hub

Spur Lake SNA Pre-workshop webinar



March 1, 2019



Danielle Shannon
Amy Staffen

Welcome to the Spur Lake SNA pre-workshop webinar!

- Plan for 90 minutes
- This will be recorded

Note: there are some tasks to complete before the workshop



Meeting details:

Rhineland DNR service center

Monday, March 11 – 10:30 a.m. - 4:00 p.m.

Tuesday, March 12 – 7:30 a.m.- 2:00 p.m.

Thanks for
joining us
today!

Agenda

Ask questions!

- Introduction
- Spur Lake SNA brief background
- Regional climate change impacts
- Watershed considerations (extra complexity)
- 5 minute break --
- Workshop process and resources
- Adaptation resources
- How to prepare for the workshop



(aka NIACS)

Northern Institute of Applied Climate Science

Chartered by USDA Forest Service, universities, non-profit, and tribal conservation organizations

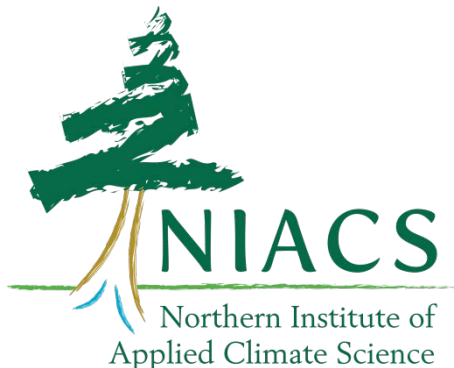
Climate and carbon services

- Climate impacts modeling
- Vulnerability assessment
- Climate adaptation
- Carbon biogeochemistry
- Carbon management

21 staff members

(Forest Service/universities)

- 10 climate outreach specialists
- 7 research scientists
- 2 web specialists
- 2 GIS/lab specialists



Michigan
Technological
University



The
UNIVERSITY
of VERMONT

UNIVERSITY OF MINNESOTA



AMERICAN FORESTS

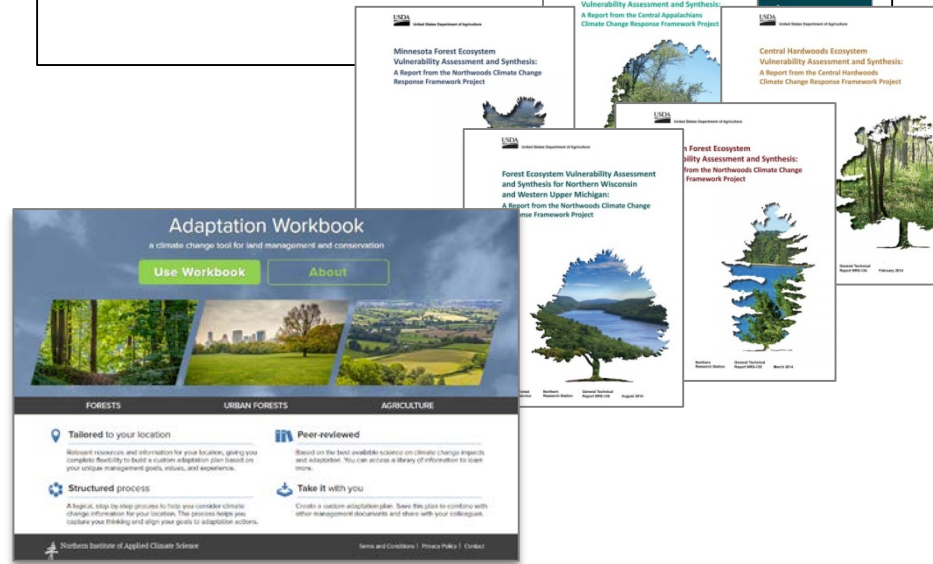
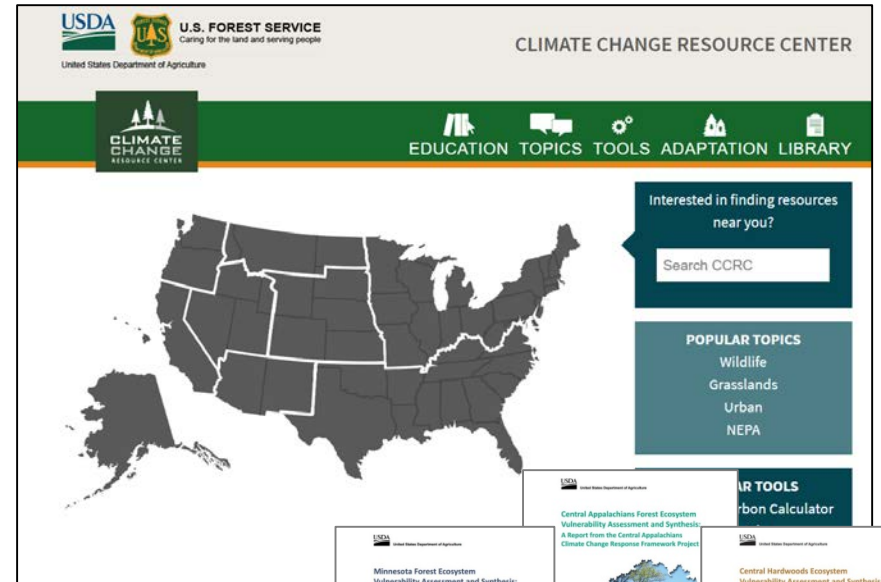


NCASI



Practical Resources & Technical Assistance

- USDA Forest Service Climate Change Resource Center
- USDA Climate Hub
- Forestadaptation.org
- AdaptationWorkbook.org



The players

- NIACS
- Wisconsin Initiative on Climate Change Impacts
- Wisconsin Department of Natural Resources
- Great Lakes Indian Fish and Wildlife Commission
- Lac du Flambeau
- Lac Vieux Desert Band
- Mole Lake Sakaogon
- Northland College
- USDA NRCS



Michigan
Technological
University

WISCONSIN
INITIATIVE ON
CLIMATE
CHANGE
IMPACTS

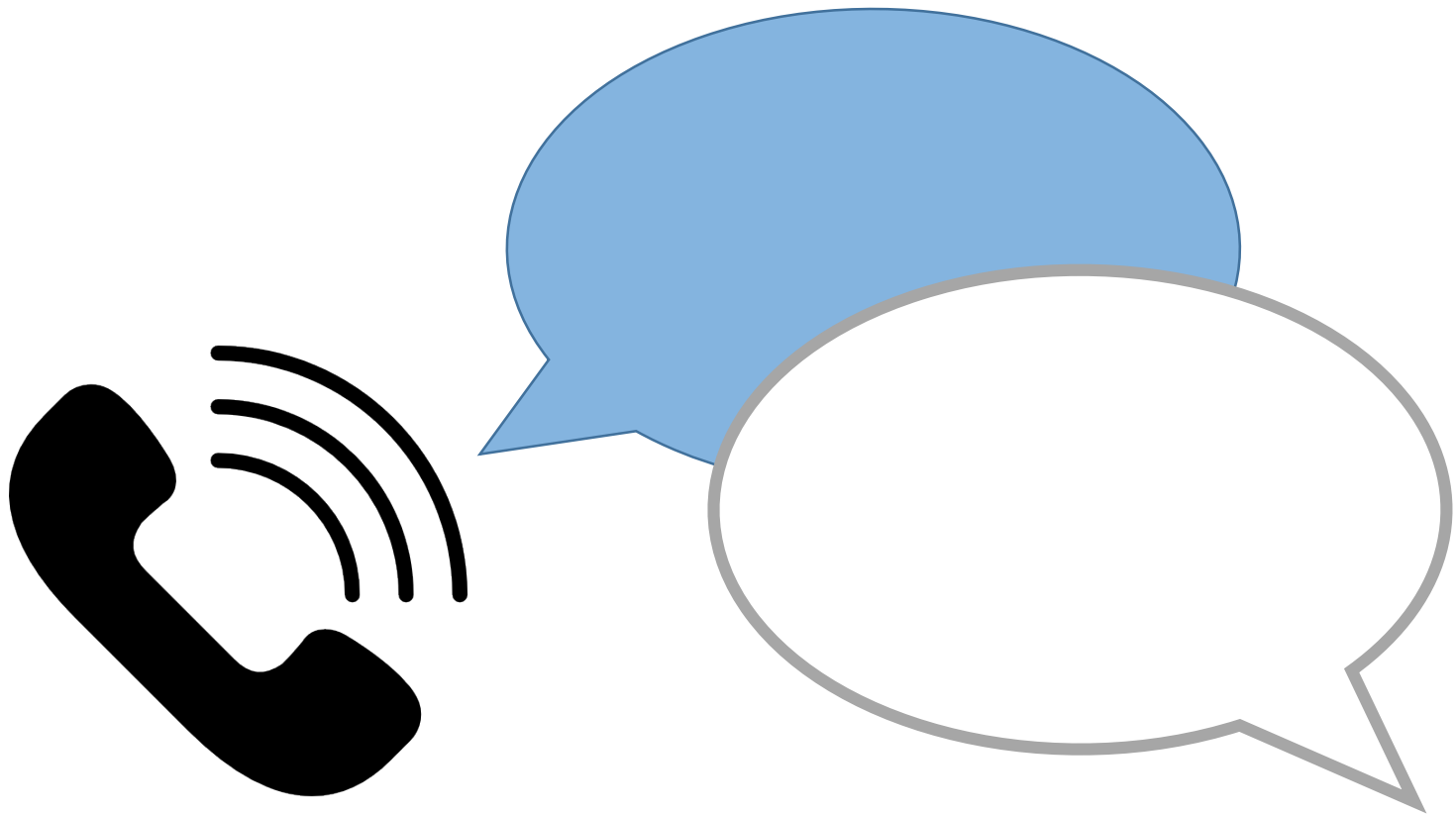


NORTHLAND
COLLEGE



Who's on the phone?

Share your name, location, favorite winter activity



Questions you might be asking...

1. How might climate change affect the resources that I manage?
2. What management actions could help prepare for those effects?

Focus of the workshop!



Spur Lake –
Brief background

Spur Lake SNA



Site Description:

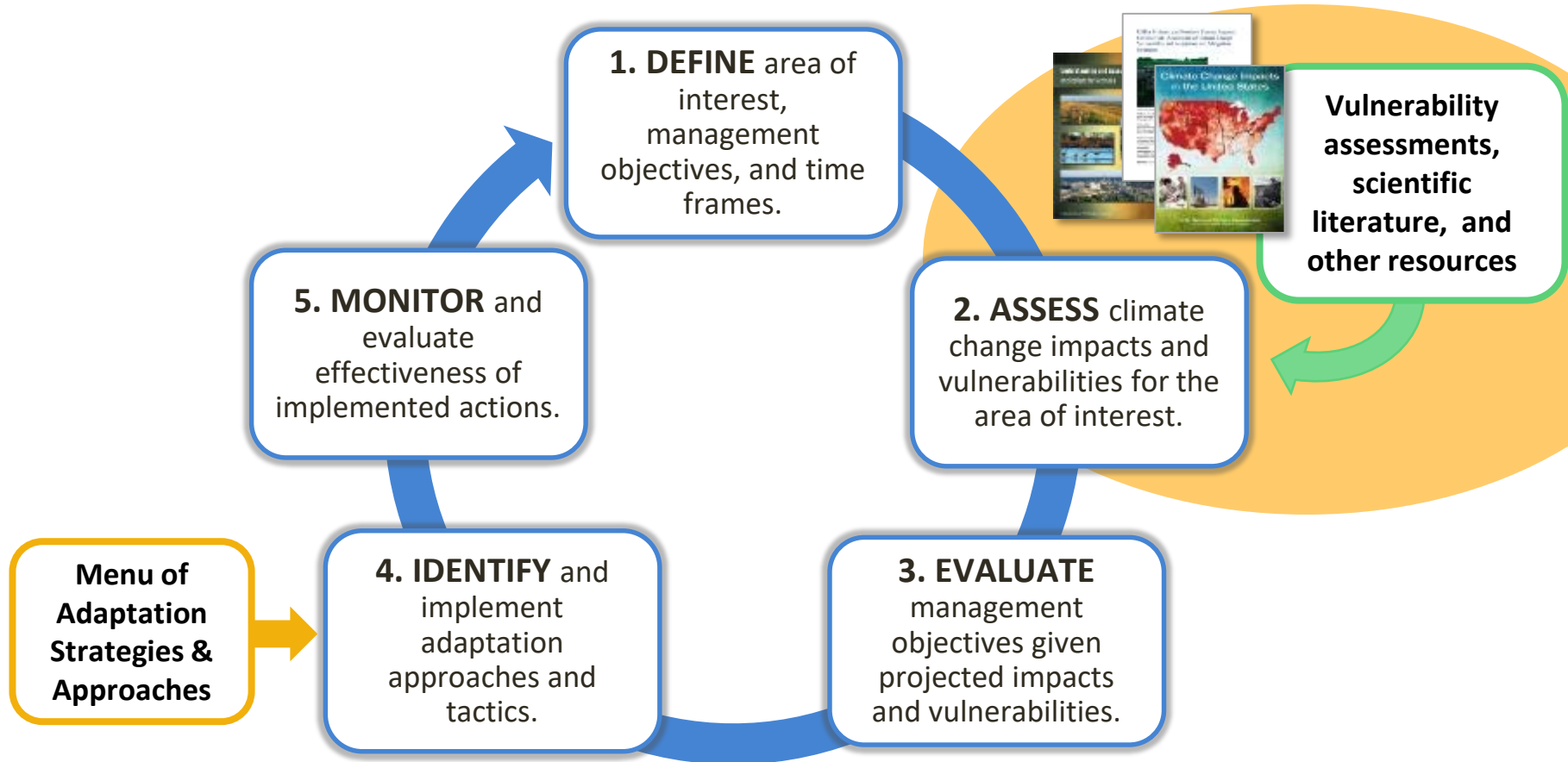
- Muck-bottomed, soft water drainage lake (historically 3' max depth) with dense beds of emergent, submergent, and floating-leaved aquatic plants.
- Historically significant wild rice; Native Americans used the property for centuries and there is an old campsite on the lakeshore.
- Breeding habitat for Black Tern colony, many duck species.
- Surrounded by good quality wetland communities (open bog, alder thicket, and black spruce-tamarack-white cedar swamp).
- Small stand of old-growth hemlock hardwoods at northeast corner.
- The outlet stream, Twin Lakes Creek, flows southward, joining the Pelican River, which in turn flows to the Wisconsin River

Management History...



Regional Climate Impacts

Primer for Step 2



Future changes

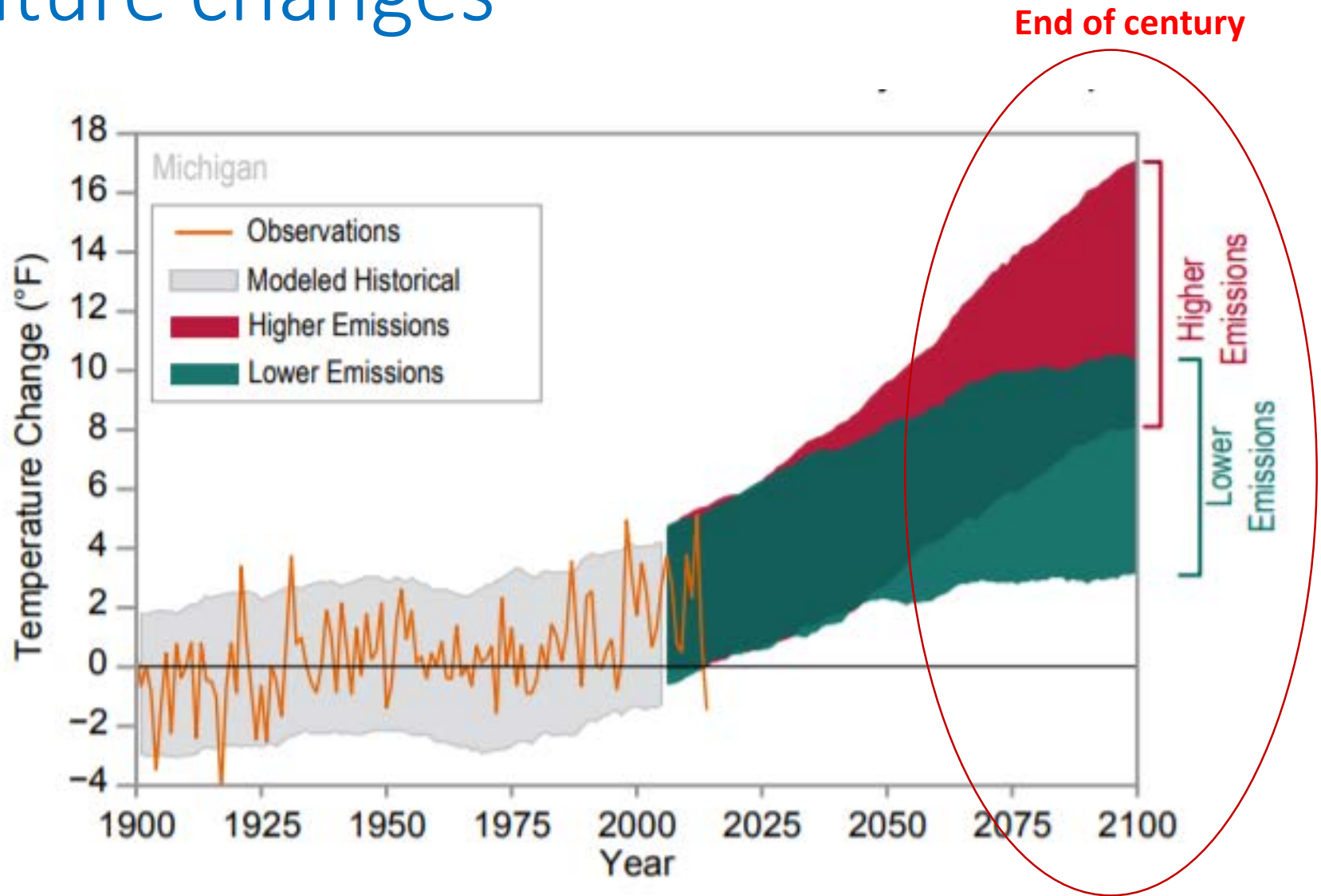


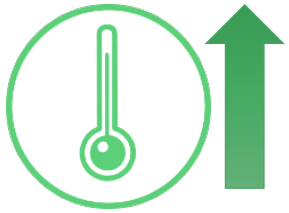
Figure source: NOAA MI State Climate Summary, CICS-NC and NOAA NCEI

Ten Key Impacts ...

1. Less cold / more heat
2. Longer growing season
3. More rain in winter/spring
4. Less snow
5. More extreme rainfall
6. Flooding
7. Water quality
8. More drought stress
9. Shifting species
10. Cumulative stressors



Future climate: Temperature



Average Annual Temp:

~ 5 - 9 °F

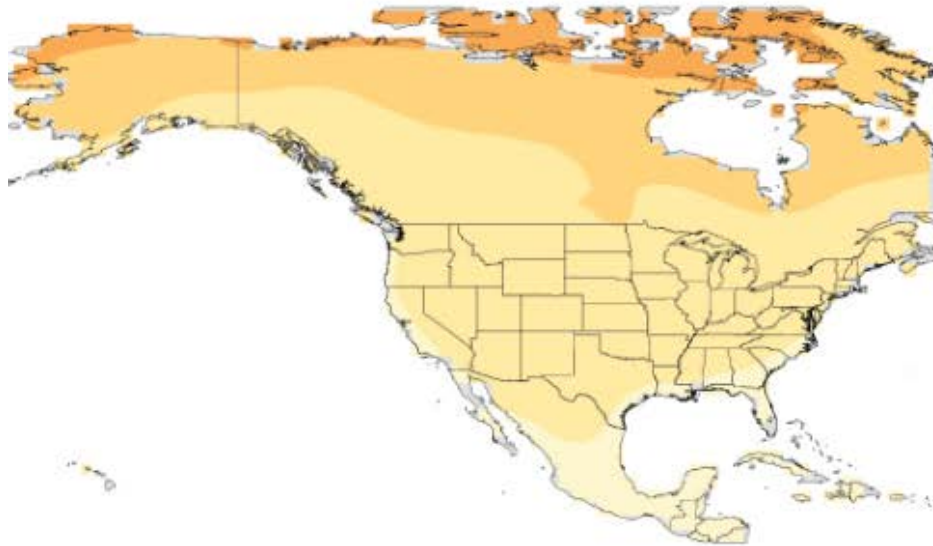
Late century (2071-2099)

Avg 32 models

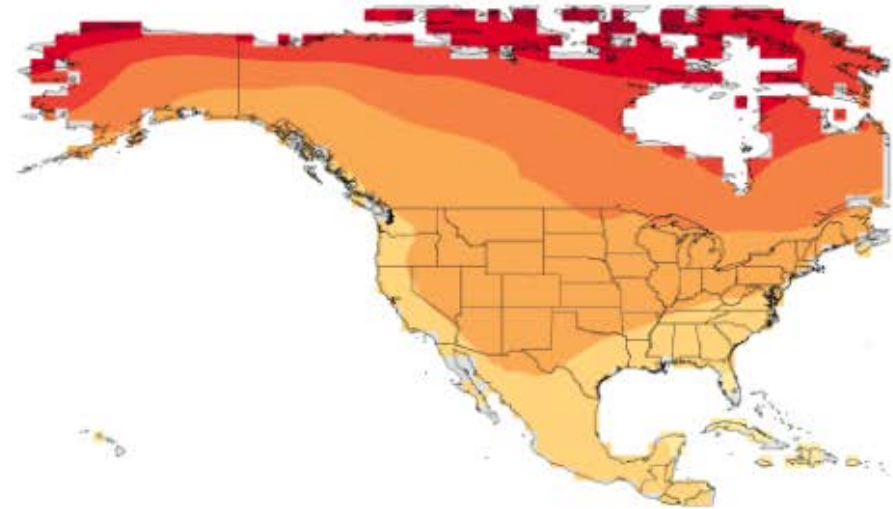
Range of scenarios low – high (RCP 4.5-8.5)

Late 21st Century

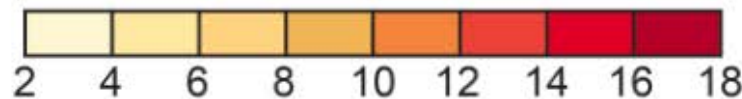
Lower Scenario (RCP4.5)



Higher Scenario (RCP8.5)



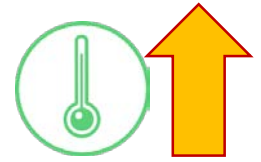
Change in Temperature (°F)



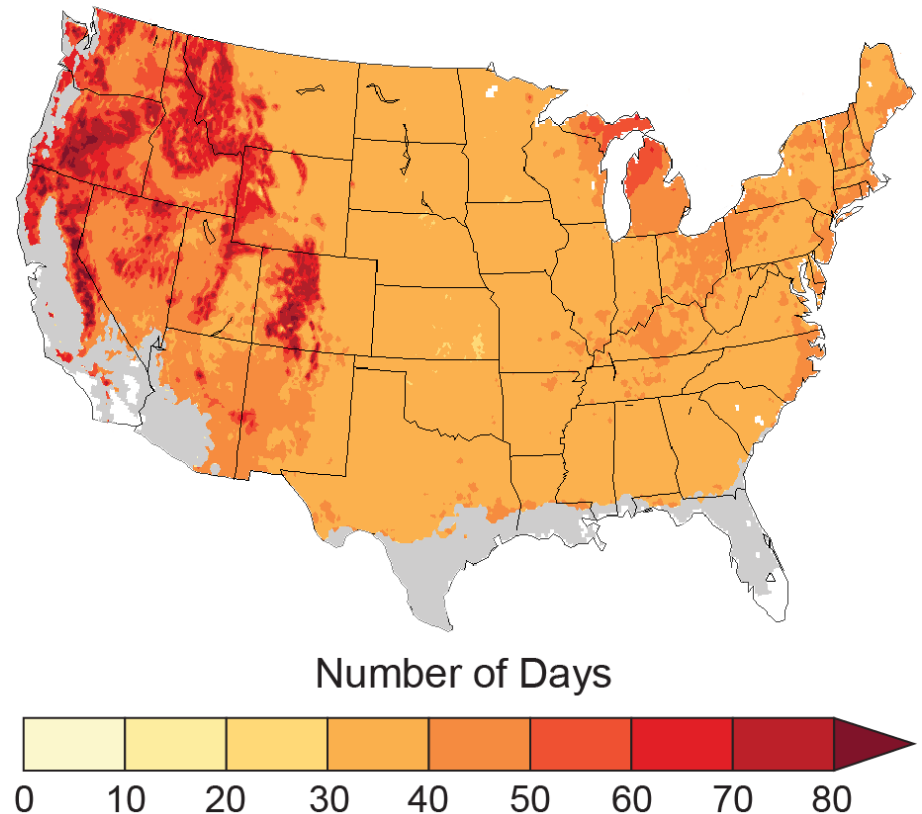
Future climate: Growing seasons

Increase of **2 to 10+ weeks** by 2100

Scenario: Low (B1) – High (A2 and A1FI)



Change in Frost-free Season Length



Opportunity:

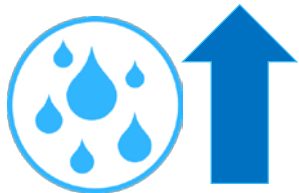
- Longer period for plant growth
- Decreased freeze of plants

Challenge:

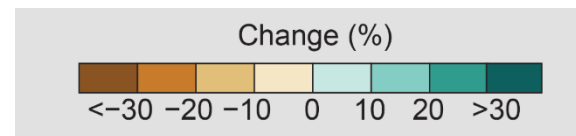
Potential risks from altered seasonality

- Shifting phenology
- Early bud break/loss of cold hardening
- Frost damage during spring freezing
- Advantage for some invasive plants
- Fire risk increases
- Water scarcity

Future climate: Precipitation



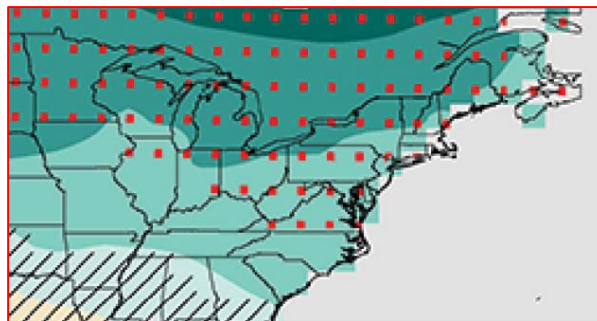
More rain in **winter** and **spring** (10-20%)
4 - 5 inches more annually



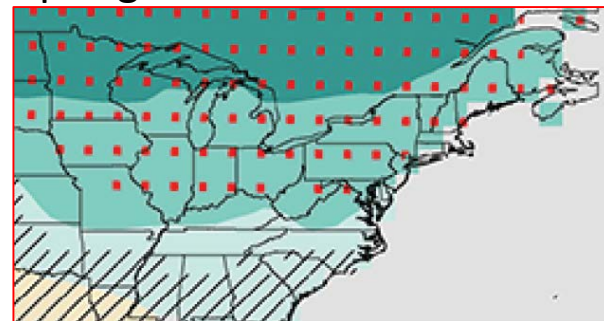
High Certainty:

- More rainfall annually & some seasons
- Potential for more frequent & intense heavy rains
- Reduced snowpack, earlier melting

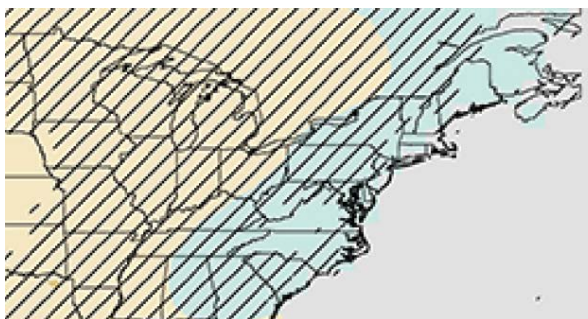
Winter



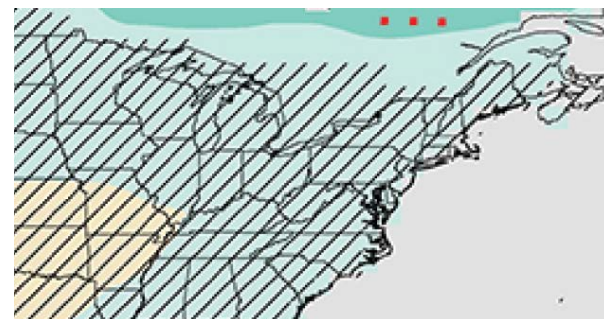
Spring



Summer



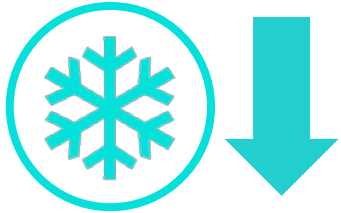
Fall



2070-2099 percent change relative to the 1976-2005 average. **RCP8.5**.

Stippling indicates that changes are assessed to be large compared to natural variations

Future climate: Shorter Winters = Less snow



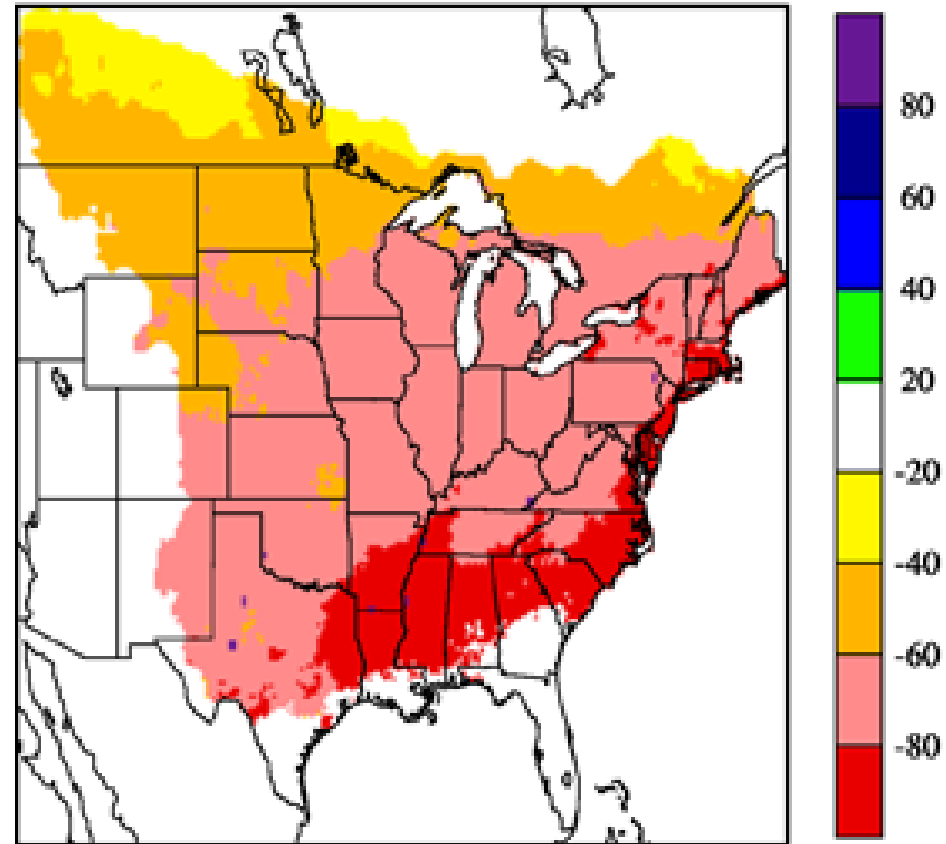
30-80% Decrease in Snow Depth

Low to high emissions

Challenge:

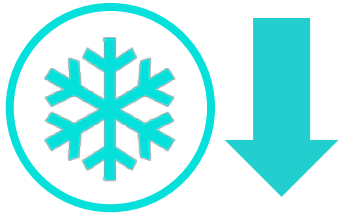
Decreased snowpack

- Increased soil frost and root damage in cold temps
- Warmer soil temperatures and altered processes
- Changing wildlife dynamics (e.g. deer)



2070-2099 End of Century – A2 scenario

Future climate: Shorter Winters = Less snow



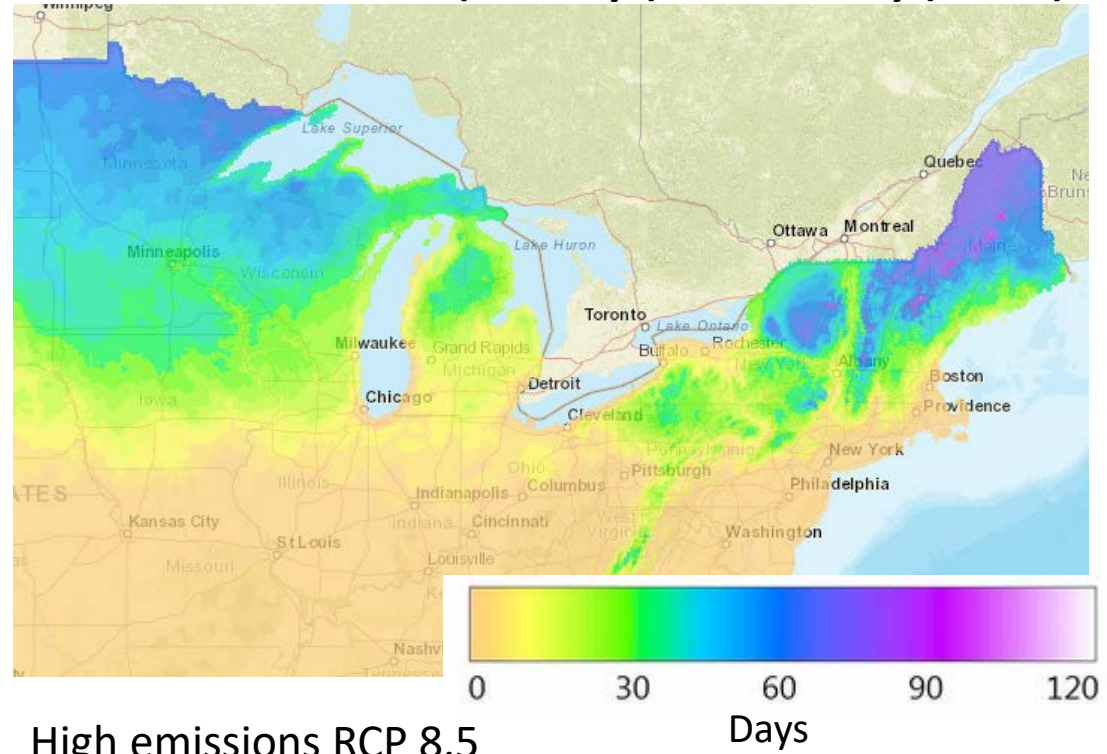
10 – 60 fewer days with snowpack

Low/High scenarios: Less snow projected in Nov, March, April

Challenge:

- Earlier spring peak streamflow
- More frequent & intense heavy rains
- Potential increases in runoff, flashiness and episodic high flows
- Erosion, washouts
- Potential declines in summer seasonal stream flow

Snow residence time (# of days) late century (2080s)



High emissions RCP 8.5

Days

Demaria et al 2016, Ning and Bradley 2015, Berguijs et al 2014, Janowaik 2014. Image: USFS - <https://arcg.is/0eCuOv>

Future climate: Frozen ground



30-50 fewer days by 2100

Scenario: Low (B1) – High (A1FI)

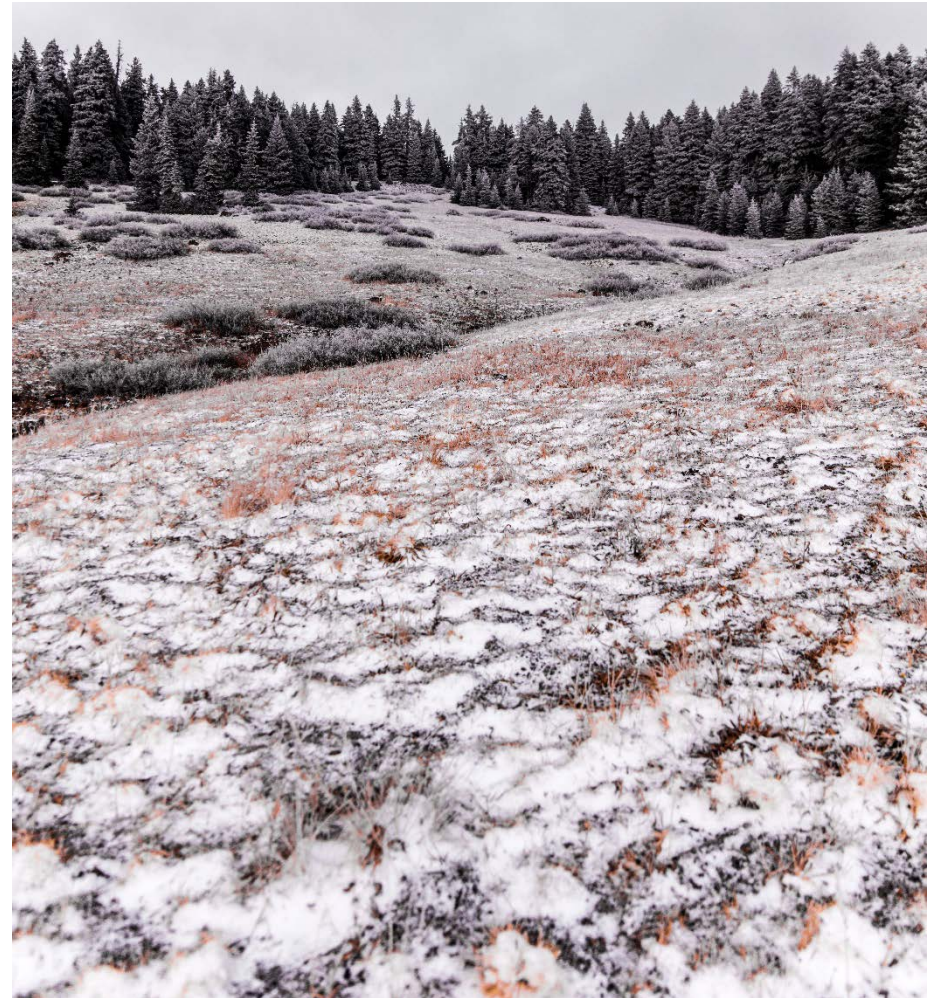
- Cold season soil temps – increase **1.8 – 5.4F**
- Frost depth is projected to decline by **40- 80%** across N. Wisconsin

Opportunity:

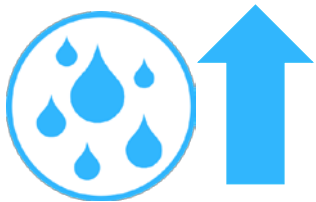
- Conditions could increase water infiltration into the soil and reduce runoff

Challenge:

- Greater soil water losses & increased ET
- Less snow, less frozen soil will affect ecosystem processes, decomposition activity, nutrient cycling and the onset of the growing season



Future climate: Increases in extreme rain

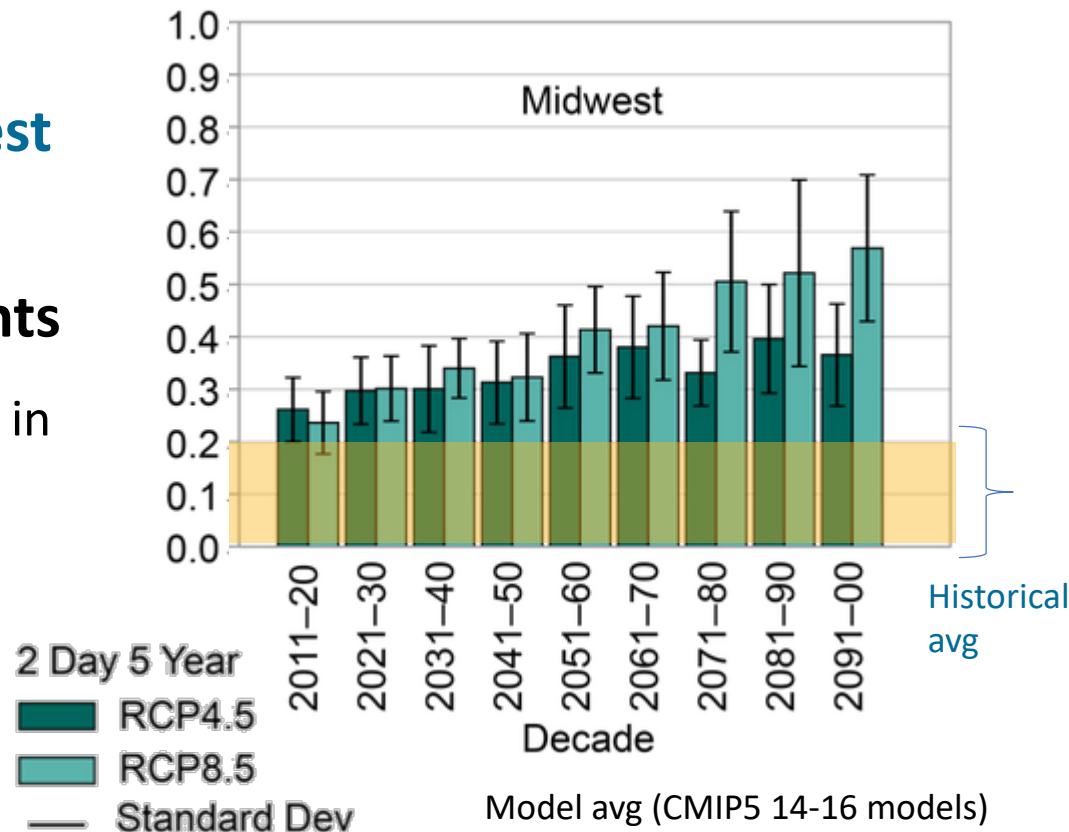


Frequency of regional extreme precipitation events

Low to high emissions

- **23% increase in the heaviest days (>1")**
- **2-3x more freq. 2-day events**
- Most heavy precip. Events occur in summer
- **Influence:** Winter and Spring Runoff and peak flows patterns

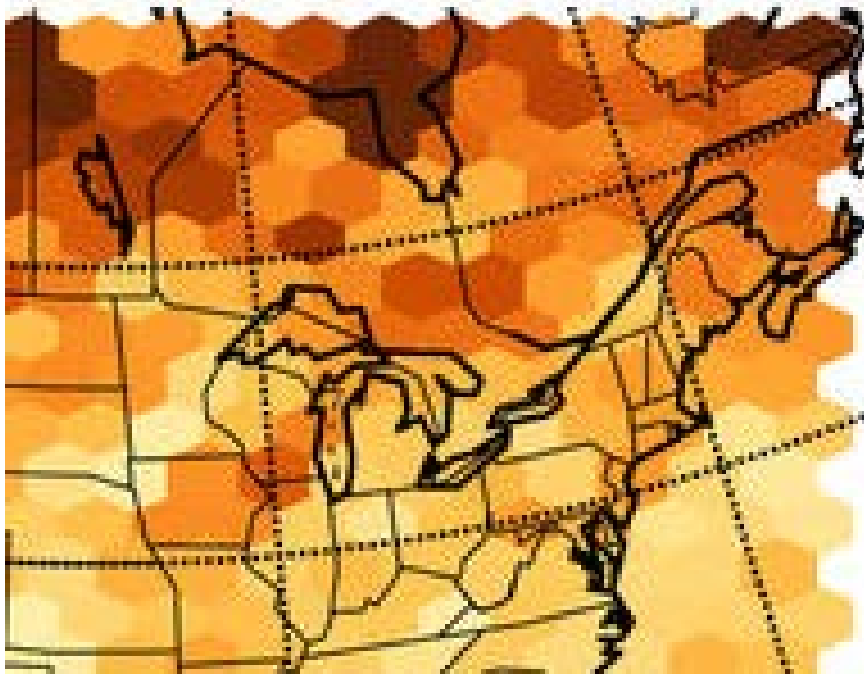
Heavy precipitation 2006–2100



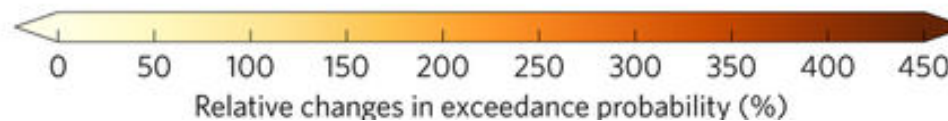
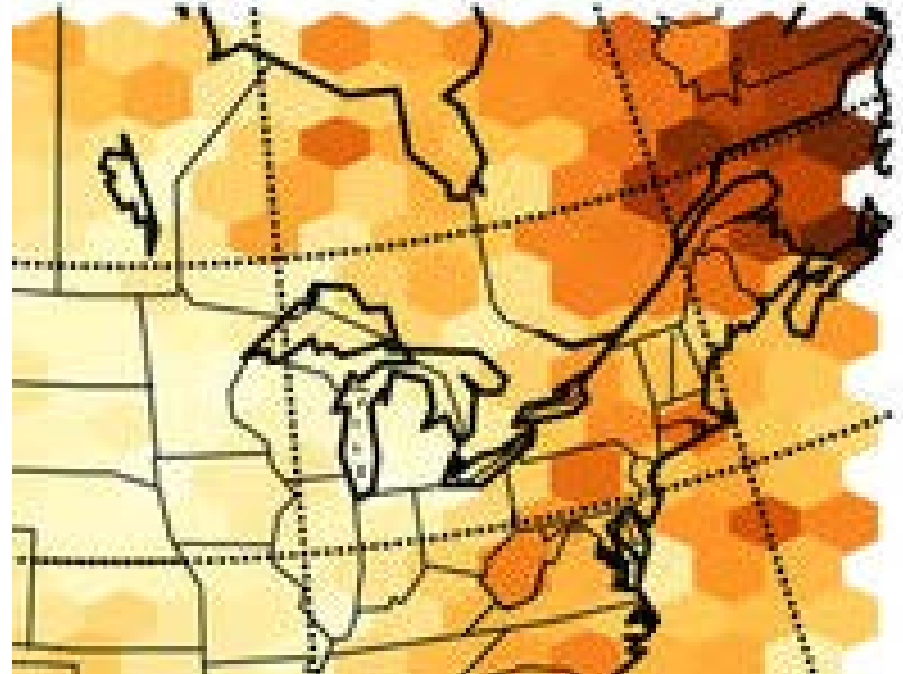
Future climate: Increases in extreme rain

Frequency & intensity of hourly heavy precip. will increase 1-2 times

Winter (DJF)



Summer (JJA)



Future increases in 99th% of hourly precipitation event intensities by 2100

Relative to January 2001 - 2013

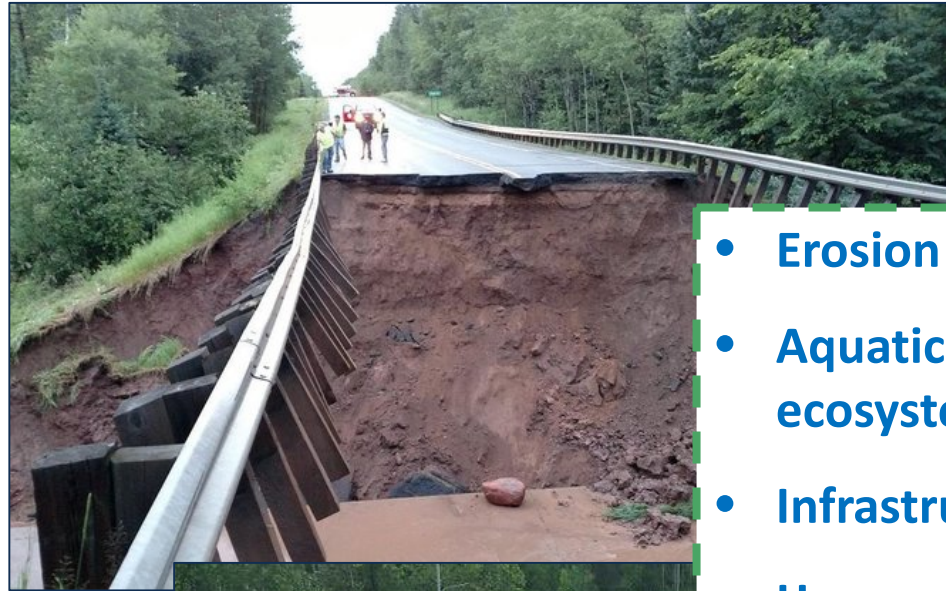
Prein et al 2017. doi:[10.1038/nclimate3168](https://doi.org/10.1038/nclimate3168).

Future climate: Increases in extreme events

Challenge:

- Heavy precipitation
- Flooding
- Ice storms
- Heat waves/droughts
- Wind storms

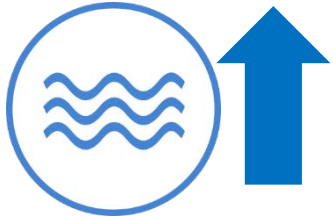
Future “Events” are very difficult to predict



- Erosion
- Aquatic ecosystems
- Infrastructure
- Human health



Future climate: Flooding and peak flows



Larger and 2-3 times more frequent 1% annual exceedance(100y) events (high emissions, RCP 8.5)

20% increase in the freq. of multiple high flow days in a row
Low to high emissions

Challenge:

- Flash floods can enlarge hydrologic flowpaths
- Initiate erosion that may destabilize slopes
- Disrupt ecosystems, damage infrastructure and impair water quality



Image: American Forests

Future change: Water quality decline

Surface water temps are projected to rise with increasing warmer ambient air temps (Low and High scenarios)

- More frequent and intense rain events increase runoff = **Surface runoff, erosion, sedimentation, nutrient runoff, and pollutant discharge that impair water quality.**
- **Warmer water** = the amount of dissolved oxygen decreases, and is further reduced by increased respiration as aquatic species cope with conditions.
- **Nutrient-enriched waters** could = more harmful algal, bacteria, and parasites.



Image: NOAA GLERL

Future climate: Drought stress



Increase # of days between rain by **1-6 days** by 2100

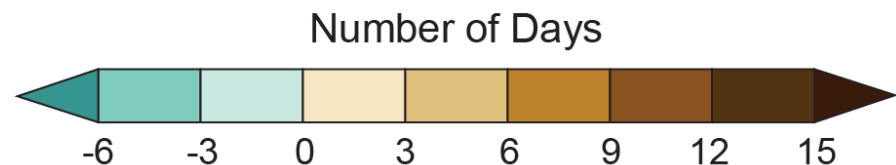
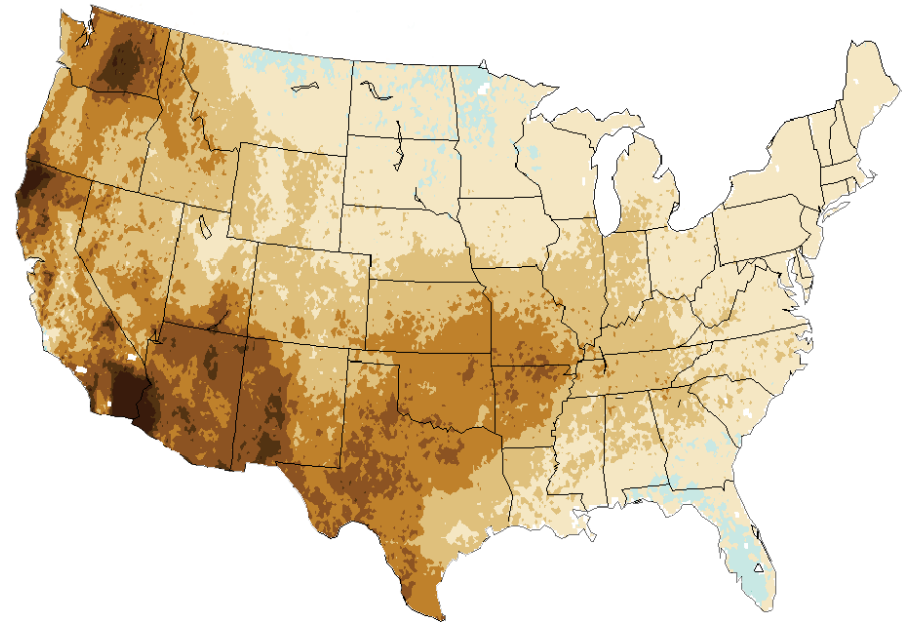
(less than 0.01 inches of rain)

High emissions (A2)

Challenge:

- Negatively affect plants and animals
- +warming will increase evaporation
- Add stress to limited water resources
- Affect irrigation and other water uses

Change in Number of Consecutive Dry Days



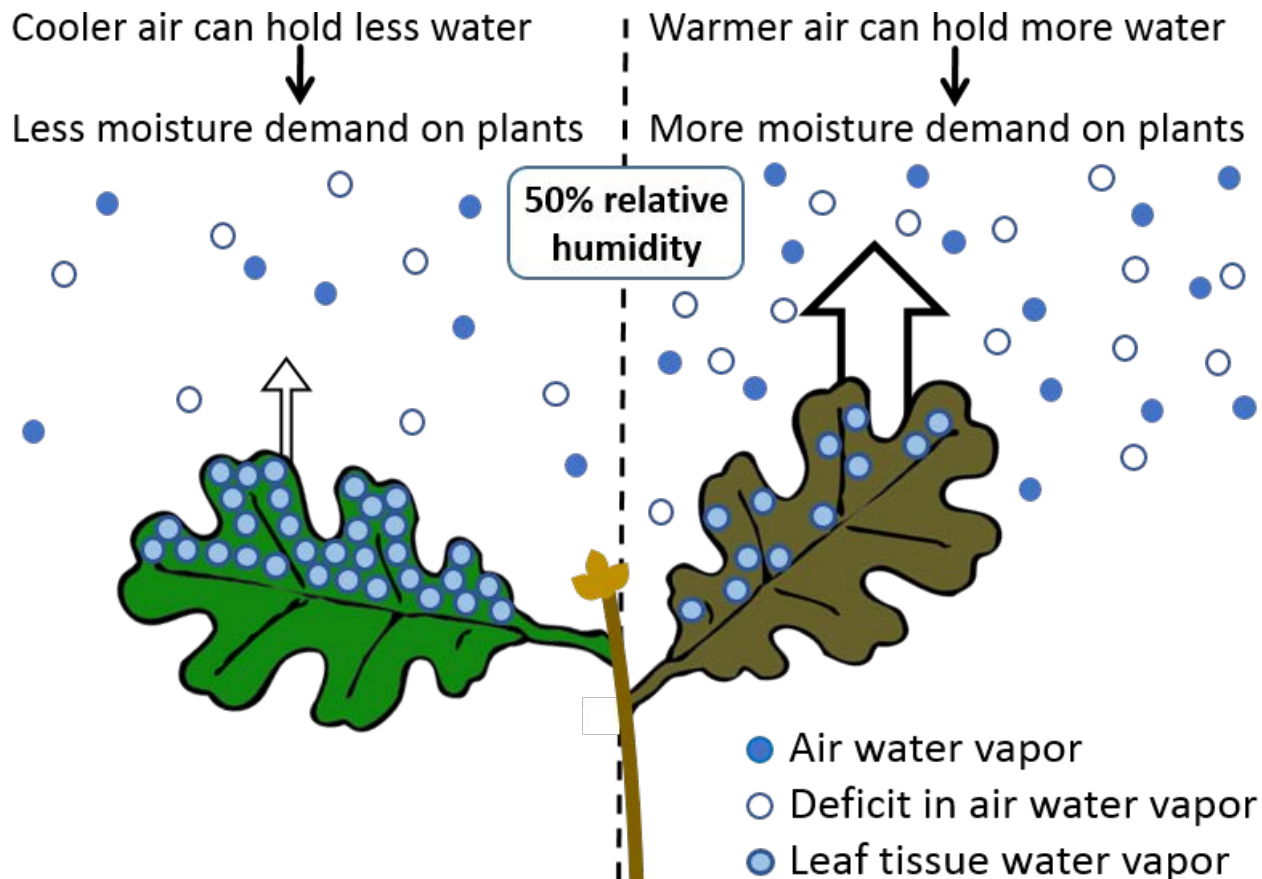
Future climate: Moisture stress

So wait...we're projected to have more drought *and* increased precipitation?



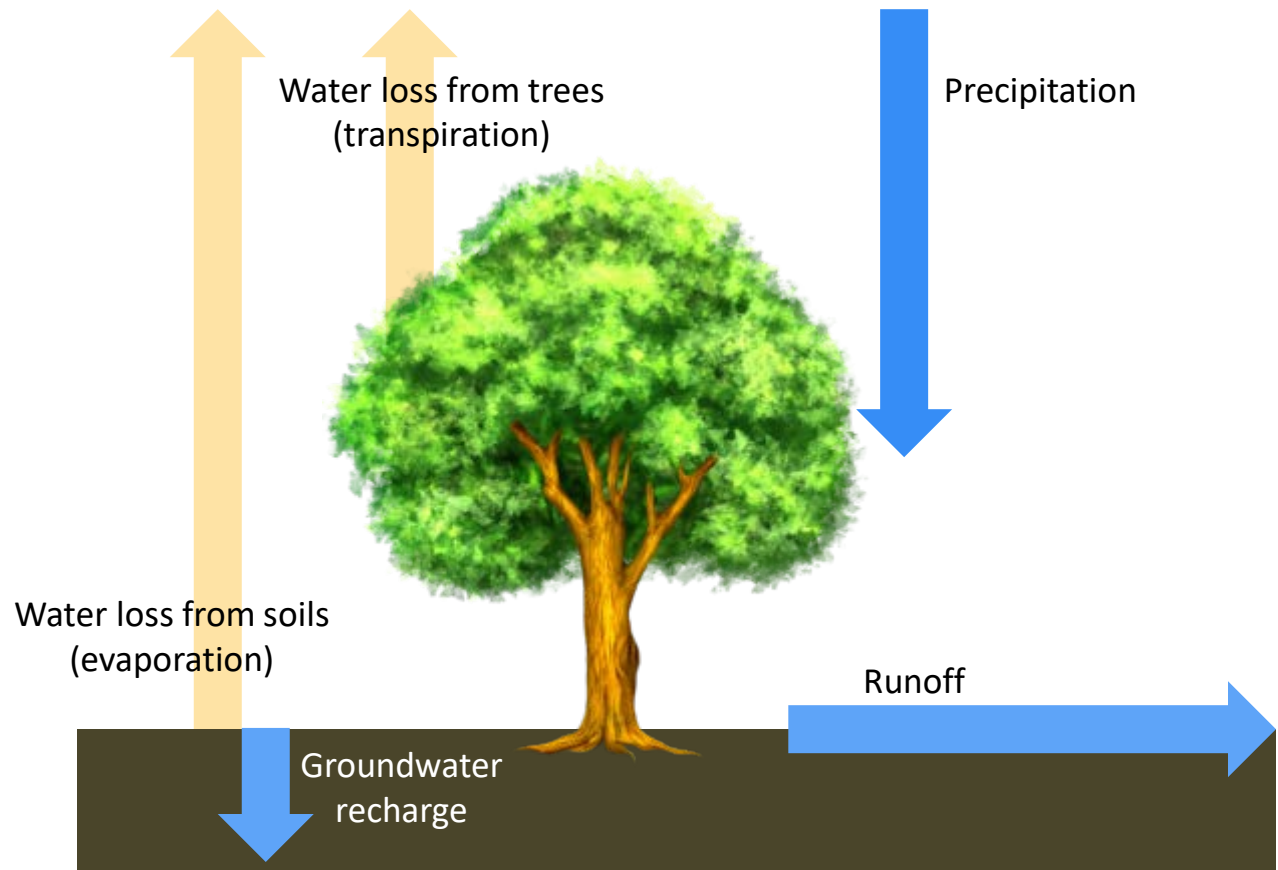
Warmer temperatures = ↑ vapor pressure deficit (VPD)

- More evaporation from soils & open water
- More transpiration from plants



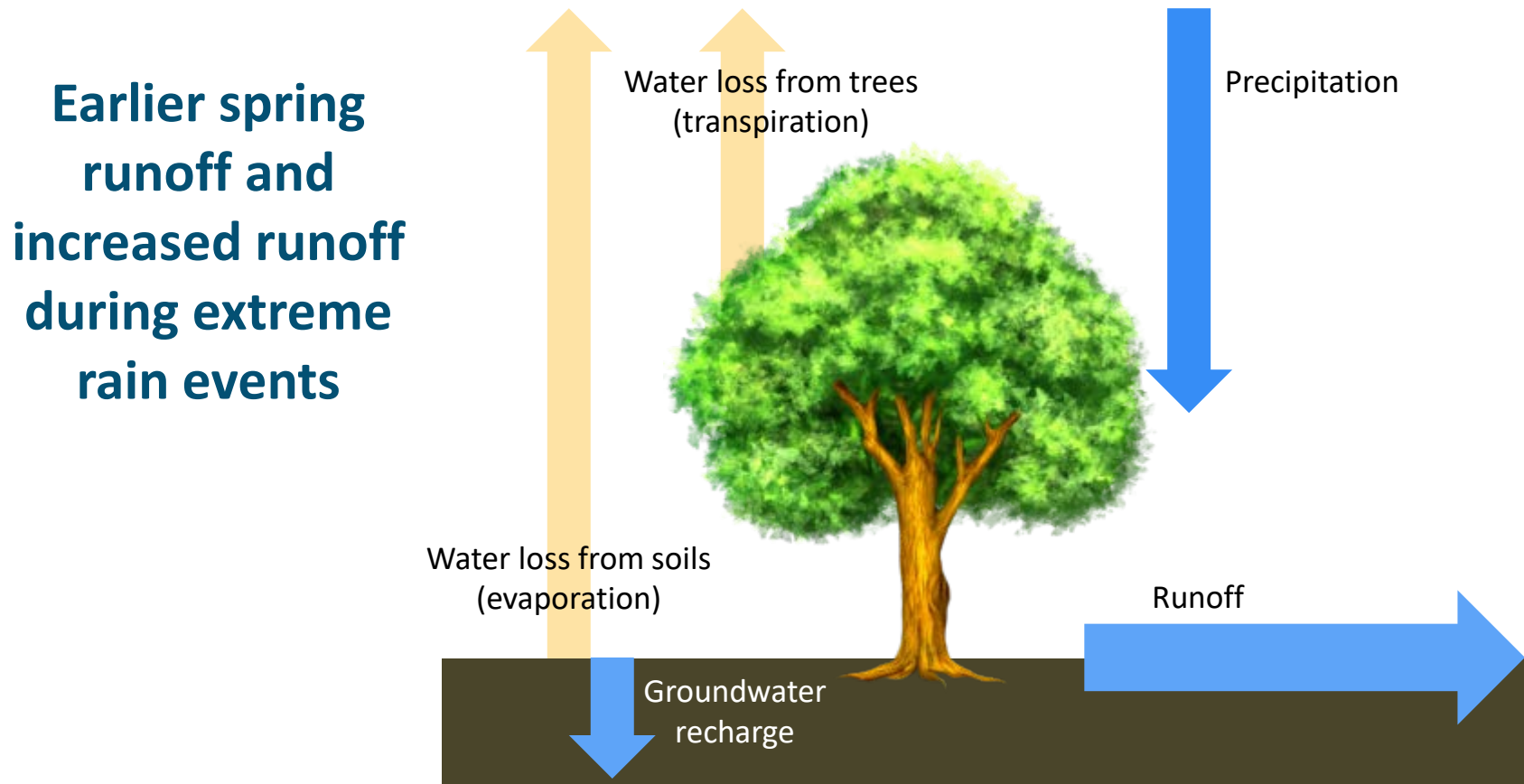
Increased Risk of Moisture Stress

Longer and warmer growing seasons may lead to drier conditions during the growing season.



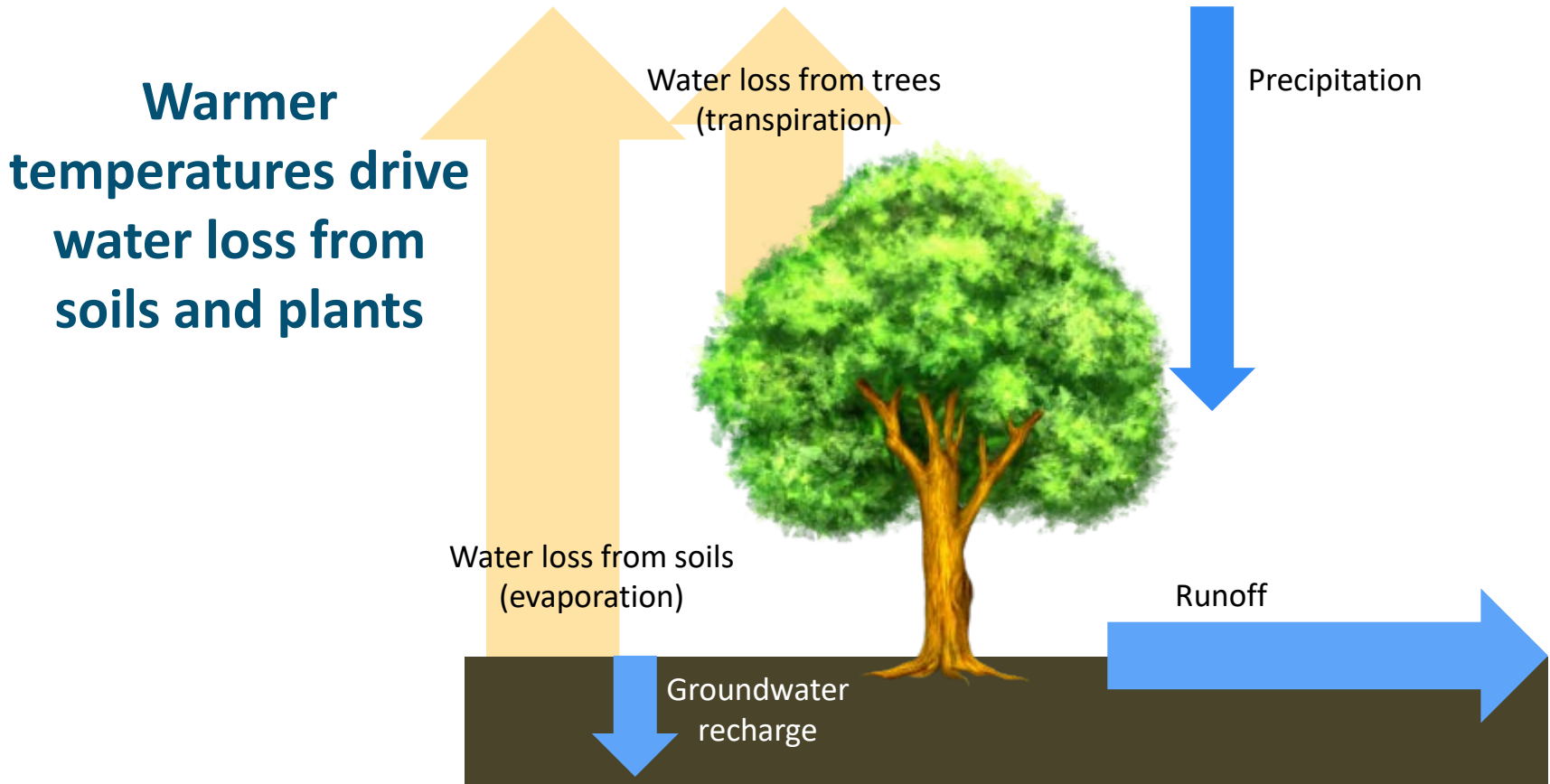
Increased Risk of Moisture Stress

Longer and warmer growing seasons may lead to drier conditions during the growing season.



Increased Risk of Moisture Stress

Longer and warmer growing seasons may lead to drier conditions during the growing season.



Changes in ecosystem composition

Challenge:

Decline of northern/boreal species

Opportunity:

Increased habitat for some species

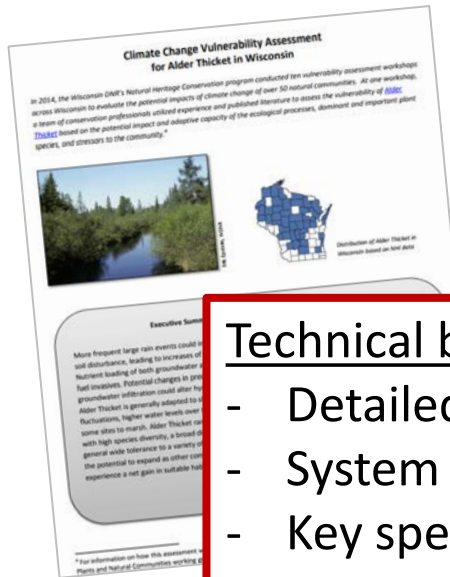
- Changes will occur slowly—not instant dieback
- Mature and established trees should fare better
- Immense lags to occupy habitats
- Critical factors: competition, management, & disturbance

Risk may be greatest:

- Location is relatively near the southern extent of species range
- Species are projected to decline and located on a marginal site
- Ecosystem is composed of few species, esp. those projected to decline
- Other factors cause additional stress

Climate change suitable habitat projections for Trees:
forestadaptation.org/Northwoods_treehandouts

Tools: Natural community Assessments



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CLIMATE
CHANGE
IMPACTS

Technical bulletins

- Detailed summary
- System drivers
- Key species
- Major threats
- References

Dive deeper:

<https://www.wicci.wisc.edu/plants-and-natural-communities-working-group.php>

High vulnerability

- Black Spruce Swamp
- Boreal rich fen
- Calcareous fen
- Central poor fen
- Coastal plain marsh
- Northern Wet-mesic forest
- Sandy moist meadow
- Shore fen
- Southern Tamarack swamp

Moderate-High vulnerability

- Bog relict
- Ephemeral pond
- Muskeg
- Poor Fen
- White Pine-Red Maple Swamp
- N. Hardwood swamp
- S. Hardwood swamp
- N. sedge meadow
- S. sedge meadow
- Open bog
- Pattered Peatland

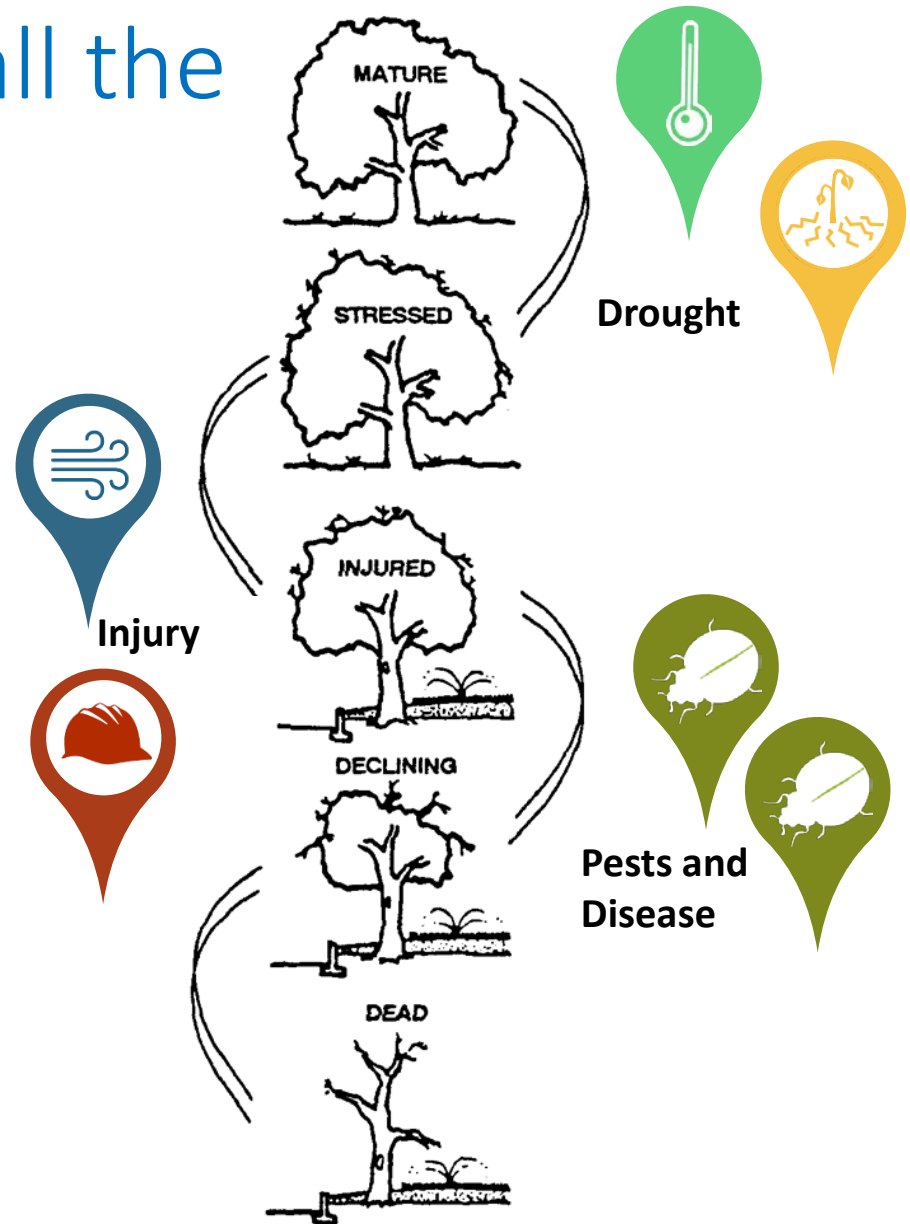
Low-Moderate vulnerability

- Alder thicket
- Emergent marsh
- Floodplain forest
- Shrub-carr

Interactions make all the difference

Challenge: could make systems more susceptible to existing or new stressors

- Chronic stress
- Disturbances
- Invasive species
- Insect pests
- Forest diseases



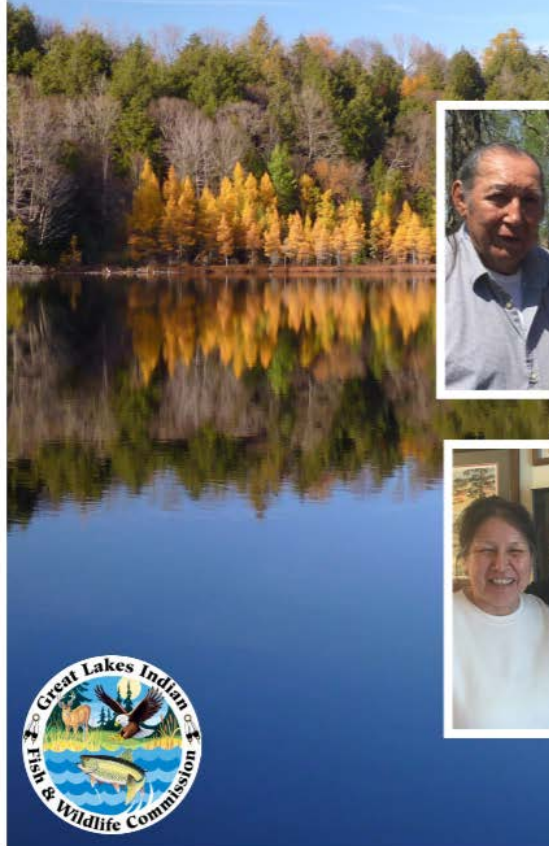


Impacts to Manoomin (Wild Rice)

Climate Change Vulnerability Assessment

Version 1 • April 2018

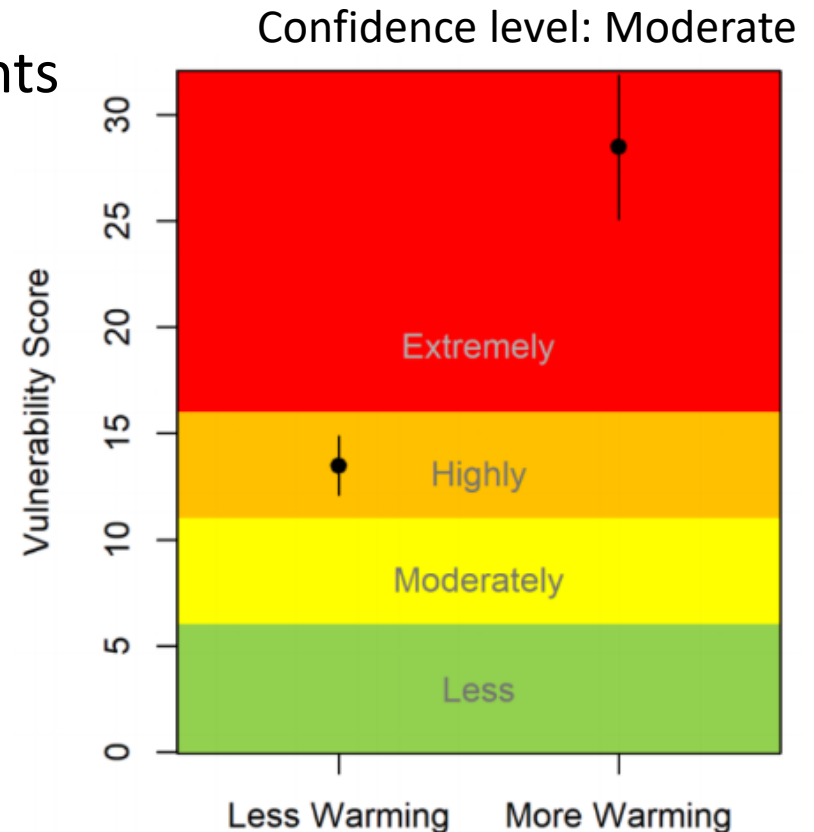
Integrating Scientific and Traditional Ecological Knowledge



Available at: glifwc.org/ClimateChange

Manoomin (Wild rice)

- Limited by natural barriers
- Affected by human land use changes
- Limited dispersal
- Adapted to cool environments
- Particular hydrological requirements
- Susceptible to disturbance
- Dependent on ice/snow
- Susceptible to competition
- Susceptible to pathogens
- Lack of genetic variation
- Documented response to climate change



Manoomin (Wild rice)

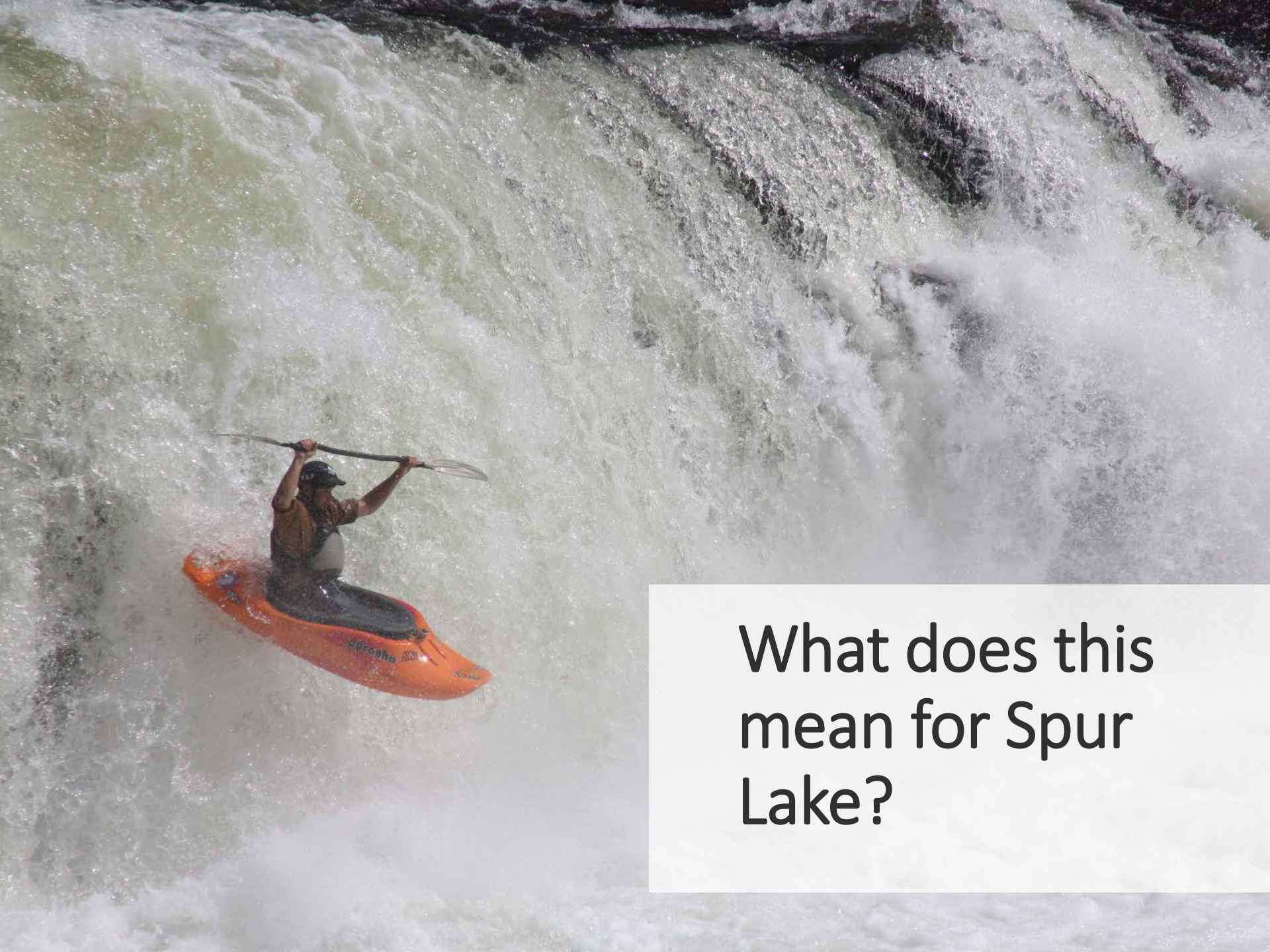


“According to the little bit I know about wild rice, you have to have the water, it’s gotta be just right in order for, otherwise you're gonna drown it.”

– *Tom Maulson Sr., Lac du Flambeau*

“You know what I was worried about this mornin’? That rain knocking my rice over.”

- *Fred Ackley, Mole Lake*



What does this
mean for Spur
Lake?

Sites will respond differently

What characteristics drive the unique attributes of this system?

Hydrologic sensitivity to change?

Hydrogeology, position & elevation, recharge potential, high & low flow recurrence

Vegetation present that thrives in ... conditions?

Tolerance to disturbance, distribution across the landscape, dispersal ability, genetic diversity, range limits

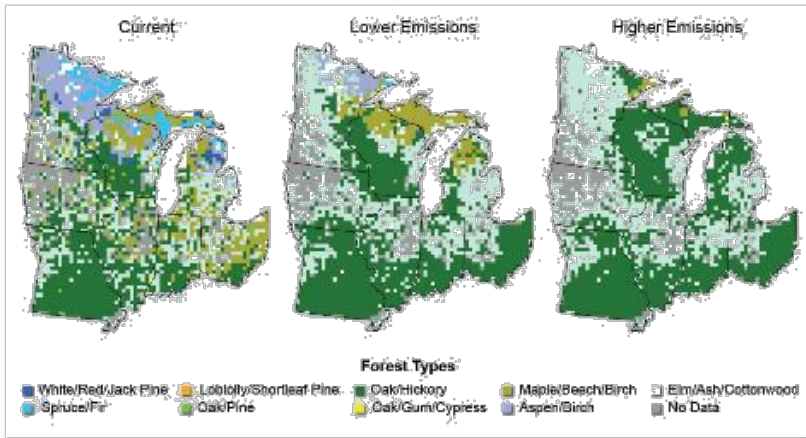
Other stressors & current challenges?

Land-uses that influence runoff, reduce infiltration & compact soils (urban, ag), past management

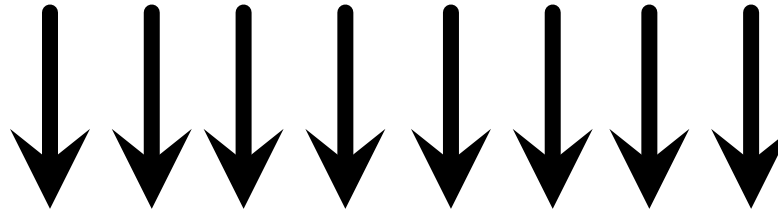
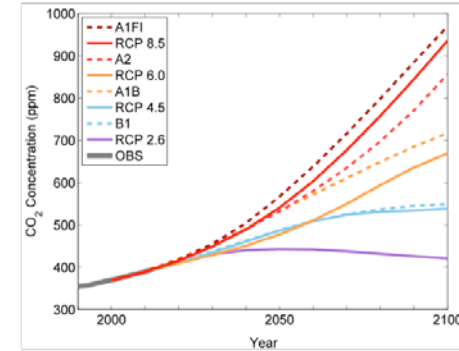
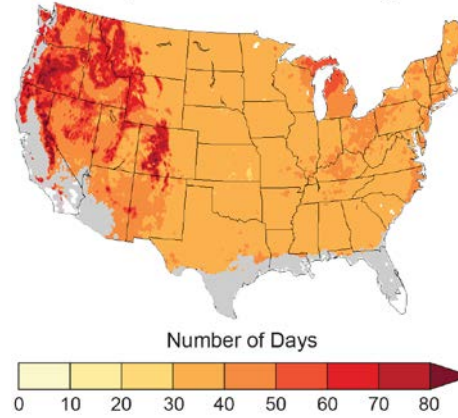
The type of system & location matters

Considering Climate Change

Forest Composition Shifts



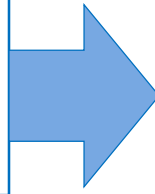
Change in Frost-free Season Length



Step 2: ASSESS site-specific climate change impacts and vulnerabilities

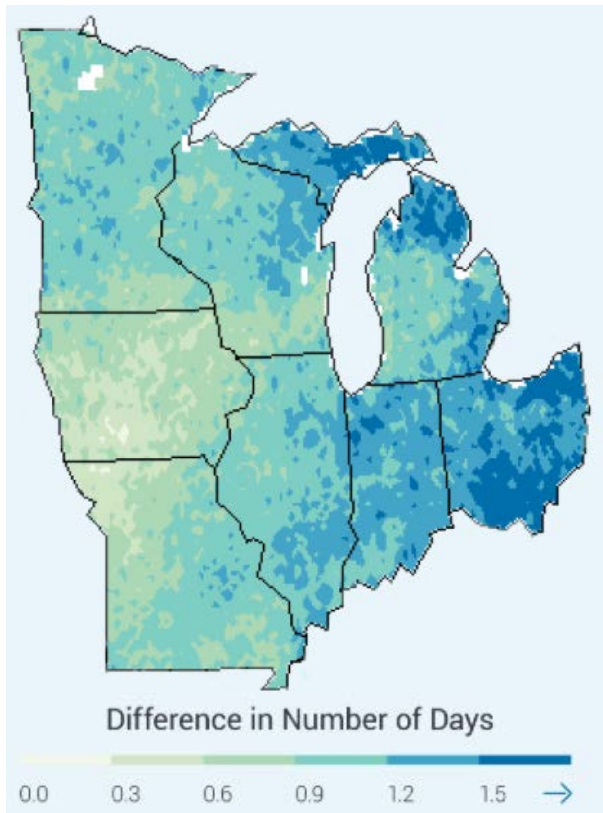
Regional Climate Impacts

Based on regional info



Site-specific Impacts

Based on your expertise



Increased frequency of days with very heavy precipitation (the wettest 2% of days)

Increasing the risk of floods and nutrient pollution.

National Climate Assessment (2014)
2041-2070 compared to 1971-2000 (High emissions A2 scenario).
Midwest and Northeast
NOAA NCDC / CICS-NC



Source: VT DEC

Tools: Explore Climate Impacts: NIACS Assessments & National Climate Assessment

adaptationworkbook.org/niacs-browser

The screenshot shows the 'Adaptation Workbook' website interface. At the top is a navigation bar with links for 'About', 'How to Use', 'LMS', 'Explore', 'Training', 'My Workbook', 'Log Out', and 'Contact'. The main content area is titled 'Explore Climate Impacts' and includes introductory text about climate change impacts and a map of the United States. The map uses color coding: blue for regions with summarized information from the National Climate Assessment (2014) and green for regions with detailed information from the Northern Institute of Applied Climate Science. A red arrow points from the map to a report titled 'Forest Ecosystem Vulnerability Assessment and Synthesis for Northern Wisconsin and Western Upper Michigan: A Report from the Northwoods Climate Change Response Framework Project'. The report cover features the USDA logo, a tree silhouette containing a landscape photo, and the UAS Forest Service logo.

Adaptation Workbook

About How to Use LMS Explore Training My Workbook Log Out Contact

Explore Climate Impacts

Click on the map below to explore how climate change may affect your region and ecosystems. The impact statements presented in this tool are summarized from published reports. [Learn more.](#)

Dig in and learn more

Ecosystems will be increasingly affected by a changing climate. Understanding and evaluating the climate change impacts that may impact a particular region or system is an important first step in adapting to climate change. This information can also be used with the **Adaptation Workbook** to help inform natural resource management. This tool describes anticipated climate impacts within the United States, including Alaska and Hawaii.

Some sections of the Midwest and Northeast, **shown in green**, have detailed information about anticipated climate impacts drawn from the Northern Institute of Applied Climate Science.

Regions, **shown in blue**, contain summarized information from the [National Climate Assessment \(2014\)](#).

USDA
United States Department of Agriculture

Forest Ecosystem Vulnerability Assessment and Synthesis for Northern Wisconsin and Western Upper Michigan: A Report from the Northwoods Climate Change Response Framework Project

UAS Forest Service Northern Research Station General Technical Report NRS-136 August 2014

Tools: Explore Climate Impacts: NIACS Assessments & National Climate Assessment

adaptationworkbook.org/niacs-browser

Adaptation Workbook About How to Use LMS Explore Training My Workbook Log Out Contact

Explore Climate Impacts

Click on the map below to explore how climate change may affect your region and ecosystems. The impact statements presented in this tool are summarized from published reports. [Learn more.](#)

Dig in and learn more

Ecosystems will be increasingly vulnerable as the climate warms. Identifying and understanding these vulnerabilities and how to adapt to and reduce risks to them is a first step in adapting to climate change. The National Climate Assessment describes anticipated impacts across a range of sectors, systems, and regions, shown in blue, on the map below.

Climate Change Impacts for Northern WI and western UP

This area includes the Laurentian Mixed Forest Ecological Province within northern Wisconsin and the western Upper Peninsula of Michigan. The area covers Albert's Ecological Sections VIII, IX, and X in Wisconsin and Ecological Section IX in Michigan.

- [Forest Ecosystem Vulnerability Assessment and Synthesis for N. Wisconsin and W. Upper Michigan](#)
- [Northern Wisconsin & Western Upper Michigan: Climate Change and Forests](#)

General Forest impacts

Temperatures in northern Wisconsin and western Michigan will increase between 3 °F and 9 °F by the end of the century, with more warming during winter.

Evidence: Robust Agreement: High

All global climate models project that temperatures will increase with continued increases in atmospheric greenhouse gas concentrations.

M. Janowiak, L. Iverson, and others. 2014. [Forest Ecosystem Vulnerability Assessment for northern Wisconsin and western Upper Michigan](#). USDA Forest Service Northern Research Station.

D. Lorenz and M. Notaro. 2014. [LCC Statistical Downscaling](#). Nelson Center for Climatic Research - University of Wisconsin-Madison.

Total snowfall, snow depth, and snowpack duration are all expected to decline substantially in northern

Evidence and agreement
Expert panel consensus

Watch this video!

In-depth discussion of *Projected changes in climate and effects on ecosystems*

37 minutes long - <https://goo.gl/KyEfrH>

Homework!

The video player interface shows the title "Climate Change Impacts on Northwoods Forests" in white text on a dark teal background. Below the title are three landscape images: a pond in a forest, a forest with a black redaction box, and a flooded forest. The video player controls at the bottom include a play button, a progress bar at 0:06 / 37:58, and various icons for volume, full screen, and sharing. Logos for USDA, NIACS, and the Forest Service are visible in the bottom left, and the presenter's name and contact information are in the bottom right.

USDA United States Department of Agriculture
Northern Forests Climate Hub

Climate Change Impacts on Northwoods Forests

Play (k) 0:06 / 37:58

NIACS Northern Institute of Applied Climate Science

FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

Stephen Handler
USDA Forest Service
Northern Institute of Applied Climate Science
sdhandler@fs.fed.us

More information can be found at:



Fourth National Climate Assessment

nca2018.globalchange.gov/



**National Climate Assessment - Climate
Science Special Report**

science2017.globalchange.gov



NOAA Climate at a Glance tool (data)

www.ncdc.noaa.gov/cag/

Impacts on ecosystems



Forests ecosystem change (NIACS)

forestadaptation.org/vulnerability-assessment

Natural communities (WICCI)

www.wicci.wisc.edu/plants-and-natural-communities-working-group.php

Culturally important species (GLIFWC)

data.glifwc.org/archive.bio/GLIFWC_Climate_Change_Vulnerability_Assessment_Version1_April2018.pdf

5 minute

Break
TIME



Workshop agenda and tools

Responding to climate change

Mitigation: Actions that reduce the human contribution to the greenhouse gas effect.



Adaptation: Actions to prepare for and adjust to new conditions.



An Uncertain Future

Don't wait for a
crystal ball...

Common Q:

“How can I adapt
and prepare if I
don't know what
the future holds?”

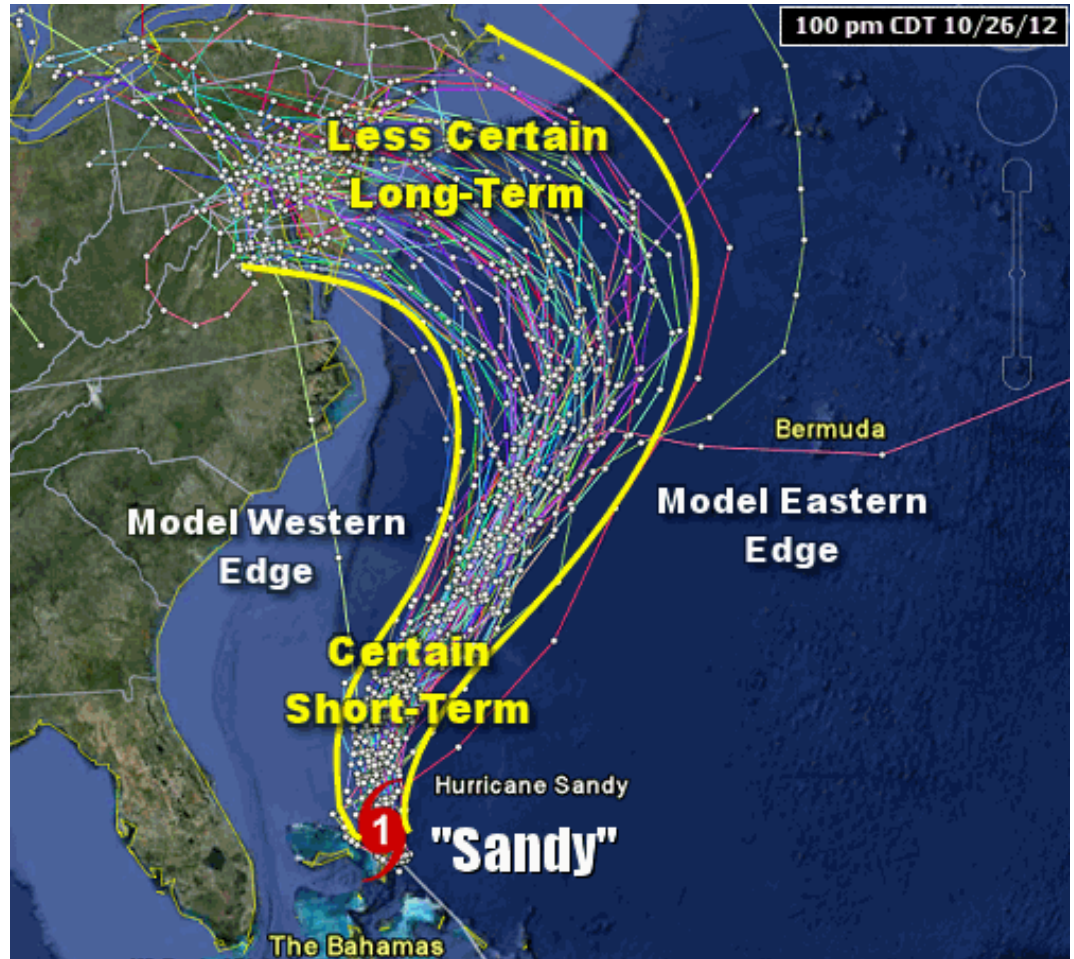


We Don't Need Certainty

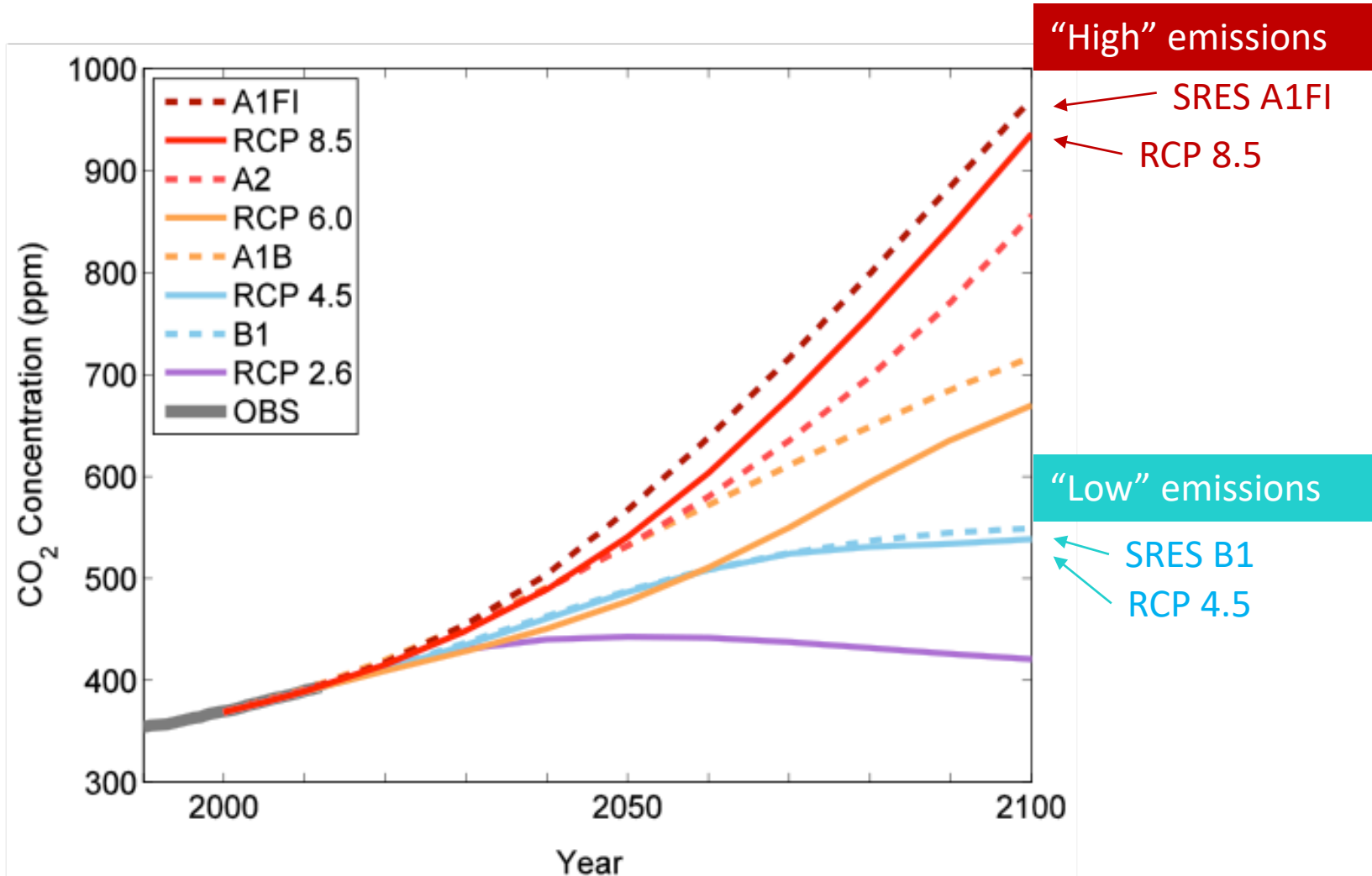
Instead: think about risk management!

Better Q:

“What can I do to reduce my risk and take advantage of opportunities?”



Plan for a Range



Adaptation Concepts

Resistance

Resilience

Transition
(Response)

Reduce impacts / Maintain current conditions

Manage for Persistence:

Ecosystems are still recognizable as being the same system (character)

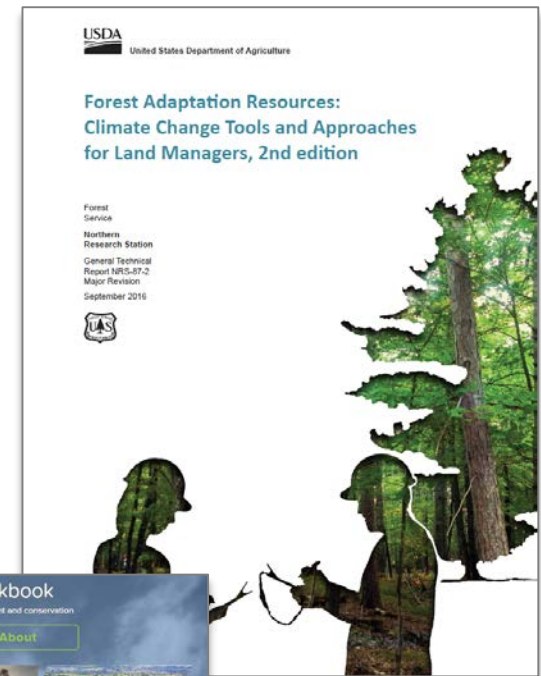
Manage for Change:

Ecosystems have fundamentally changed to something different

Forward-looking/Promote change

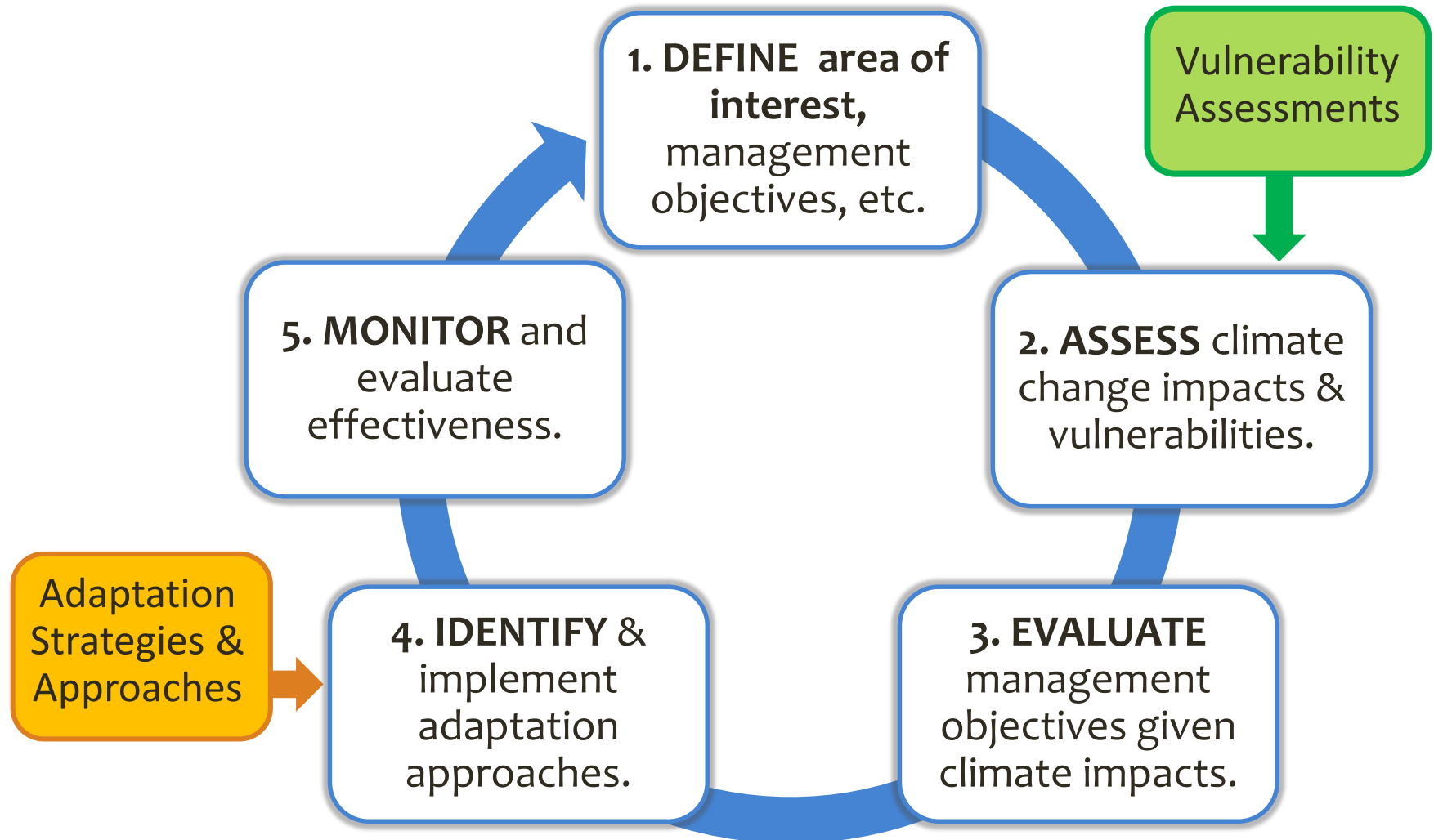
Adaptation Resources + workbook

- **Practical process** to intentionally consider climate & customize adaptation actions
- Designed to be flexible – for diverse goals, and values
- Does not make recommendations
- New online version!



AdaptationWorkbook.org

Workshop process



Document your thoughts

Management Objectives	Challenges	Opportunities	Feasibility	Other Considerations		
Adaptation Actions			Benefits	Drawbacks/ Barriers	Practicability	Recommend Tactic?
Approach (From Chapter 2)	Tactic	Time Frame				

Worksheets!

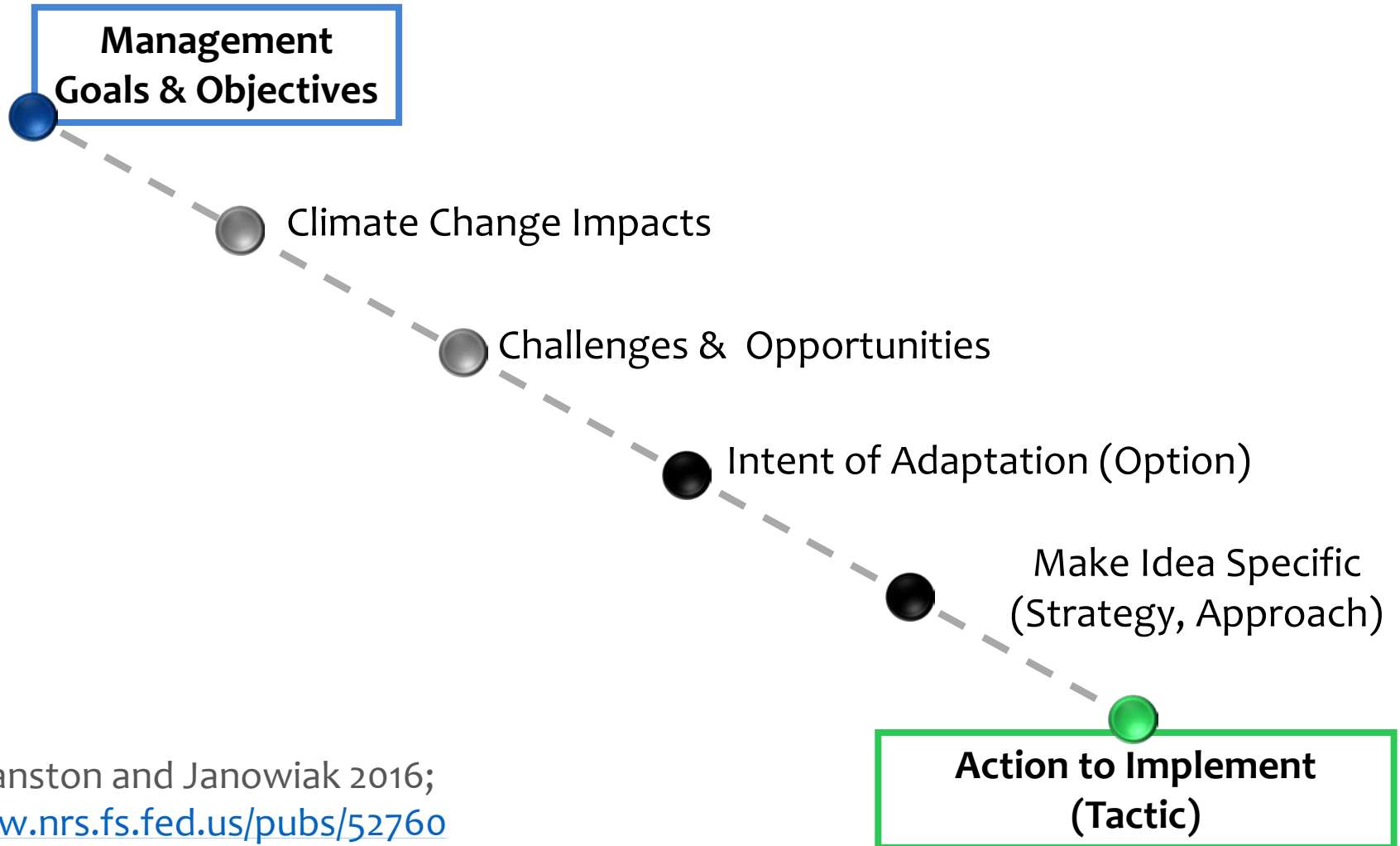
Worksheets!

Worksheets!

Worksheets!

Connecting the Dots

A clear train of thought shows *intentionality*





Adaptation Resources: Menus

PLANTS & NATURAL COMMUNITIES WG

WISCONSIN
INITIATIVE ON
CLIMATE
CHANGE
IMPACTS

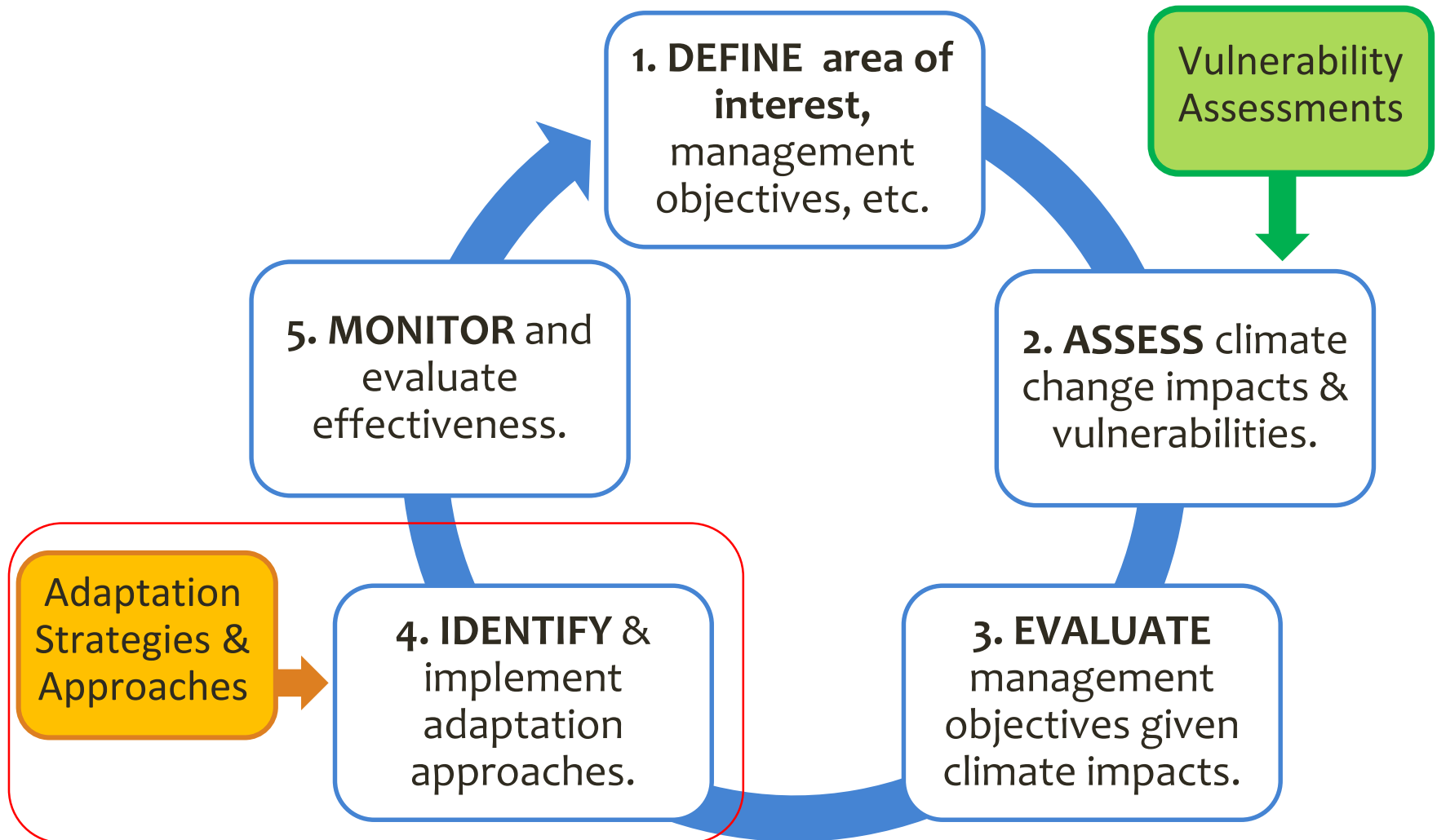


2018 Wetland Adaptation Workshop



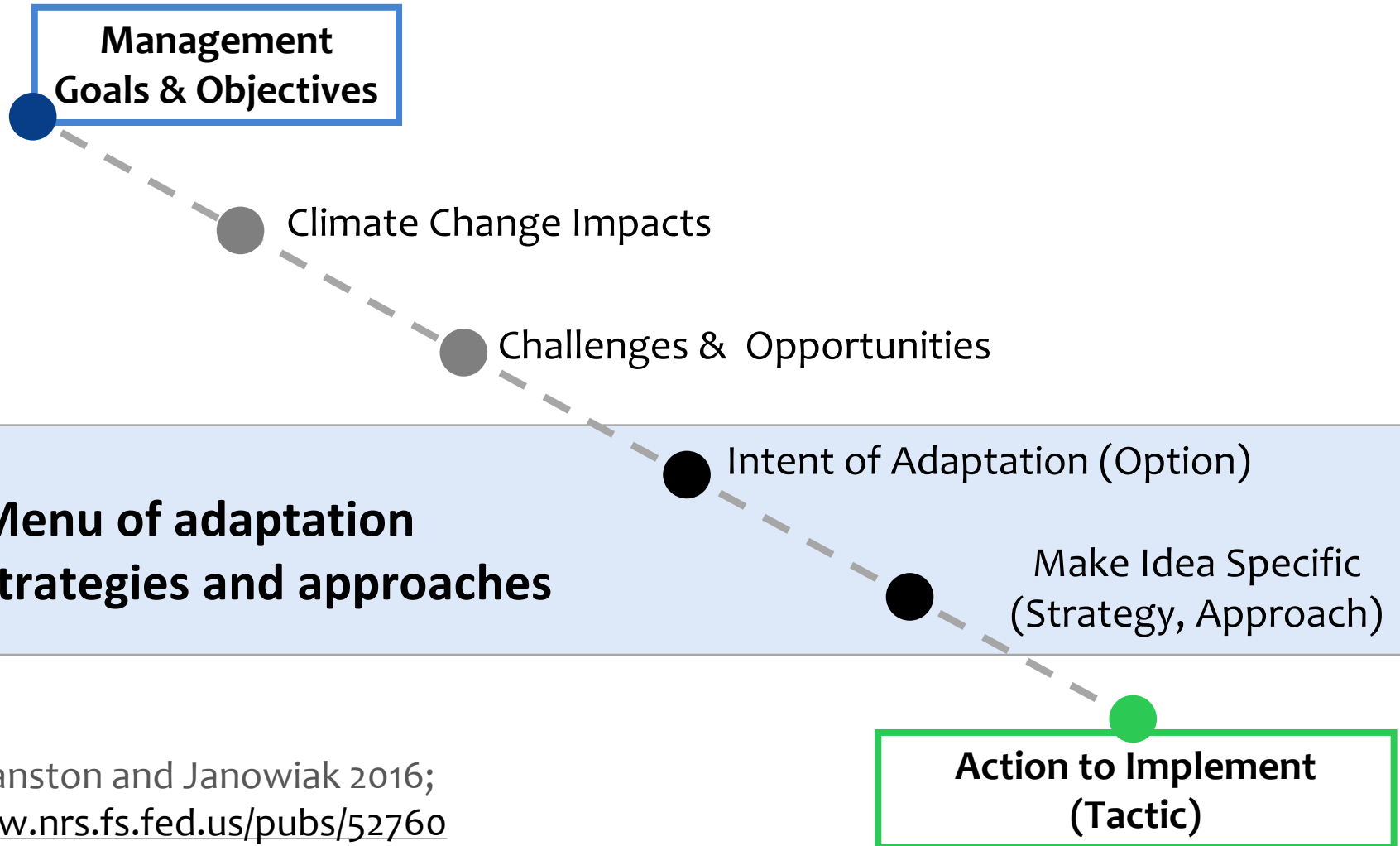
Bohn Farms Case Study

Workshop process



Connecting the Dots

A clear train of thought shows *intentionality*



A “Menu” for Adaptation

Translating concepts to actions



Adaptation Concepts:

- Resistance, Resilience, Transition

Strategies:

- Broad adaptation responses

Approaches:

- More specific adaptation responses applicable to a **specific ecosystems**

Tactics:

- Prescriptive site-specific actions **designed for local conditions** and mgmt. objectives

Non-Forested Wetland Strategies

6 Strategies. 21 Approaches. Infinite Tactics!

Strategy 1: Maintain and enhance hydrologic processes and water quantity

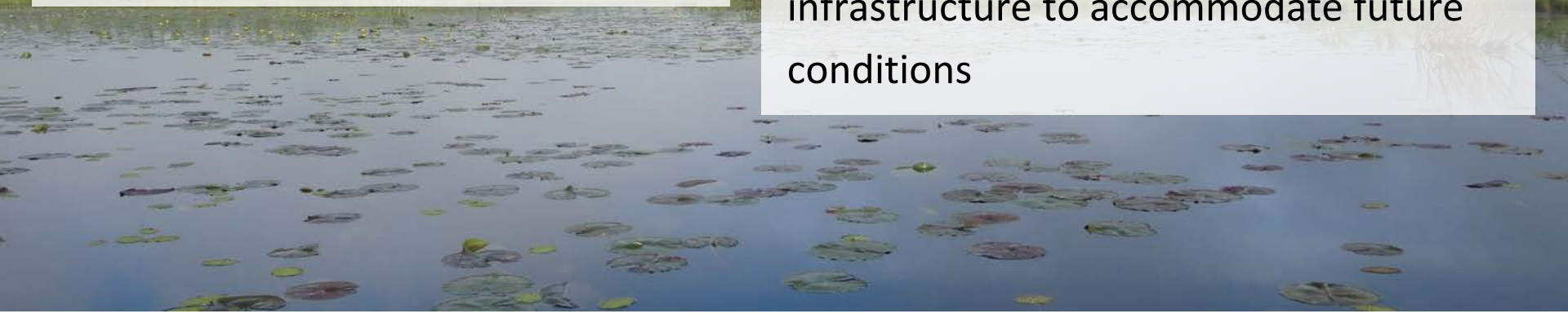
Strategy 2: Maintain and enhance water quality of wetland habitats

Strategy 3: Maintain or restore wetland vegetation

Strategy 4: Facilitate transformation of wetland communities by adjusting species composition

Strategy 5: Adjust wetland systems to cope with altered hydrology

Strategy 6: Design and modify infrastructure to accommodate future conditions



Example:

Strategy 3: Maintain and restore wetland vegetation



Approach 3.2: Enhance and maintain species diversity and plant trait diversity



Tactics 3.2.5: Favor and restore native species local to a given wetland that are most likely to be adapted to future conditions, e.g., avoid species that are at the southern edge of their range

Goals of non-forested wetland menu

- Provide a flexible resource
- Identify 'win-win' adaptation actions
- Propose new practices
- Provide a platform for discussion



What the menu doesn't do:

- Make recommendations
- Express preferences
- Provide an exhaustive list of tactics
- Offer guarantees



Local knowledge and experience are crucial!



Tell us what strategies you think are important for Spur Lake

<https://goo.gl/Kx1KxU>

Non-forested Wetland Adaptation Menu

We would like to familiarize you with the menu of climate adaptation strategies and approaches for non-forested wetland conservation and management. These resources are integrated into the Adaptation Workbook framework, that will be used on the Spur Lake SNA property.

Please review the list below and SELECT any adaptation approaches that you feel will be most important for Spur Lake adaptation planning. Strategies and approaches help to broadly define the intentions of adaptation actions. Note, in the meeting we will define specific tactical (detailed) adaptation actions related to these approaches.

Answers are anonymous and will be used to direct discussions in the meeting. Contact Danielle Shannon (dshannon@mtu.edu) with any questions!

Please select the top approaches most important to adapting Spur Lake SNA to climate change (limit to 10 approaches)

This is a brainstorming activity! There are no wrong answers!

Provide feedback!



Non-forested Wetland Adaptation Strategies and Approaches

View Edit Delete

Home » Learn » Resource Finder » Non-forested Wetland Adaptation Strategies and Approaches

This document includes a draft set of adaptation strategies and approaches for **non-forested wetlands** that can be used by managers working on projects that support hydrologic function, vegetation management, ecological restoration, and infrastructure improvements. It is a supplemental topic to be used with the **Adaptation Workbook** (originally developed by the Climate Change Response Framework and published in the **Forest Adaptation Resources: Climate Change Tools and Approaches for Land Managers**).


This menu was developed in partnership with the Wisconsin initiative for Climate Change Impacts (WICCI) and the Northern Institute of Applied Climate Science to help land managers consider climate change and increase the ability of non-forested wetland ecosystems to cope with climate change impacts. It does not provide specific recommendations, but rather serves as a decision-support tool for incorporating adaptation considerations into current management objectives. **Learn more about this effort.**

Contact **Danielle Shannon** for more information

Download the one page menu of Non-Forested Wetland Adaptation Strategies and Approaches:

 [Wetland Adaptation Menu - draft2018 - WICCI_NIACS Climate Change Response Framework.pdf](#)

<https://forestadaptation.org/wetland-menu>

A photograph of a forest. In the foreground, there are several evergreen trees, possibly spruce or fir, with green needles. The background is filled with deciduous trees whose leaves have turned yellow and orange, indicating autumn. The sky is visible through the canopy, appearing overcast. A semi-transparent white box is overlaid on the bottom right of the image, containing the text "Tribal Adaptation Menu".

Tribal Adaptation Menu

Culturally relevant tribal adaptation menu: Strategies 1-3

Homework!

Strategy 1: Consider cultural practices and seek spiritual guidance

Strategy 2: Learn through careful and respectful observation (gikinawaabi)

Strategy 3: Support tribal engagement in the environment

The first several strategies and approaches in the Tribal Adaptation Menu describe how cultural & spiritual knowledge and tribal engagement can help support climate adaptation.

Menu is in draft form.
Danielle can share a copy
(not for distribution)

Indicate how you are (or would like to) incorporate these ideas into the Spur Lake SNA project.

Homework!

Culturally Relevant Climate Change Adaptation Planning for Tribes and Tribal Partners – Project Template

The first several strategies and approaches in the Tribal Adaptation Menu describe how cultural & spiritual knowledge and tribal engagement can help support climate adaptation (please see full Tribal Adaptation Menu for more detail on each strategy and approach). Please list some of the ways (if applicable) that you are already incorporating these ideas into your project. For example, if there are documented stories and teachings from elders that could be useful to guide your project, you can write down helpful notes about how you've incorporated those teachings into your work or who you've contacted thus far (Approach 1.3).

Strategy 1: Consider cultural practices and seek spiritual guidance.

Approach 1.1. Consult cultural leaders, key community members, and elders.

Approach 1.2. Consider mindful practices of reciprocity.

Approach 1.3. Understand the human and landscape history of the community.

Approach 1.4. Hold respect for all of our relations, both tangible and intangible

Approach 1.5. Maintain dynamic relationships in a changing landscape.

Strategy 2: Learn through careful and respectful observation (gikinawaabi).

Approach 2.1. Learn from beings and natural communities as they respond to changing conditions over time.

Strategy 3: Support tribal engagement in the environment.

Approach 3.1. Maintain and revitalize traditional relationships and uses.

Approach 3.2. Establish and support language revitalization programs.

Approach 3.3. Establish, maintain, and identify existing inventory and monitoring programs.

Approach 3.4. Establish and maintain cultural, environmental education, and youth programs.

Approach 3.5. Communicate opportunities for use of tribal and public lands.

Approach 3.6. Participate in local- and landscape-level management decisions with partner agencies.

Strategy/Approach	Notes and details
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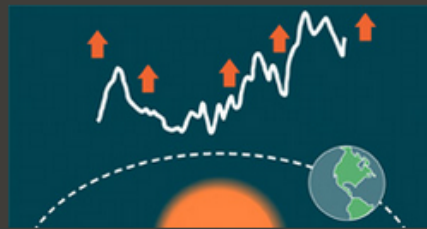


Preparing for the Workshop

For more background ...

Education Modules

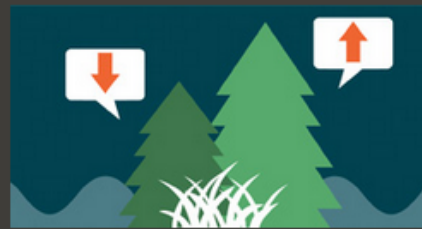
These comprehensive education modules were created using curriculum developed by the Forest Service Climate Change Advisor's Office, Climate Change Education and Training Team. They give an in-depth introduction to basic climate change science, the effects of climate change on forest and grassland ecosystems, and how we can respond to climate change with management.



Climate Change Science and Modeling

Learn about the climate system, greenhouse gases, climate models, current climate impacts, and future projections.

[Read More >](#)



Climate Change Effects on Forests and Grasslands

Explore current and projected climate effects on water resources, vegetation, wildlife, and disturbances for forest and grassland ecosystems.

[Read More >](#)



Responses to Climate Change

Review the adaptation options, resistance, resilience, and transition, and learn how to incorporate them into natural resource planning.

[Read More >](#)



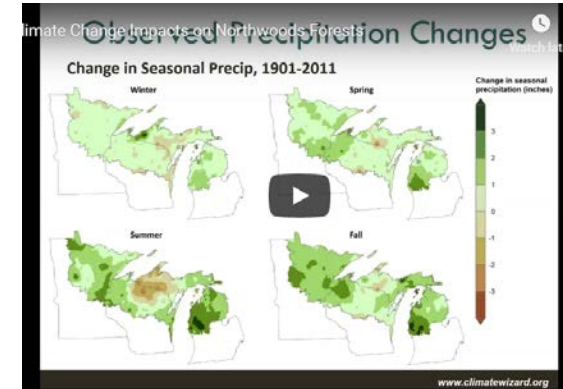
www.fs.usda.gov/ccrc/education

Before the workshop – do this

1. Get comfortable w/ regional climate projections and **watch this video:**

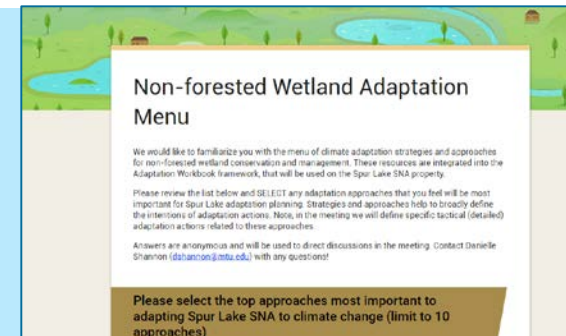
Regional impacts in the Northwoods (37 min)

<https://goo.gl/KyEfrH>

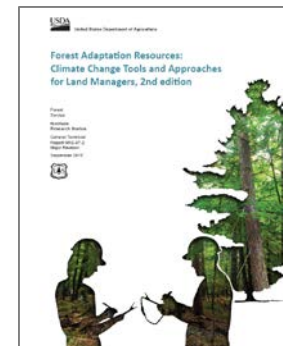


2. Take this survey: <https://goo.gl/Kx1KxU>

3. Complete culturally relevant worksheet



4. Learn the **Adaptation Workbook** process (p80)
www.forestadaptation.org/far



Between then and now

Ask questions!

Danielle Shannon

dshannon@mtu.edu, 906-482-6303x 1325

Forestadaptation.org/wetlands

See you Monday March 11!



Questions ?