



United States Department of Agriculture
Northern Forests Climate Hub

Wetland Adaptation Planning and Practice

Pre-workshop Webinar



3



WISCONSIN
INITIATIVE ON
CLIMATE
CHANGE
IMPACTS



Danielle Shannon & Todd Ontl

January 26, 2018

Plants and Natural Communities Group

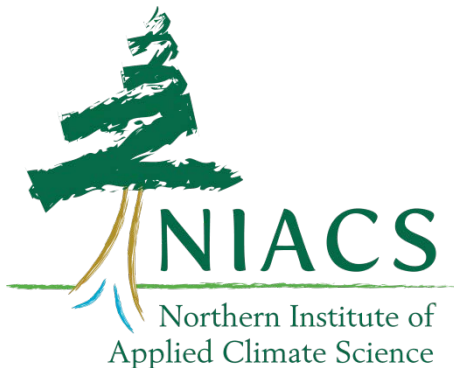
Northern Institute of Applied Climate Science



Climate
Carbon

Provides **practical** information, resources, and technical assistance related to forests and climate change.

Regional multi-institutional partnership among:



Michigan
Technological
University



The
UNIVERSITY
of VERMONT



UNIVERSITY OF MINNESOTA

ncasi



Practical Resources & Technical Assistance

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



Agenda

Ask questions!

1. Introduction
2. Preview of Workshop process
3. Climate changes
 1. General observed climate trends
 2. Potential climate impacts
4. Homework before the workshop



Source: wisconsinbirds.org

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!

Responding to climate change

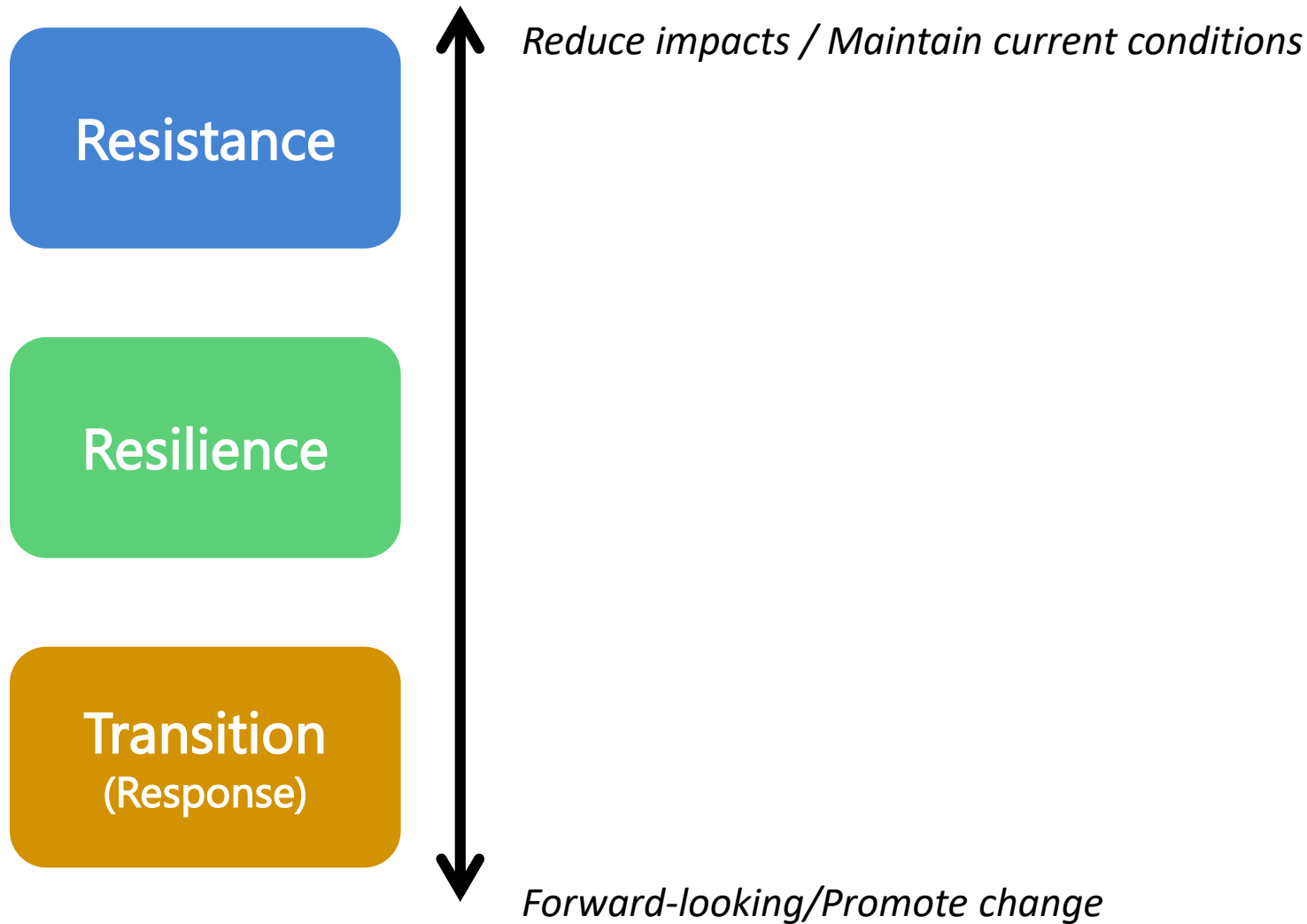
Mitigation = actions that reduce the human contribution to the greenhouse gas effect.



Adaptation = actions to prepare for and adjust to new conditions.



Adaptation Concepts



Adaptation Concepts

Resistance

Reduce impacts / Maintain current conditions

Manage for Persistence:

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

Resilience

Transition
(Response)

Manage for Change:

Ecosystems have fundamentally changed to something different

Forward-looking/Promote change



?
thinning
≡

?
promoting
connectivity
≡

?
planting
≡
?
controlling
invasives
≡

?
prescribed
burning
≡



intentionality

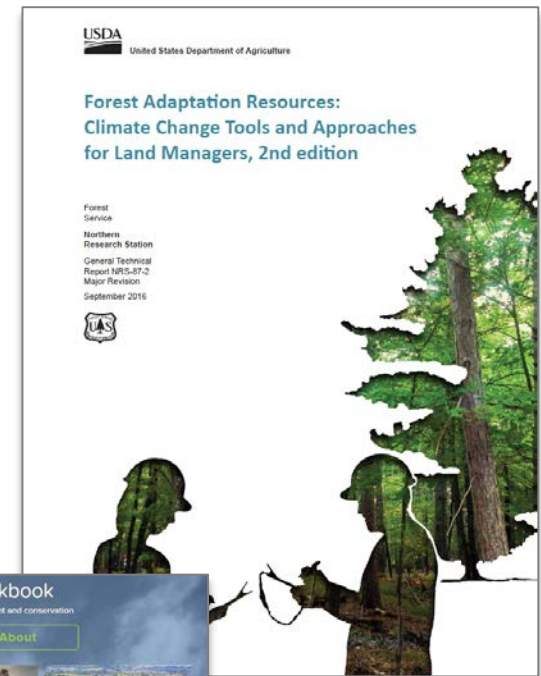
Intentionality

- Explicitly consider and address climate change
- Sure we might get lucky...
- Intentionally assessing risk and vulnerabilities **makes our plans more robust!**



Adaptation Resources + workbook

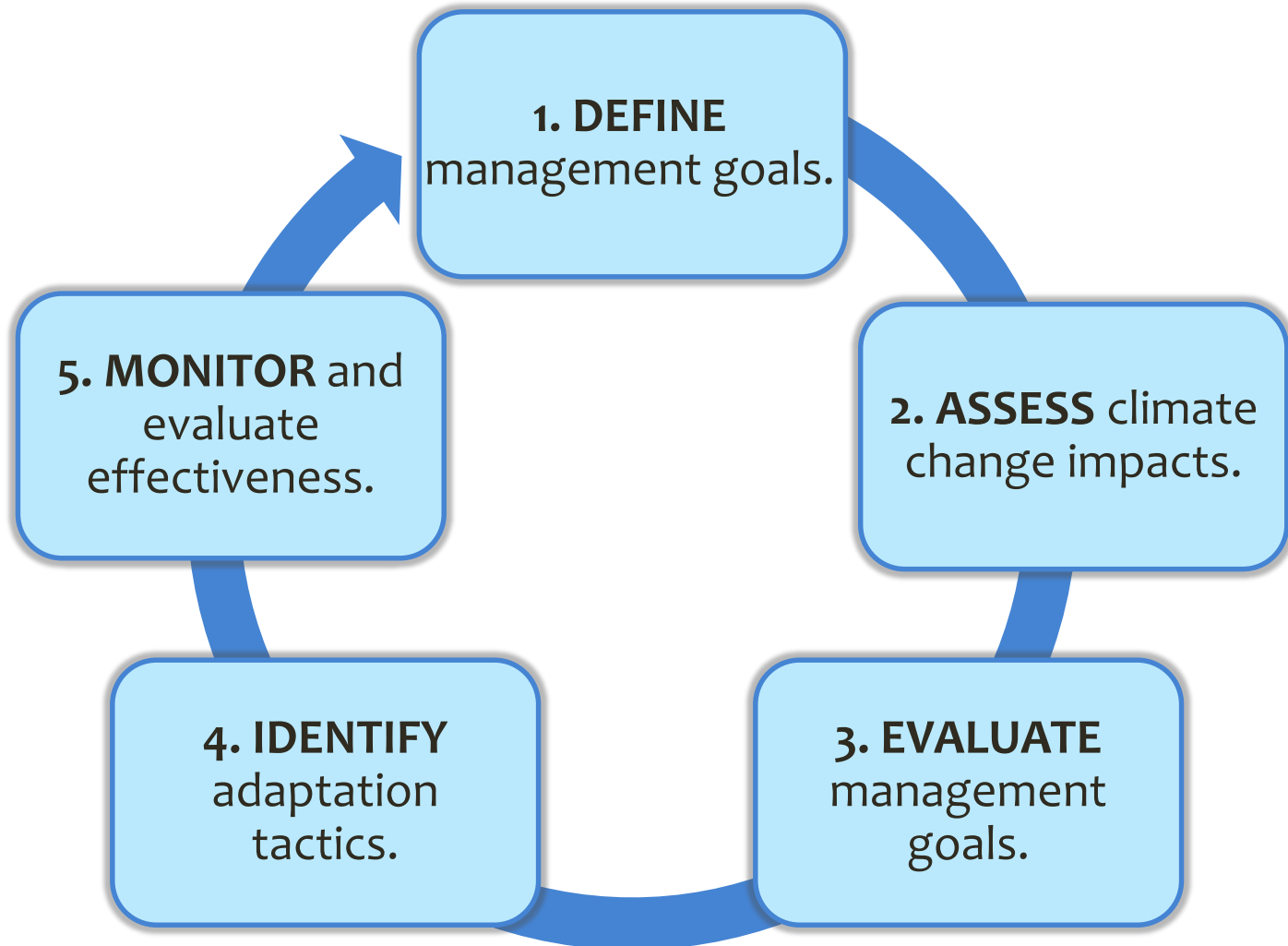
- **Practical process** to intentionally consider climate & customize adaptation actions
- Designed to be flexible – for diverse goals, and values
- Does not make recommendations
- New online version!



AdaptationWorkbook.org

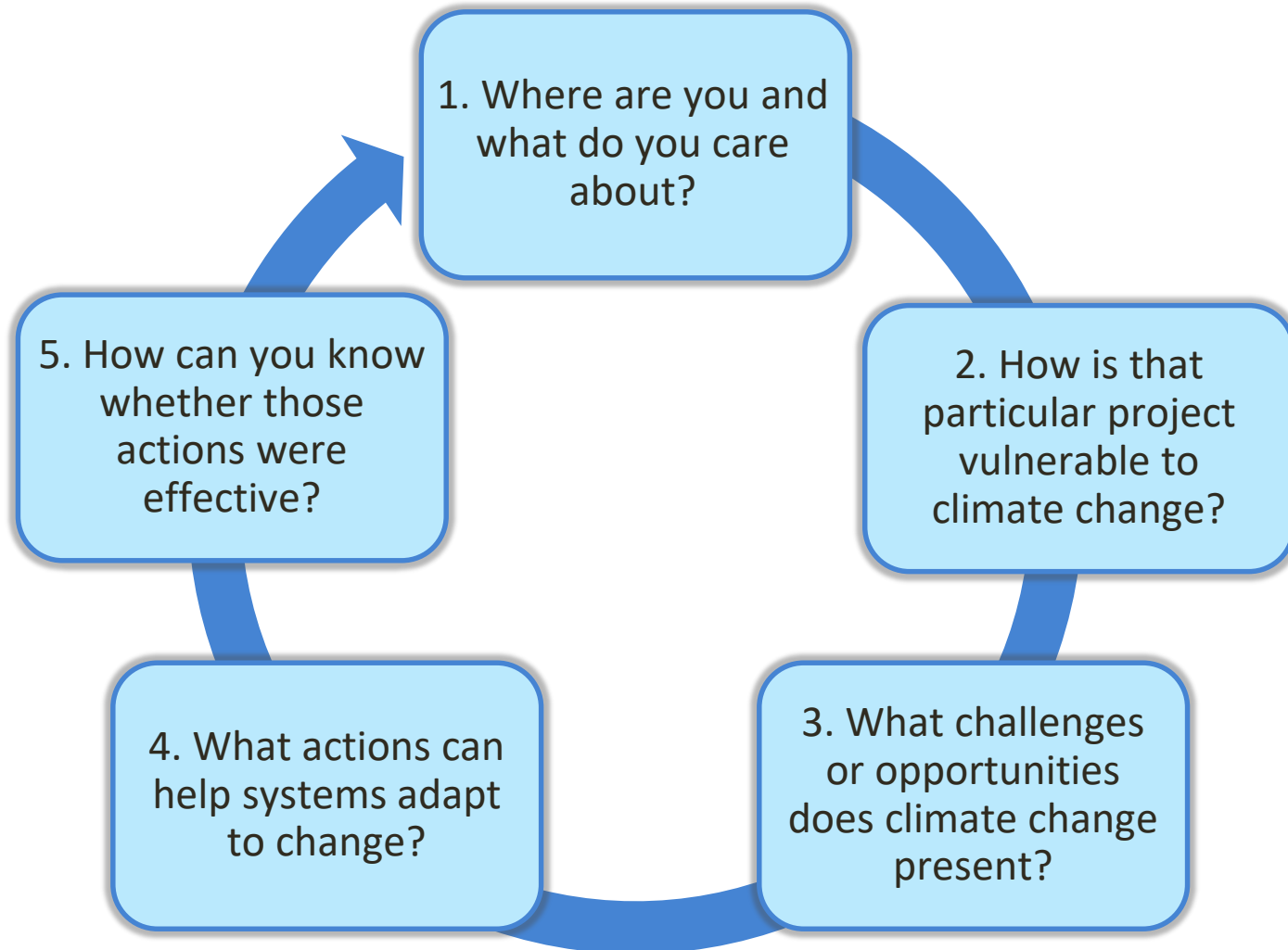
Preview to the Workshop process

Adaptation Workbook



Deciphered

Adaptation Workbook



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!

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?”

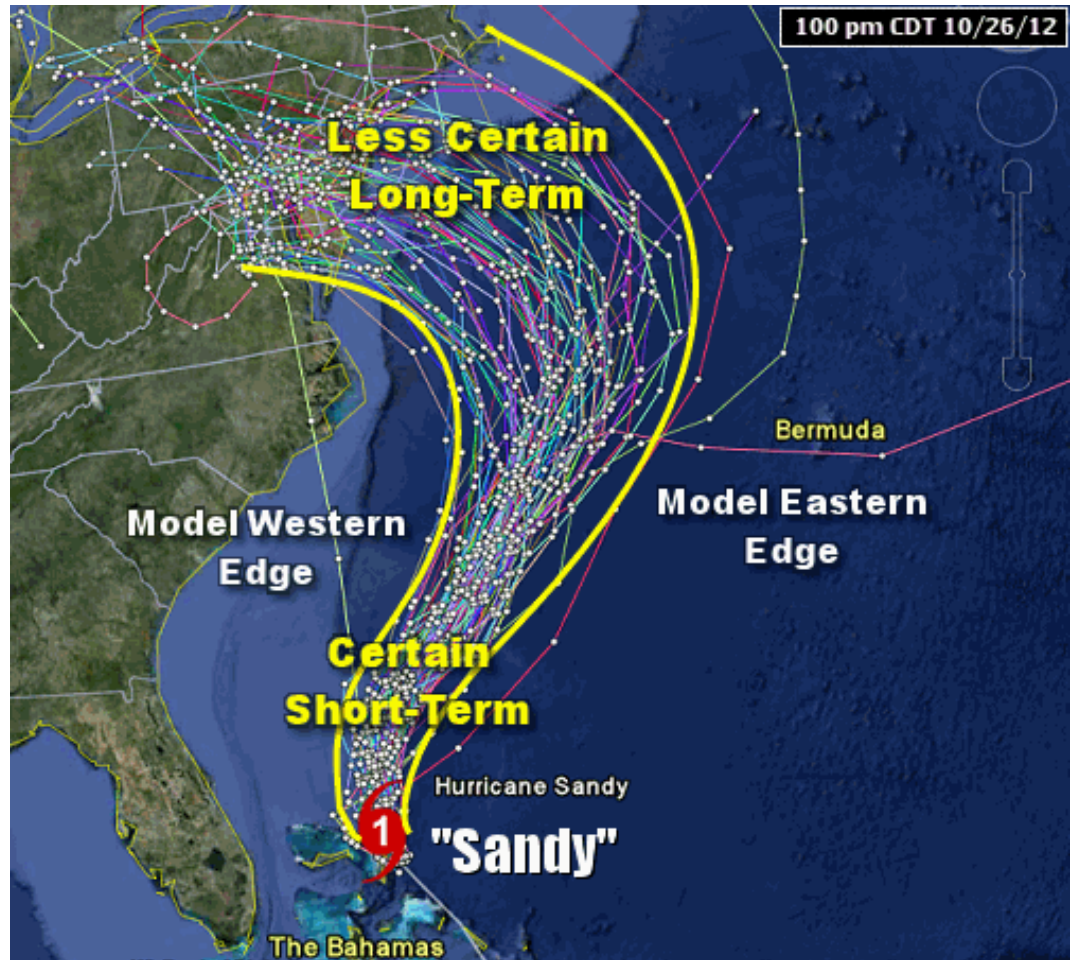


We Don't Need Certainty

Instead: think about risk management!

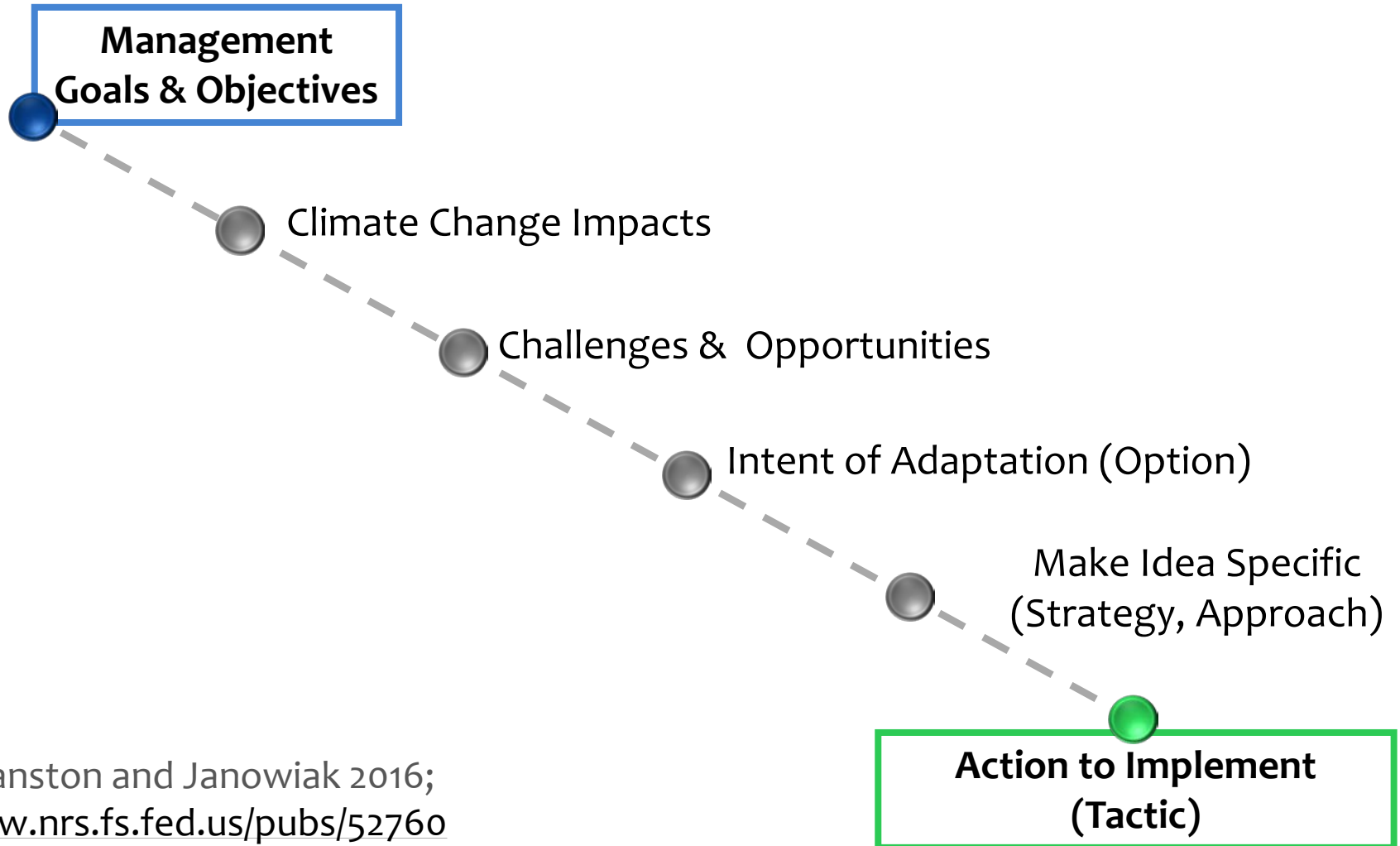
Better Q:

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

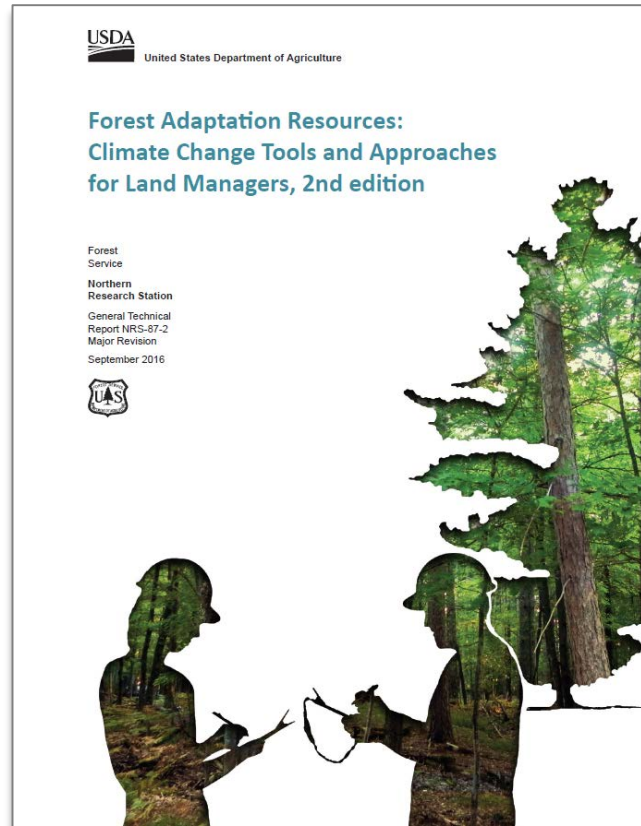


Purpose: Connecting the Dots

A clear train of thought shows *intentionality*



Adaptation Resources



Swanston and Janowiak 2016;
www.nrs.fs.fed.us/pubs/52760

Strategies & Approaches

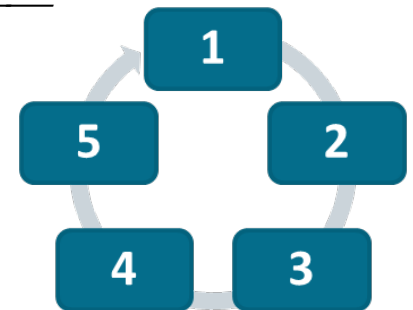
Menu of adaptation actions



Adaptation Workbook

Structured process to integrate climate change considerations into management.

- Workbook approach



Also online: AdaptationWorkbook.org

Testing a new menu

Goal: test menu of adaptation resources for wetland managers with a diversity of management goals



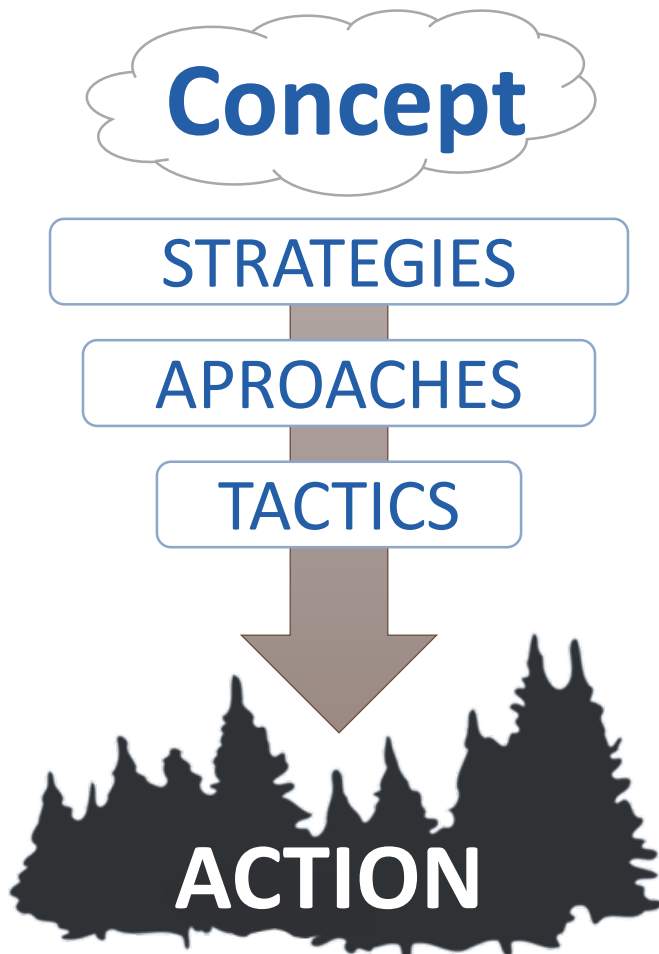
Is this a useful
resource? ←
...Need feedback!

Plants and Natural Communities Group

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

A “Menu” for Adaptation

Translating concepts to actions



Adaptation options (concepts):

- Resistance, Resilience, Transition

Strategies:

- Broad adaptation responses considering **ecology & mgmt.**

Approaches:

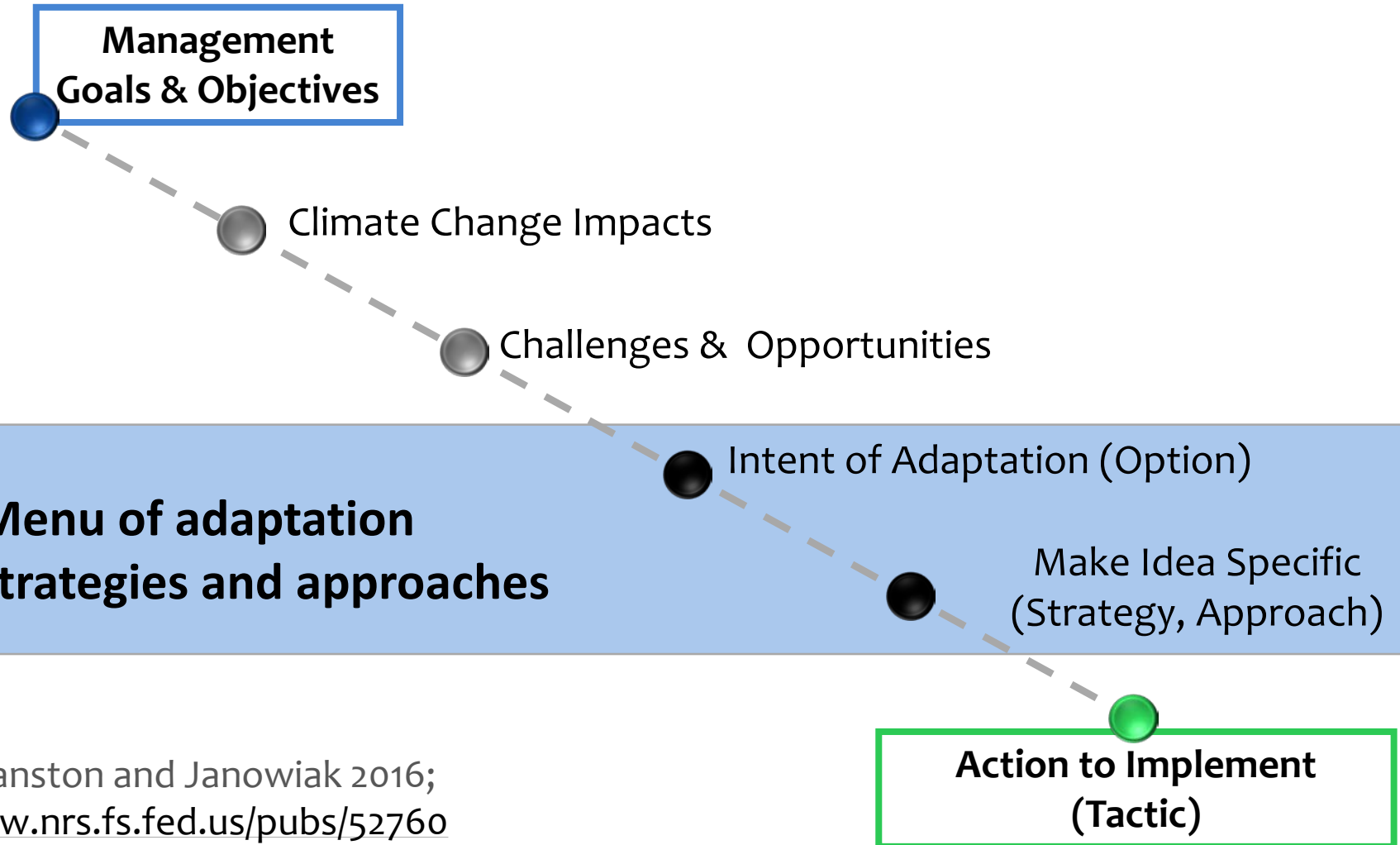
- More specific adaptation responses applicable to a **specific ecosystems**

Tactics:

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

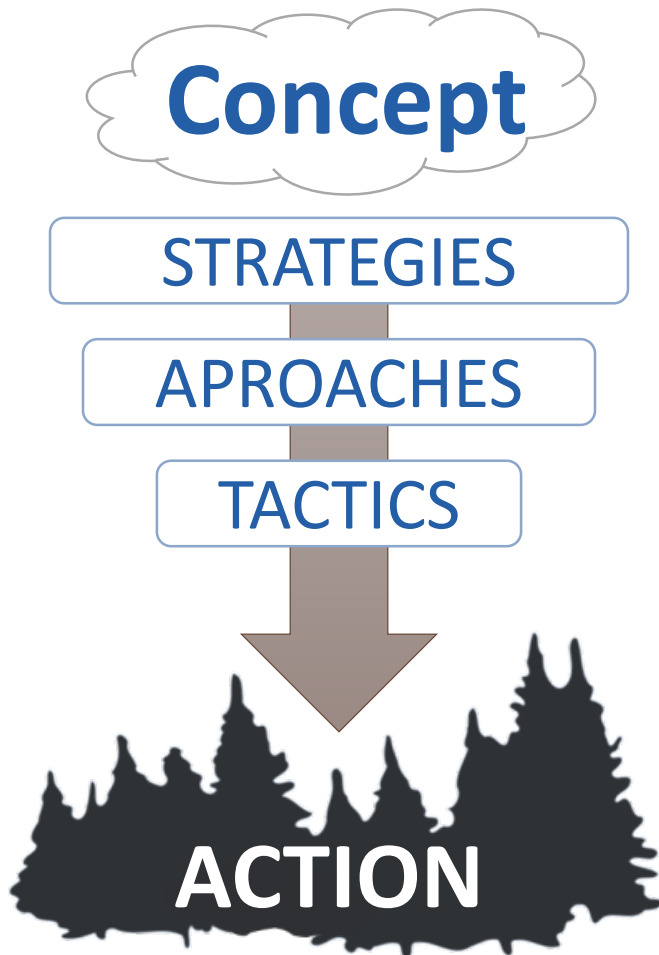
Connecting the Dots

A clear train of thought shows *intentionality*



A “Menu” for Adaptation

Translating concepts to actions






The **Menu** helps you create **clear rationale** for your actions by connecting them to **broader adaptation ideas.**

Intentionality
Success

Adaptation Resources: more menus

Menus to try

- ✓ Forests  Swanston et al. 2016 (2nd edition)
www.nrs.fs.fed.us/pubs/52760
- ✓ Urban forests 
- ✓ Agriculture  Janowiak et al. 2016. USDA

Non-forested wetlands

Forested watersheds

Wildlife

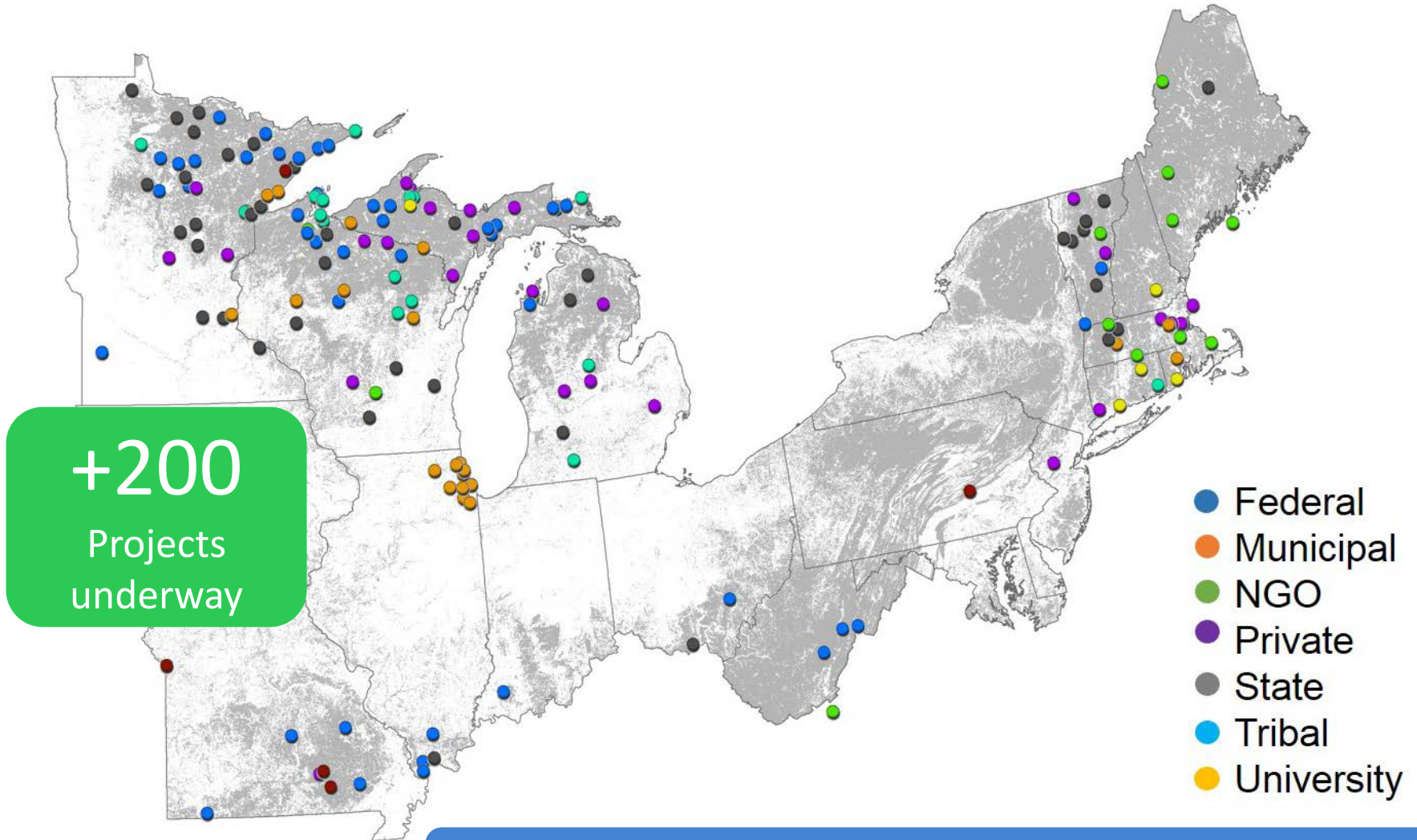
Tribal perspectives

Carbon...?

Ranching...?

Coming soon

Real World Examples



Forestadaptation.org/demos

How has the climate
changed over the last
century?

A changing climate...



Annual
Observed:
1895 – 2017
1.8 °F



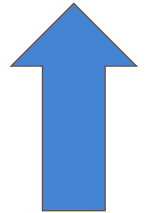
Winter temp
Observed:
1895 – 2017
3.3 °F



Precipitation
Observed:
1901 – 2016
3 inches more
annual precipitation



Extreme events
Observed:
More frequent
extreme rain
events (>3" over
last 30yr)



Soil moisture
Observed:
Drier than average in
some areas, moderate
drought during growing
seasons



Sources: NCA, NIACS and NOAA
Climate at a Glance for WI (statewide)
<https://www.ncdc.noaa.gov/cag>

A changing climate...

**More information
can be found at:**

National Climate Assessment - Climate Science Special Report
science2017.globalchange.gov

NIACS - N. Wisconsin Forest Ecosystem Vulnerability
Assessment
forestadaptation.org/vulnerability-assessment

NOAA Climate at a Glance tool (data)
<https://www.ncdc.noaa.gov/cag/>

... at the forum! Go to Dan Vimont's presentation



How is the climate
expected to change over
the next century?

Future changes

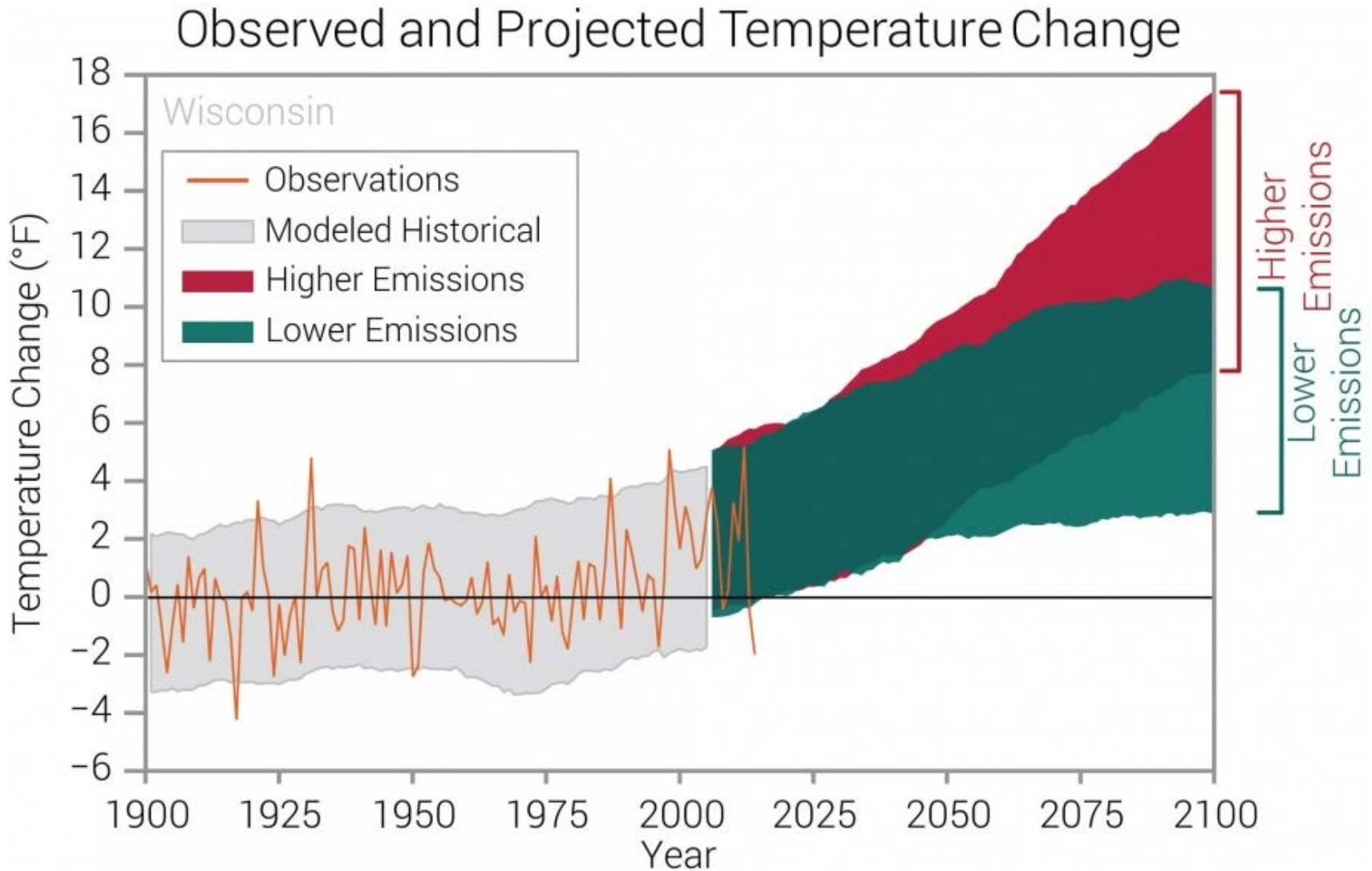


Figure source: NOAA WI State Climate Summary, CICS-NC and NOAA NCEI

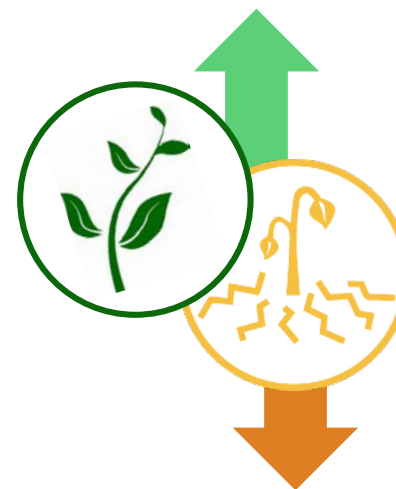
Projected climate...



2 - 9 °F



- More rain in winter and spring (1"-3")
- Snow reduction 10—30%



- Growing season lengthen by 1-2 months
- Dry end of season – limited soil moisture



Winters will become shorter, more rain



More frequent extreme rain events + wind

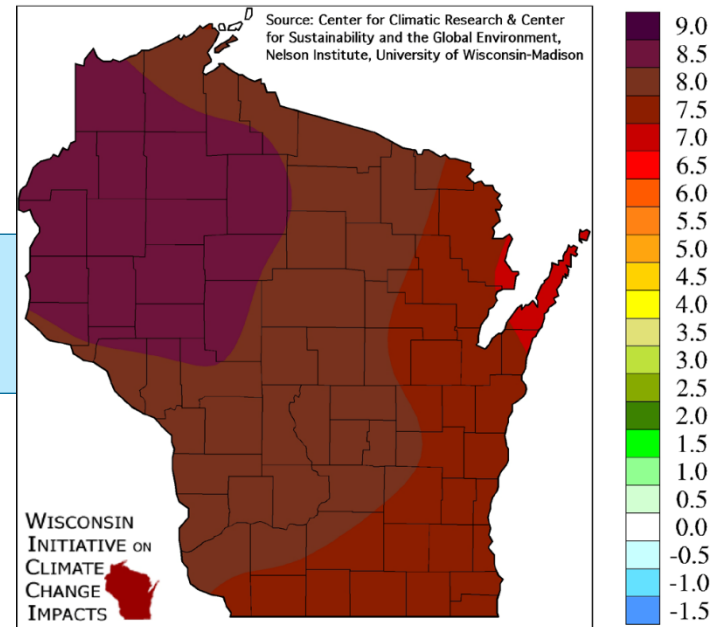


Climate change Ecosystem Vulnerability Assessment at
forestadaptation.org/vulnerability-assessment

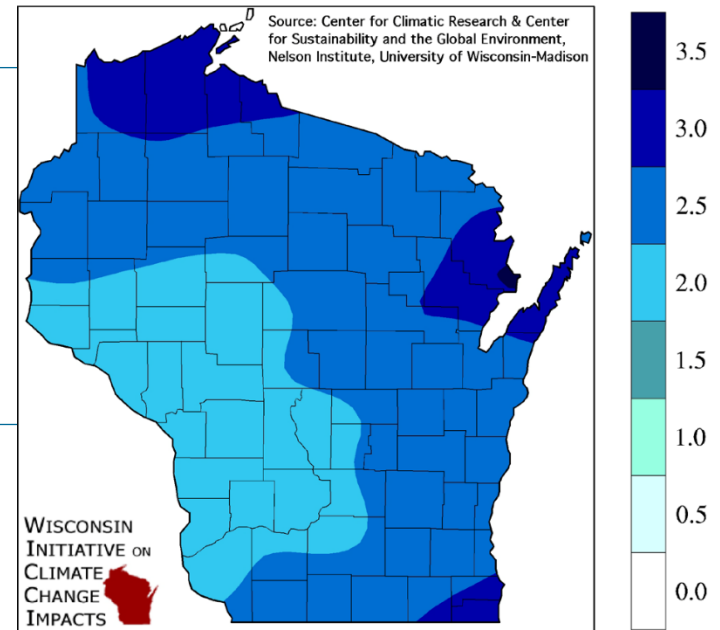
Future Changes

Variable	What We Know (High Certainty)
Temperature	<p>Warmer temperatures</p> <p>More hot days, fewer cold nights</p> <p>More frequent & longer heat waves</p> <p>Milder winters, longer warm season</p>
Precipitation	<p>More rainfall annually & some seasons</p> <p>More frequent & intense heavy rains</p> <p>Reduced snowpack, earlier melting</p>

Projected Change in Winter Average Temperature (°F) from 1980 to 2055



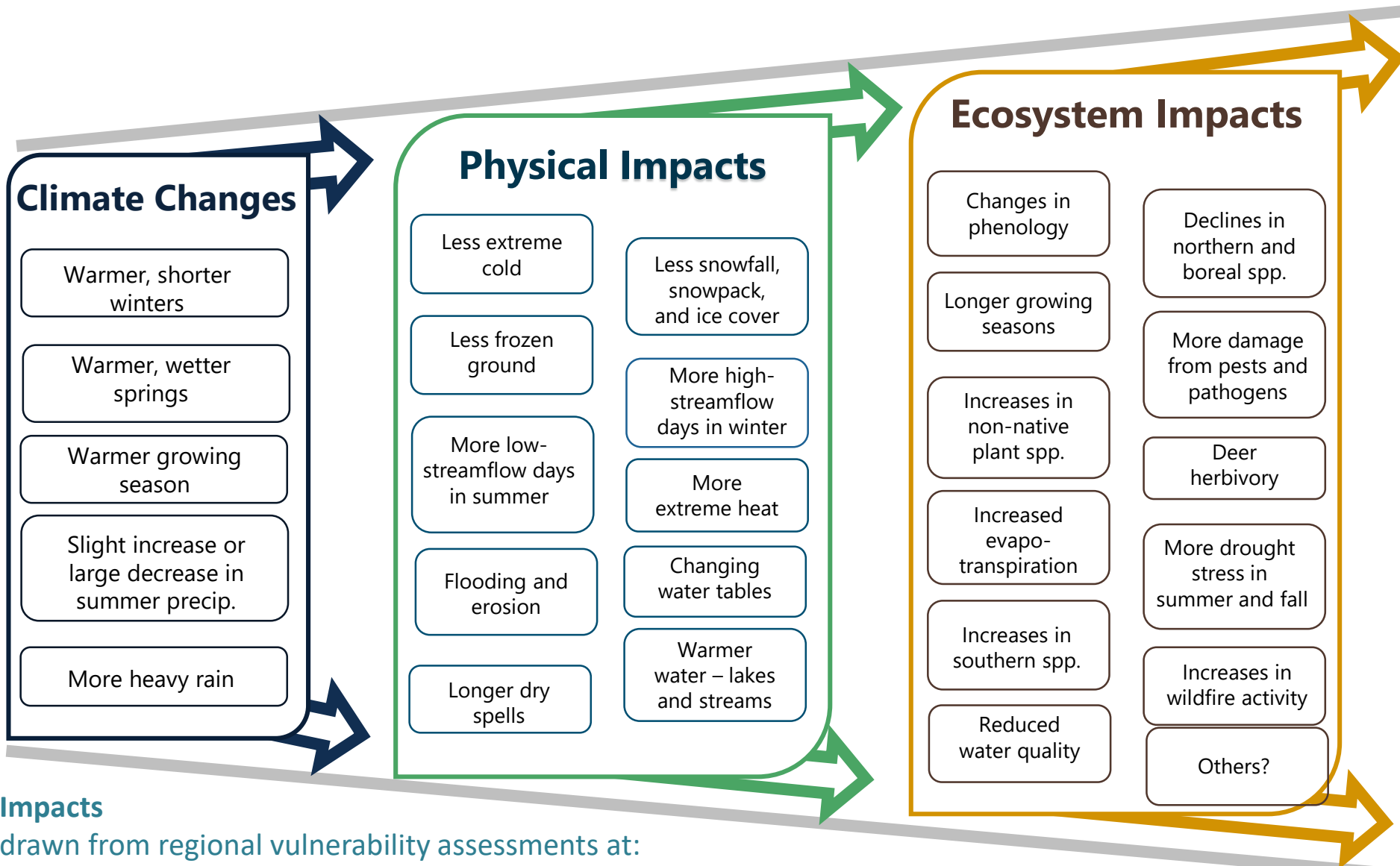
Projected Change in the Frequency of 2" Precipitation Events (days/decade) from 1980 to 2055



Future Changes

Variable	What We Don't Know as Well (<i>Greater Uncertainty</i>)
Temperature	Amount of warming: How much? Rate of warming: How fast? Delay in warming: Role of Atlantic Multidecadal Oscillation Annual & seasonal variability
Precipitation	Extreme rain events: Will frequency & intensity continue to increase? Changes in summer precipitation Relationship between warmer temperatures & altered precipitation Annual & seasonal variability
Sea-level	Amount of rise: How much? Storm characteristics

Regional climate change impacts

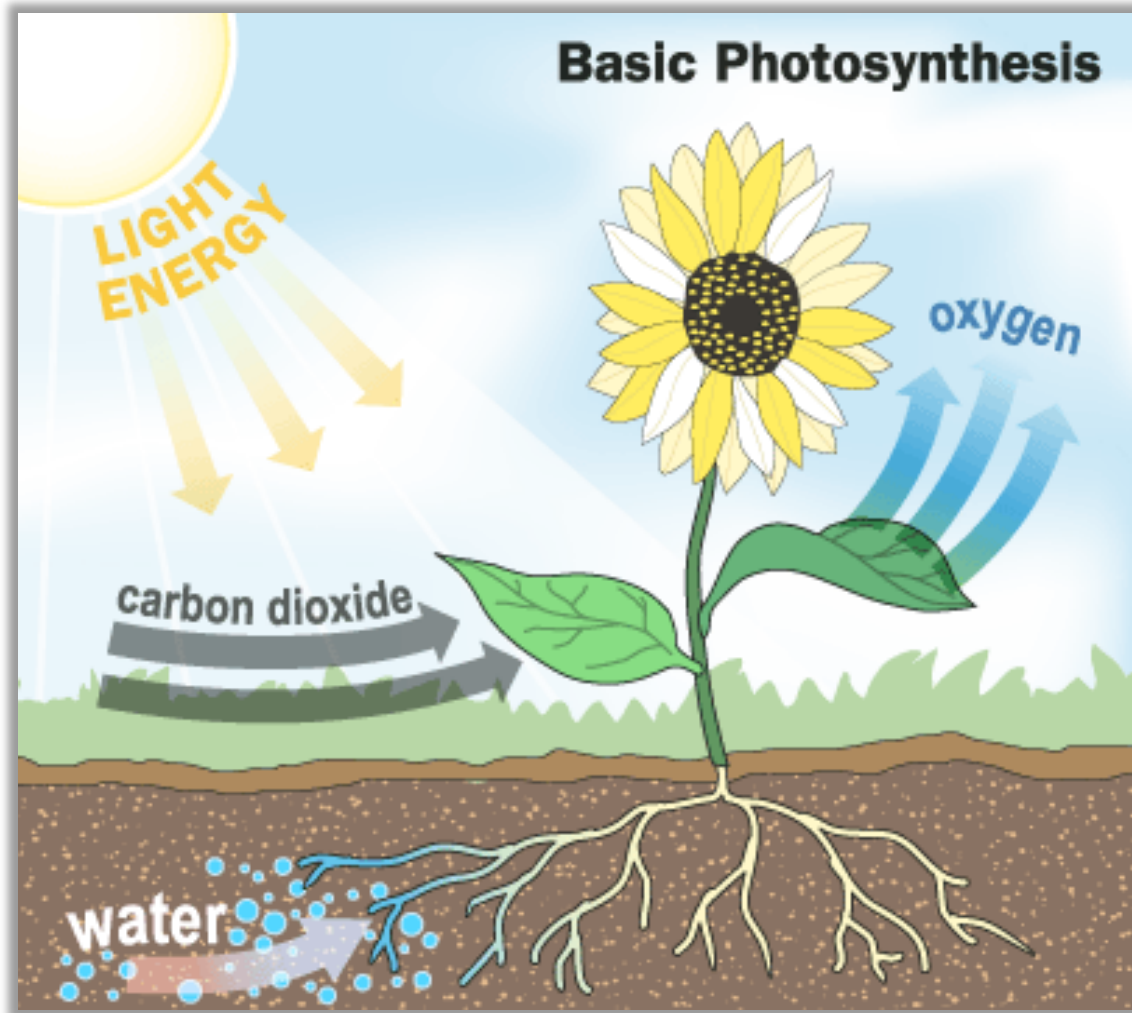


Impacts

drawn from regional vulnerability assessments at:
forestadaptation.org/vulnerability-assessment

How could ecosystems
be affected?

Increased Carbon Dioxide



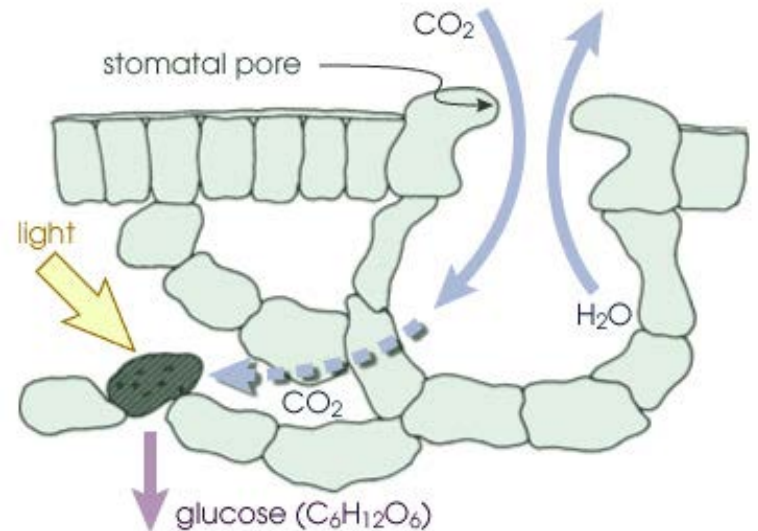
Increased Carbon Dioxide

Opportunity: Increased productivity*

- Increased photosynthesis
- Increased water use efficiency

***Effect likely limited:**

- Limited sink strength
- Interactions with nitrogen
- Ozone damage
- Other reductions in productivity (e.g., moisture stress, disturbance)



Longer Growing Seasons

Projected to increase by **2-7+ weeks** by 2100

Opportunity:

Longer period for plant growth

Challenge:

Potential risks from altered seasonality

- Early bud break/loss of cold hardening
- Frost damage during spring freezing
- May advantage some invasive plants

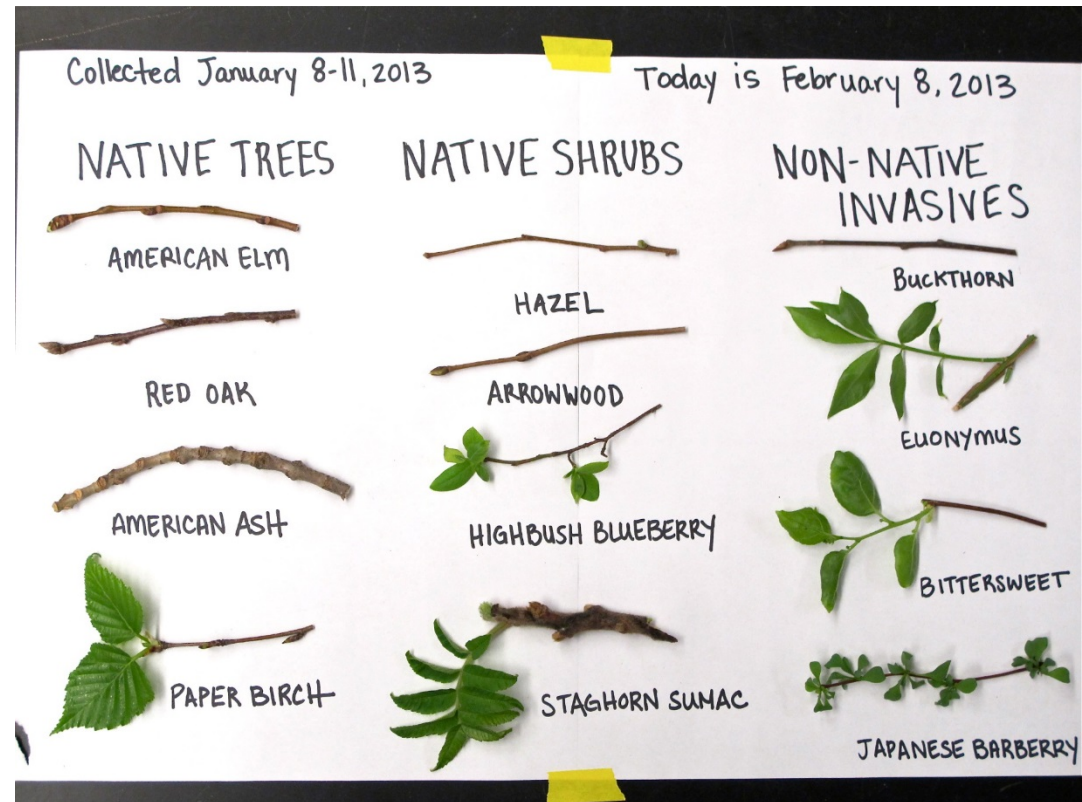
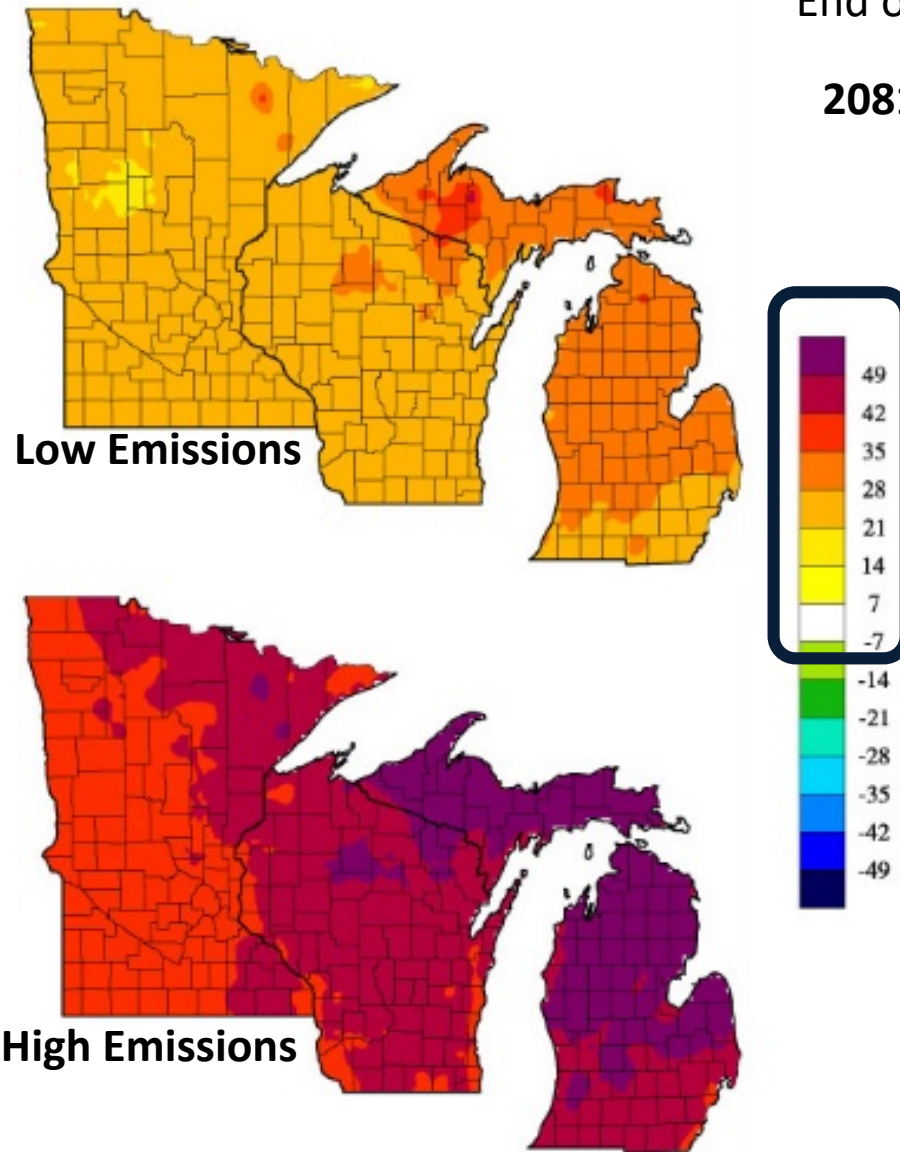


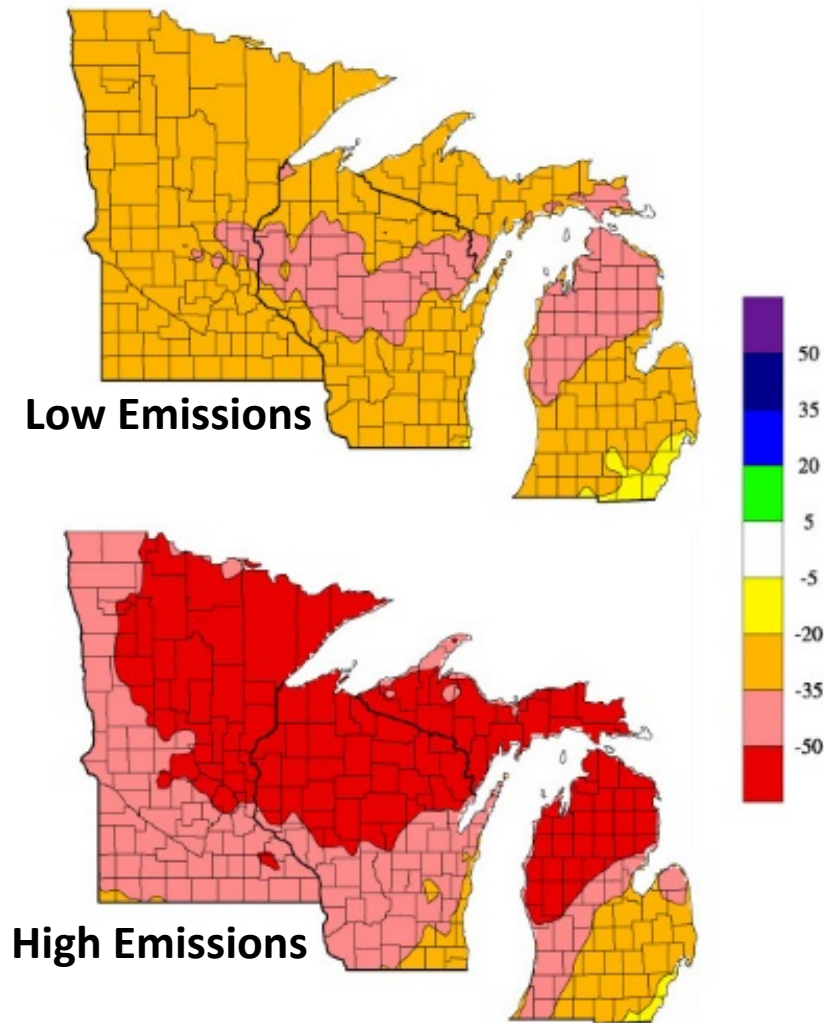
Image: Sciencedaily.com

Season length in days
End of Century vs. Current

2081-2099 vs 1981-2000



Shorter Winter = Less Snow



2081-2100 v. 1981-2000

Janowiak et al. 2014

Projected decreases in snow fall, cover, and depth

- 30-50% decreases in snowfall (Notaro 2015)

Challenge:

Decreased snowpack

- Increased soil frost and root damage in cold temps
- Warmer soil temperatures and altered processes

Shorter Winter = Less Snow, More Rain

Precipitation is projected to increase = more rain

Challenge: Altered stream flow timing and amount

- Earlier spring peak flows
- Potential increases in flashiness and episodic high flows
 - *Erosion, washouts*
- Potential declines in summer seasonal stream flow

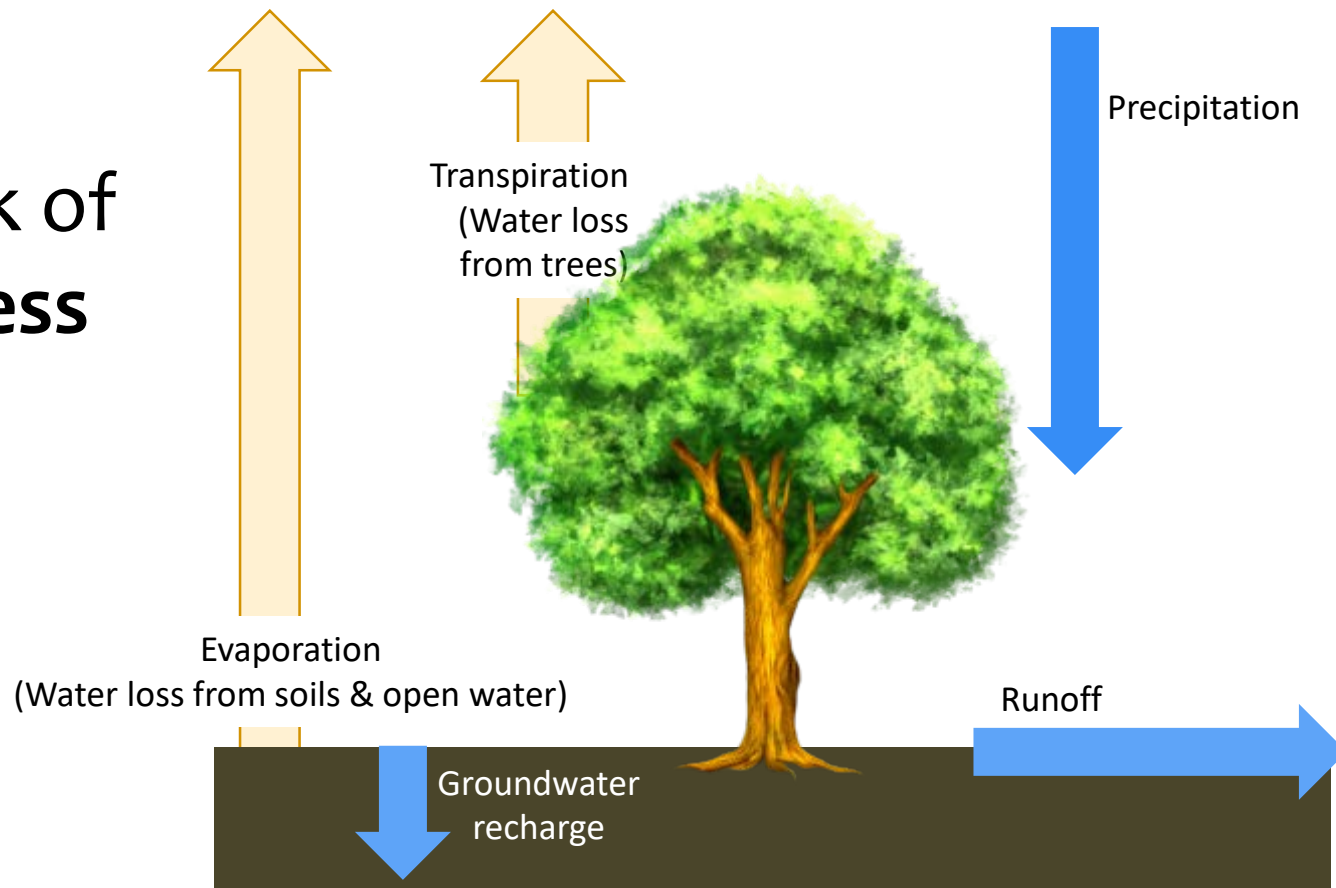


Kate Redmond

Climate change + Water

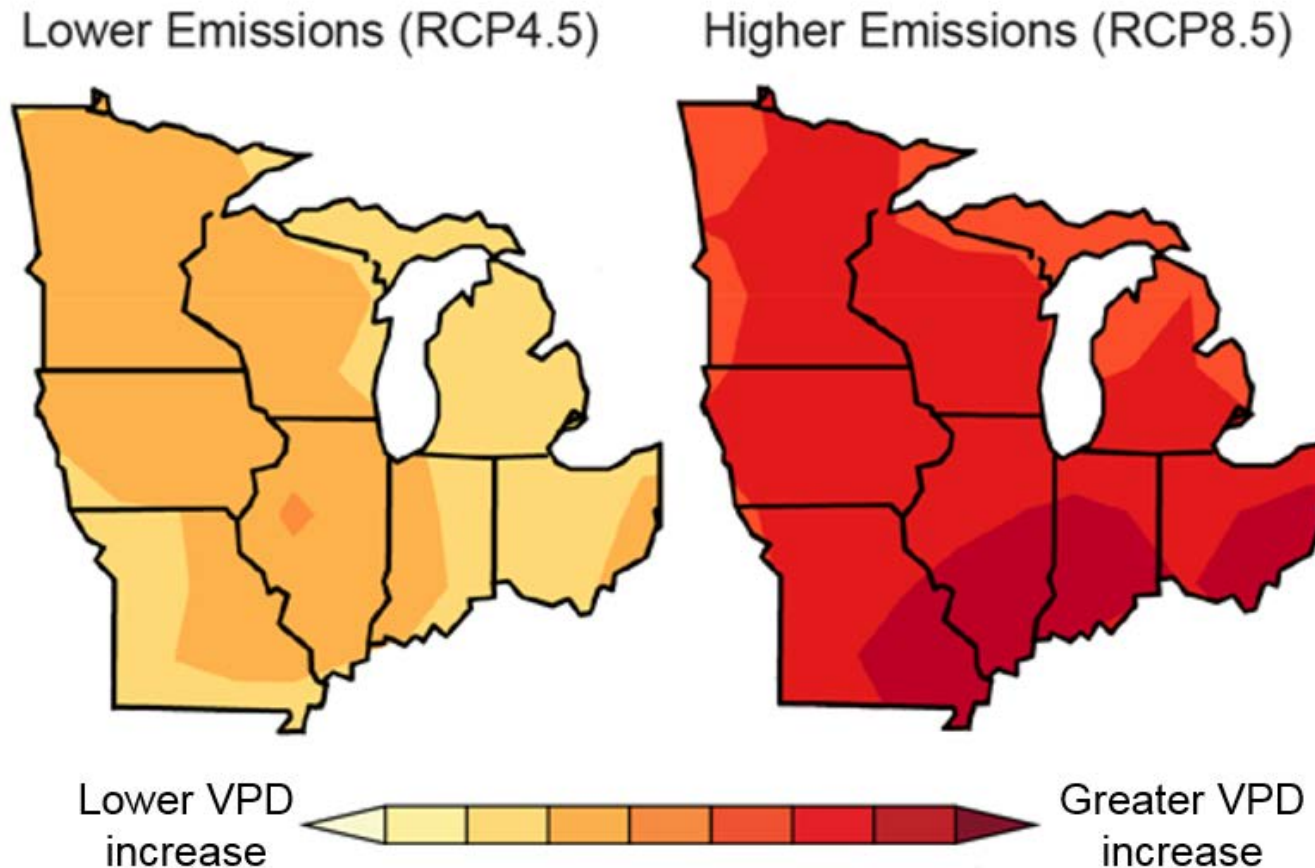
Weather & climate drive hydrology.

Challenge:
Increased risk of
moisture stress



Warmer temperatures = ↑ vapor pressure deficit (VPD)

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



Climate Change + Water = Wetter

Observed:

- 3+ inches more annual precipitation
- More frequent extreme rain events

Future:

- Precip increases: annual, winter, spring, and fall
- More extreme events
- More runoff, less retained in system



July 12, 2016
Northern Wisconsin

Photos: Linda Parker/ USFS

Climate Change + Water = Wetter AND Drier

Observed:

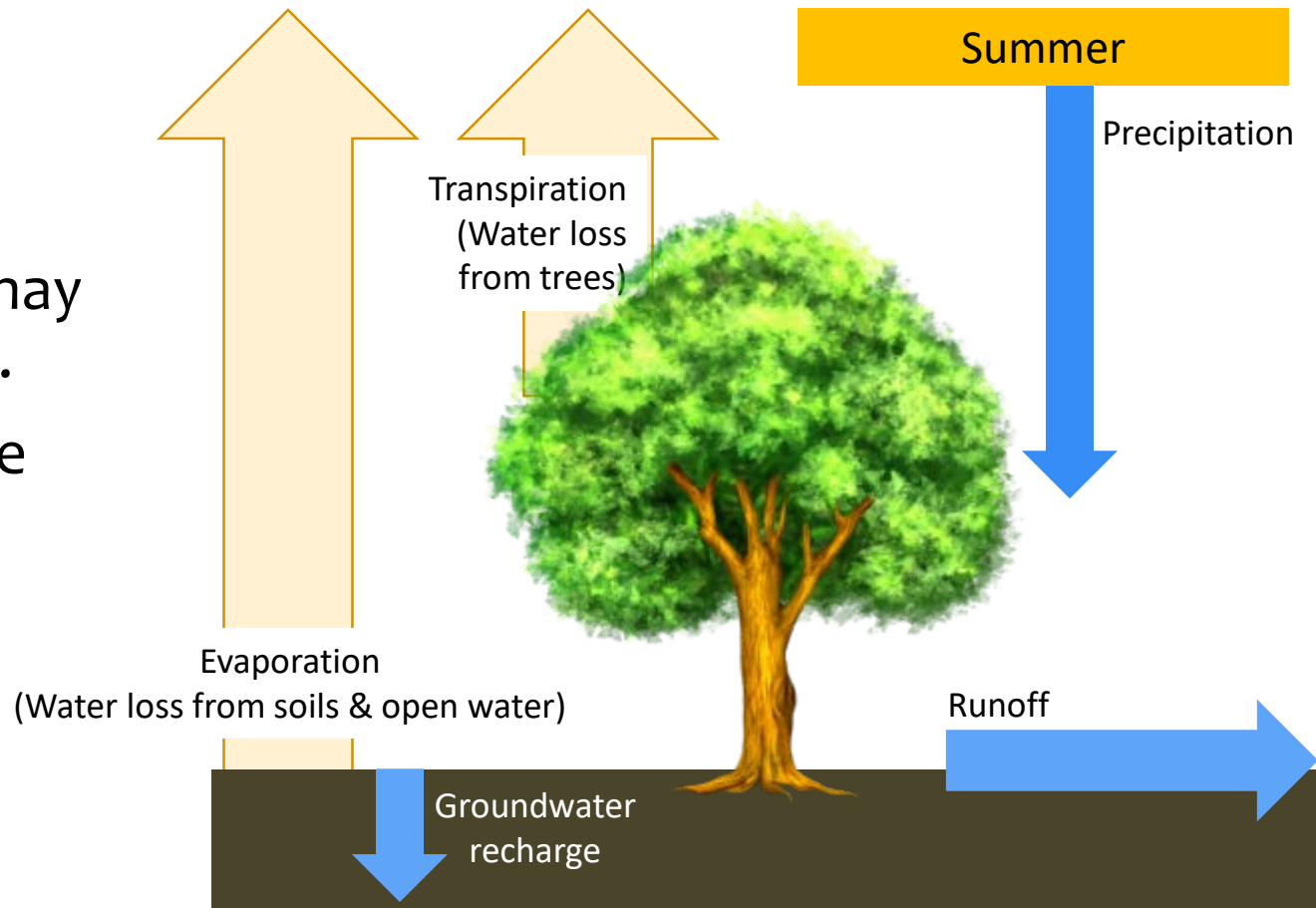
- Dry periods in some areas

Future

- Summer rainfall may not change much.
- Possibility of more consecutive dry days

- Warmer temperatures dry air & soils
- Extreme events increase runoff

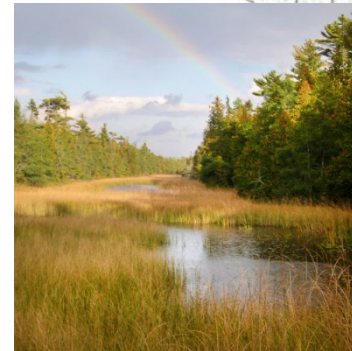
Result: Risk of moisture stress & drought



Changes in Ecosystem Species assemblages

Habitat based on:

- Temperature
- Precipitation
- Elevation
- Latitude
- Soils
- Slope & Aspect
- Land use
- Competition
- Management



Map: Charles Lane, US EPA
Photos: wisconsinwetlands.org

Changes in Ecosystems Composition

Challenge: Decline of northern/boreal species

Opportunity: Increased habitat for some species

- Some species: reduced habitat suitability in the future
- Changes will occur slowly—not instant dieback
- Immense lags to occupy habitats
- Critical factors: competition, management, & disturbance

Extreme Events

Challenge: Increased disturbance from extreme events

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

“Events” are not well modeled



Interactions: Insects and Disease

Challenge: Increased forest insects & diseases

Indirect: Stress from other impacts increases susceptibility

Direct:

- Pests migrating northward
- Decreased probability of cold lethal temperatures
- Accelerated lifecycles



Top: bugwood.org/ Bottom: USFS

Interactions: Invasive Plants

Challenge: Increased invasive & noxious plants

Indirect: Stress or disturbance from other impacts can affect the potential for invasion or success

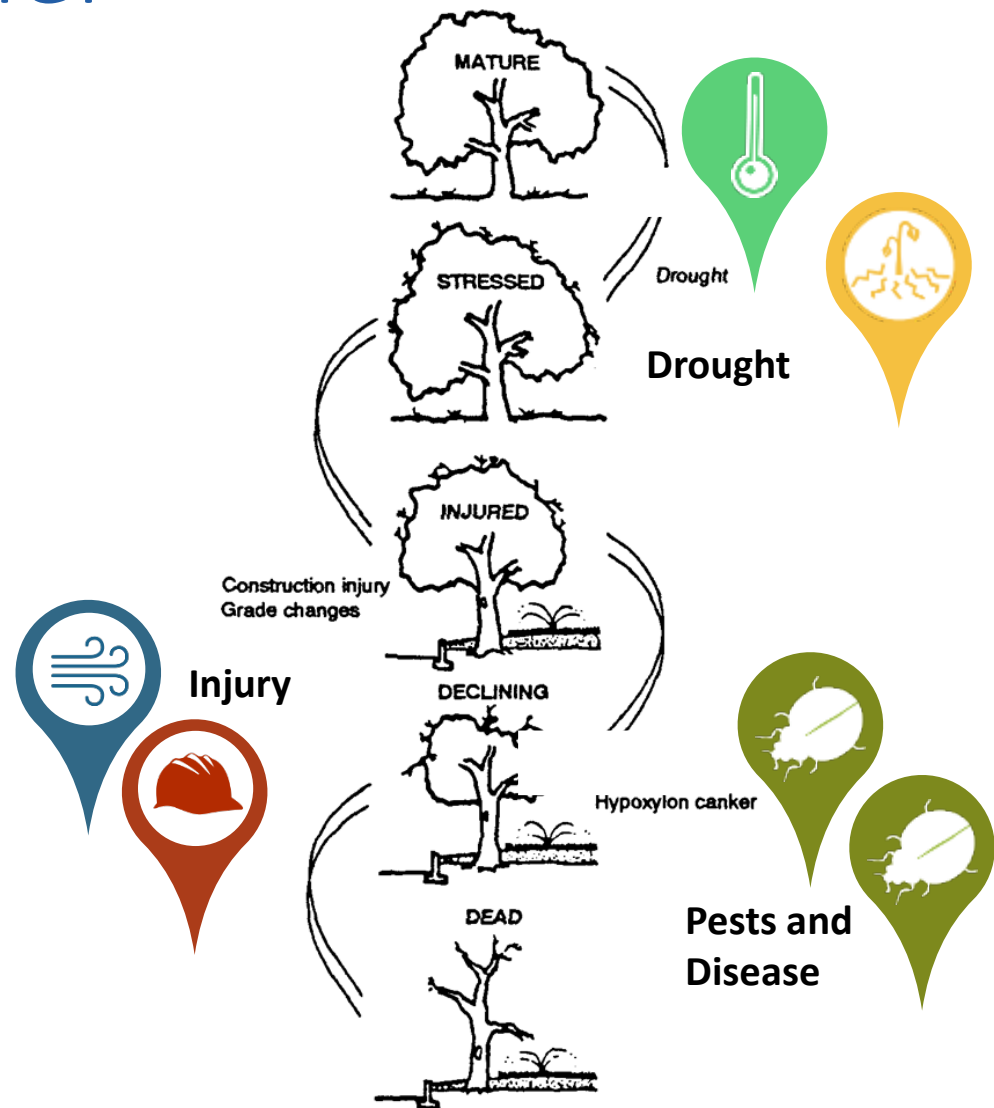
Direct:

- Expanded ranges under warmer conditions
- Increased competitiveness from ability of some plants to take advantage of elevated CO₂



A “Threat Multiplier”

- Interactions can trigger big changes
 - Stress
 - Disturbance
 - Invasive species
 - Insect pests
 - Forest diseases



How could wetlands be affected?

Generally Challenges

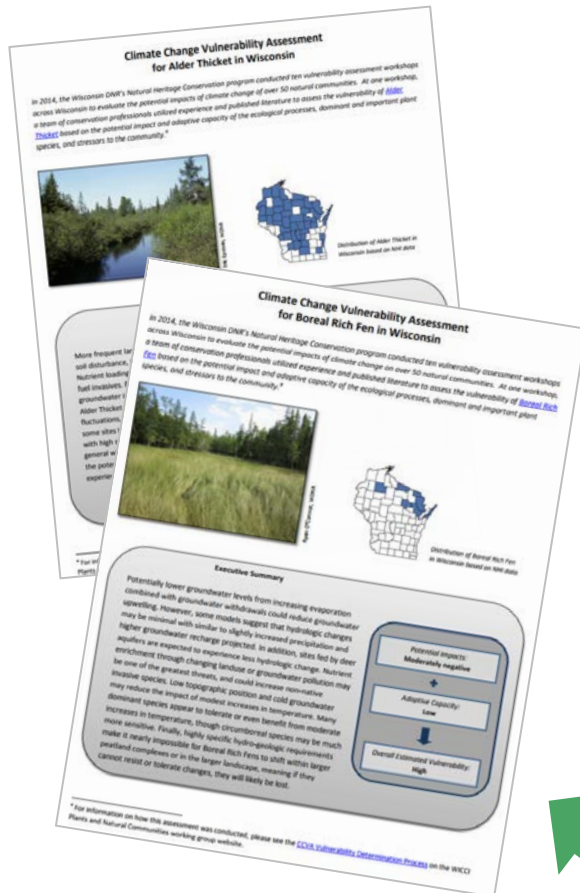
- Reduced growth: moisture stress
- Decline of northern/boreal species
- Disturbance from extreme events
- Wildfire potential
- Pests & disease
- Invasive species
- Altered land uses

Generally Opportunities

- Increased productivity: longer growing season
- Increased productivity: more CO₂
- Increased habitat for some species

***What would
you add?***

Non-forested Wetland vulnerability



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

High vulnerability

- Boreal rich fen
- Calcareous fen
- Central poor fen
- Coastal plain marsh
- Sandy moist meadow
- Shore fen

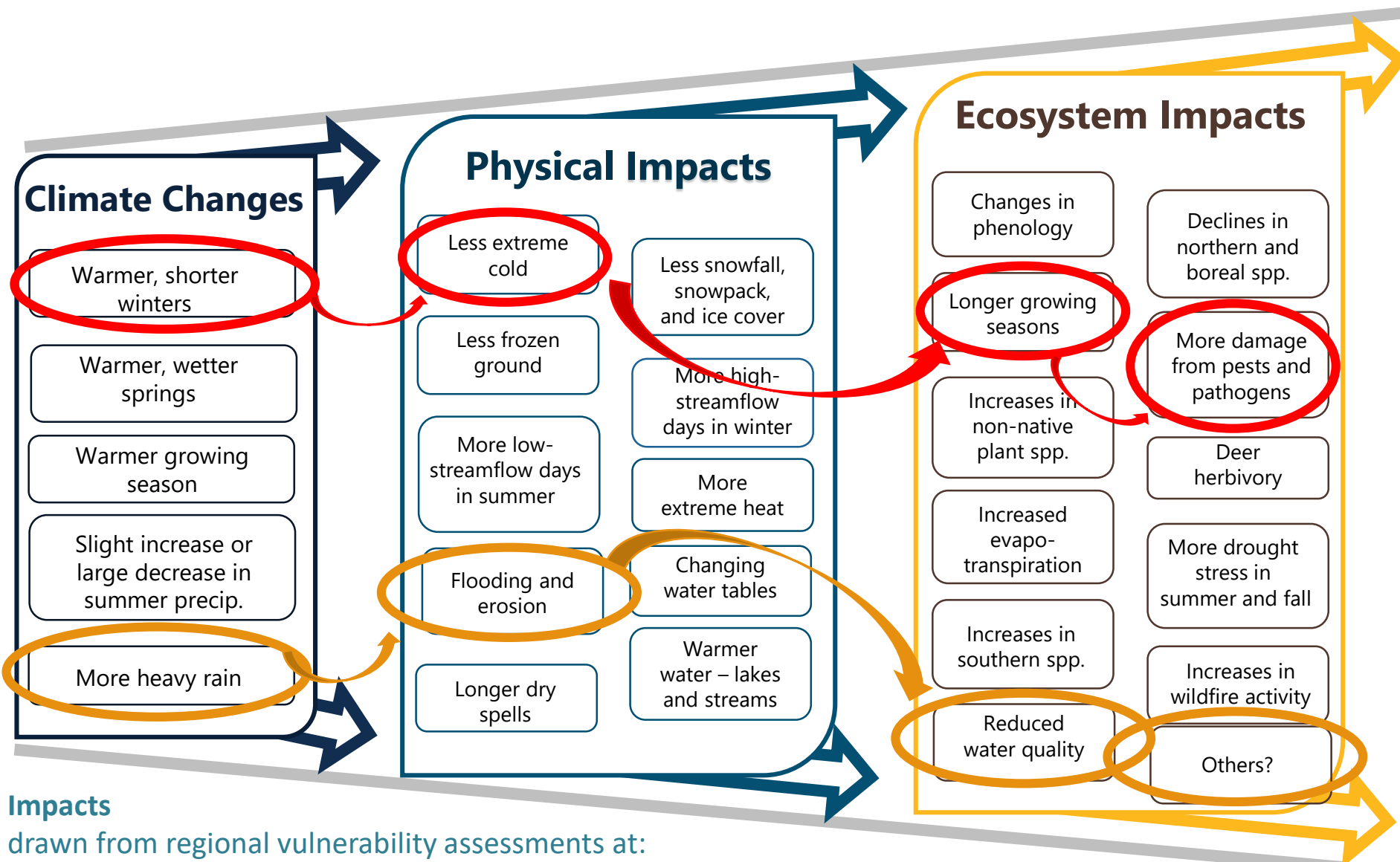
Moderate-High vulnerability

- Bog relict
- Ephemeral pond
- Muskeg
- Poor Fen
- Nor. sedge meadow
- So. sedge meadow
- Open bog
- Pattered Peatland

Low-Moderate vulnerability

- Alder thicket
- Emergent marsh
- Shrub-carr

Regional climate change impacts

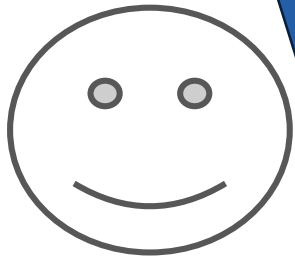


Impacts
drawn from regional vulnerability assessments at:
forestadaptation.org/vulnerability-assessment

How can I get ready for
next week?

Workshop prep: Step 1

Bring a project, it sets context & a starting point



Workshop prep: Step 1

Management goals and objectives for your project!

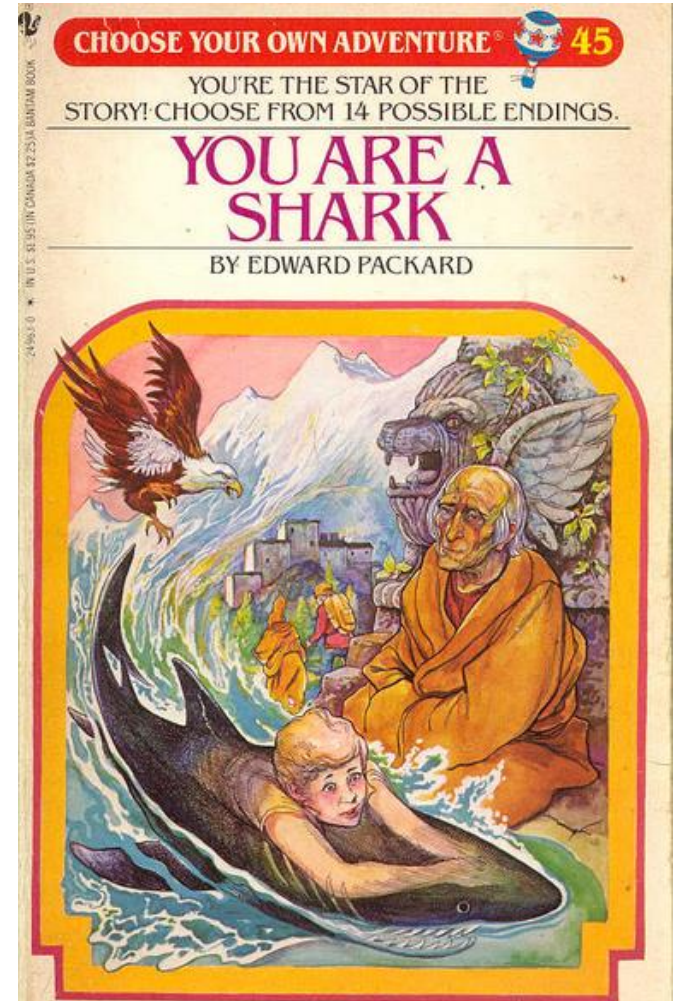
Resource Areas	Goals	Objectives	Timeframe
Wetland Next to Highway 2	<ul style="list-style-type: none">• Control exotic invasive species	<ul style="list-style-type: none">• Plant seedlings of X, Y, Z• Monitor and spray roadsides each summer. - Focusing on management of A, B, and C species.	5 years
Wetland #124	<ul style="list-style-type: none">• Maintain a diverse system with many species• Restore hydrologic function and water quality	<ul style="list-style-type: none">• Replace undersized and poorly placed culverts• Stabilize eroding banks due to agriculture runoff to reduce impacts on water quality.	10 years

Learn more, find the Adaptation Workbook at: forestadaptation.org/far

Maintain flexibility!

There is no single answer.

People will make different choices, and **that's OK.**

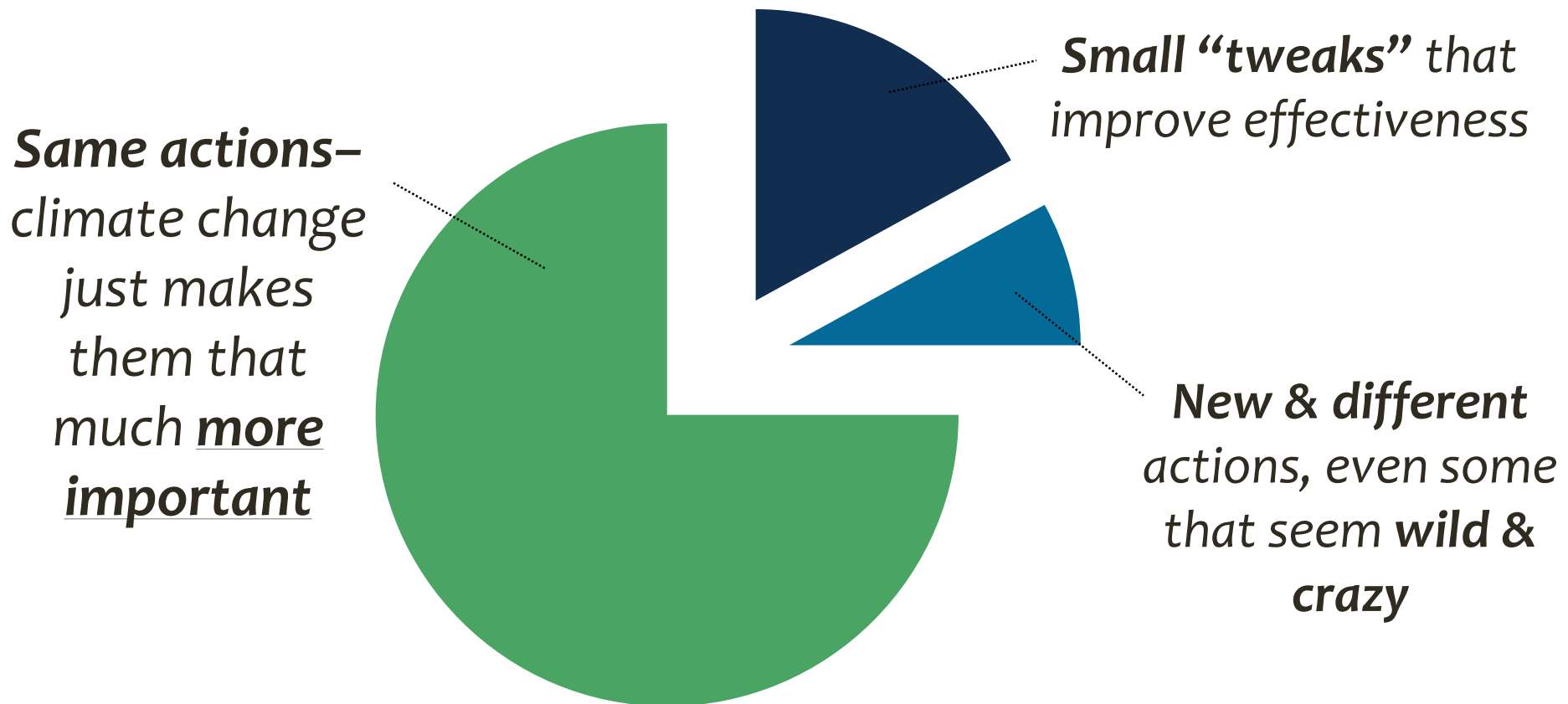


Local knowledge and experience is crucial

Research and assessments describe broad trends but local conditions and management make the difference.



Adaptation actions may not look that different from current management actions, especially in the near term.



Before the workshop – do this

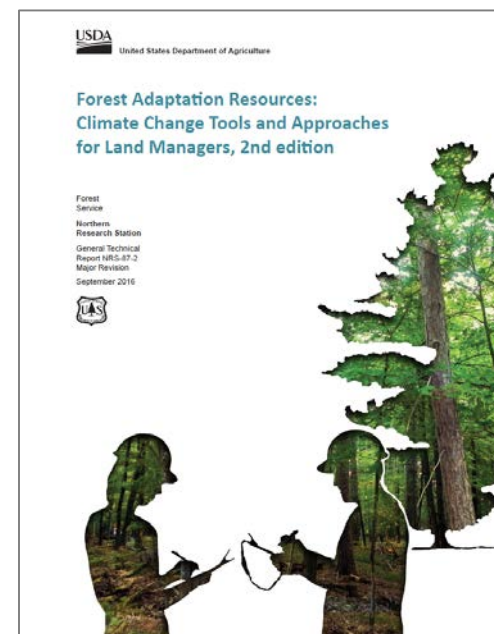
Get comfortable w/ regional climate projections

A list of resources can be found at:
forestadaptation.org/wi-wetlands

Learn the Adaptation Workbook process

Complete Step 1 worksheet!

Go to the WWA symposium
(Thurs 2/22)



forestadaptation.org/far

Between then and now

Ask questions

Danielle Shannon

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

Todd Ontl

tontl@fs.fed.us, 906-482-6303x 1324

See you February 23!