A Climate Adaptation Toolbox for Natural Resource Managers

Amy Staffen

Wisconsin DNR, Natural Heritage Conservation Program

Wisconsin Initiative on Climate Change Impacts (WICCI)

Wisconsin Initiative on Climate Change Impacts (WICCI)

- New webpage soon!
- WICCI working groups that relate most directly to lakes and streams:
  - Water Resources
  - Great Lakes
  - Infrastructure
  - **Plants & Natural Communities**
  - Tourism & Outdoor Recreation
- Update to 2011 report

wicci.wisc.edu

Northern Institute of Applied Climate Science (NIACS)

WICCI Plants & Natural Communities Working Group

- How will climate change impact the sites that I manage?
- What actions can I take to:
  - promote resilience?
  - protect species?
  - retain ecosystem services?
- How will it affect the way that I go about my work?


VA State Parks


David Eagan


USACE

~~Predictions?~~ Projections.

Slide courtesy Stephen Handler, NIACS

Risk Management

Graphic courtesy Stephen Handler, NIACS

Plot the range of possible climate scenarios

⇩

Assess risk to our lands and waters

⇩

Adapt with logic and intentionality

BUILDING AN ADAPTATION TOOLBOX

1. Climate Change Vulnerability Assessments
2. Menus of Adaptation Actions
3. Adaptation Workshops
4. Adaptation Demonstration Sites

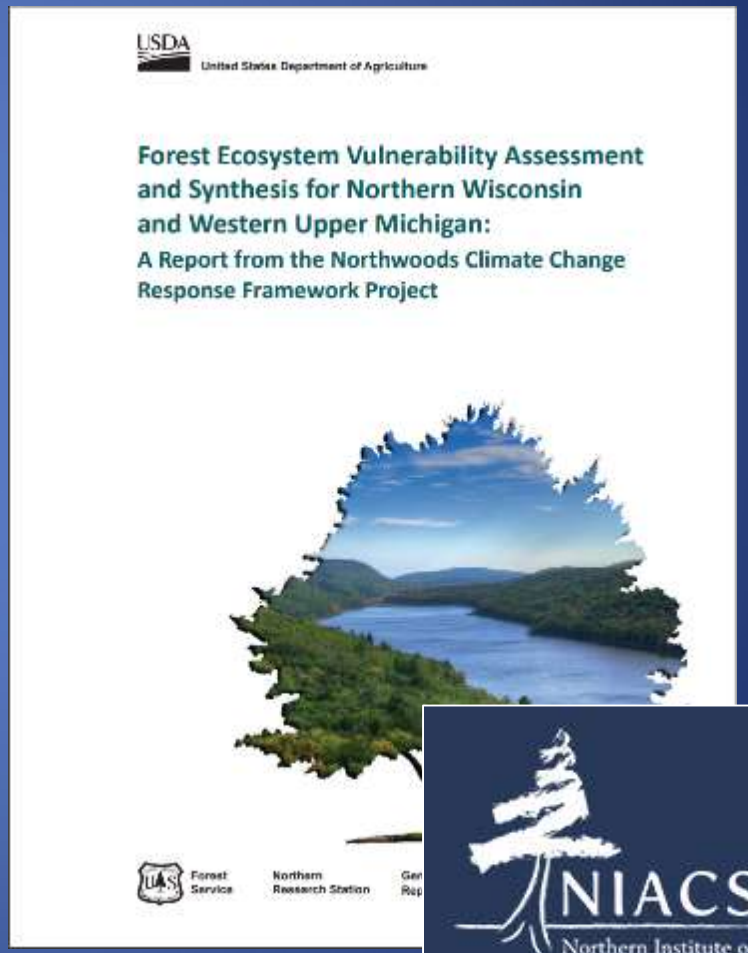

Amy Staffen

Climate Change Vulnerability Assessments (CCVAs)

for Wisconsin's Natural Communities

1. Previous assessment for forests of northern Wisconsin and western Upper Peninsula of Michigan

2. We did remaining 52 natural communities, including:
   - non-forested wetlands
   - southern forested wetlands
   - upland forest and savanna
   - Great Lakes shorelines



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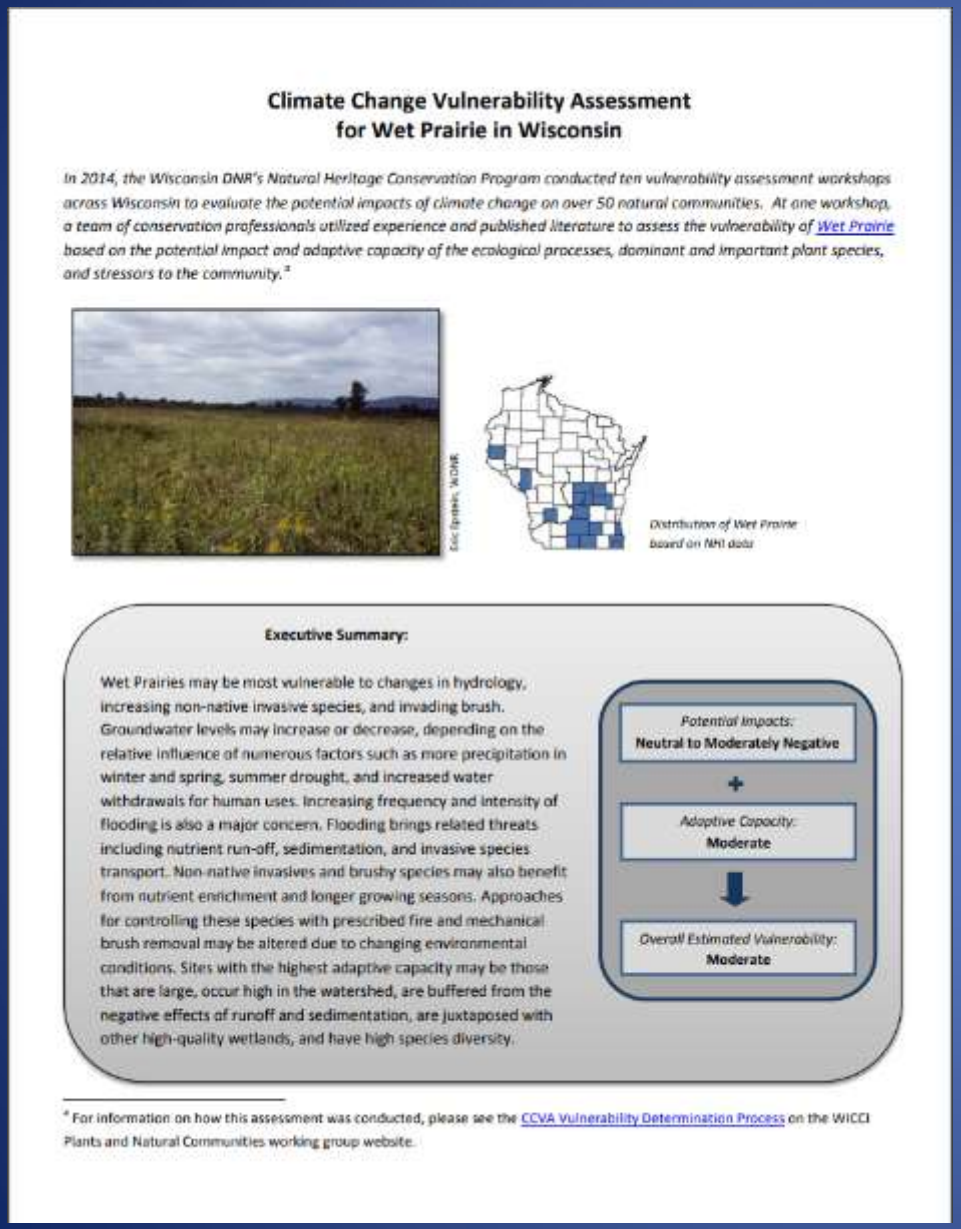
CCVAs: 52 Technical Bulletins



Climate Change Vulnerability Assessment for Wet Prairie in Wisconsin

In 2014, the Wisconsin DNR's Natural Heritage Conservation Program conducted ten vulnerability assessment workshops across Wisconsin to evaluate the potential impacts of climate change on over 50 natural communities. At one workshop, a team of conservation professionals utilized experience and published literature to assess the vulnerability of Wet Prairie based on the potential impact and adaptive capacity of the ecological processes, dominant and important plant species, and stressors to the community.[a]

Eric Epstein, WDNR

Distribution of Wet Prairie based on NHI data

Executive Summary:

Wet Prairies may be most vulnerable to changes in hydrology, increasing non-native invasive species, and invading brush. Groundwater levels may increase or decrease, depending on the relative influence of numerous factors such as more precipitation in winter and spring, summer drought, and increased water withdrawals for human uses. Increasing frequency and intensity of flooding is also a major concern. Flooding brings related threats including nutrient run-off, sedimentation, and invasive species transport. Non-native invasives and brushy species may also benefit from nutrient enrichment and longer growing seasons. Approaches for controlling these species with prescribed fire and mechanical brush removal may be altered due to changing environmental conditions. Sites with the highest adaptive capacity may be those that are large, occur high in the watershed, are buffered from the negative effects of runoff and sedimentation, are juxtaposed with other high-quality wetlands, and have high species diversity.

Potential Impacts: **Neutral to Moderately Negative**

+

Adaptive Capacity: **Moderate**

Overall Estimated Vulnerability: **Moderate**

[a] For information on how this assessment was conducted, please see the CCVA Vulnerability Determination Process on the WICCI Plants and Natural Communities working group website.

Key Components for technical bulletins:

- Transparency
- Knowledge gaps and research needs
- Confidence rankings

CCVAs
10 Broad Community Group Factsheets

- Bedrock
- Barrens
- Grasslands
- Great Lakes Shorelines
- Non-forested Wetlands
- Savannas
- Northern Lowland Forests
- Northern Upland Forests
- Southern Lowland Forests
- Southern Upland Forests

Climate vulnerability assessment:
Non-forested wetlands

Introduction: Climate change may bring higher temperatures, variable precipitation, and more frequent intense storms. This document provides a broad summary of potential impacts of climate change, and may provide a foundation for conservation planning in the face of an uncertain future.

Hydrology

Altered hydrology is the greatest anticipated impact to non-forested wetlands from climate change. The likelihood of more extreme precipitation events increases the risk of erosion and sedimentation as well as nutrient runoff, which can fuel the transportation and growth of non-native invasive plants and weedy native species. The impact of these events is likely to be greatest lower in the watershed, where flood waters collect for a longer period of time. In addition, winter temperature and precipitation

NRCS Staff

Runoff from large rain events carries sediments and excess nutrients into wetlands

is likely to become more variable, which may affect groundwater-fed communities in unpredictable ways: rapid snow melt and rain on frozen ground could increase runoff and decrease groundwater recharge, while rain on unfrozen ground could infiltrate and increase groundwater levels.

Invasive and aggressive species

Non-native invasive species are already a problem in many natural communities, especially in southern Wisconsin. Longer growing seasons disproportionally benefit invasives like reed canary grass, which can continue growing longer in the fall than native grasses and sedges. In addition, sedimentation and excess nutrients favor species like non-native cattail and Phragmites. Elevated levels of CO_2 may favor woody species, including invasive shrubs like glossy buckthorn. In general, non-native invasives species respond well to rapid environmental changes, including extreme storms, which can disturb soil and spread propagules.

Vulnerable species

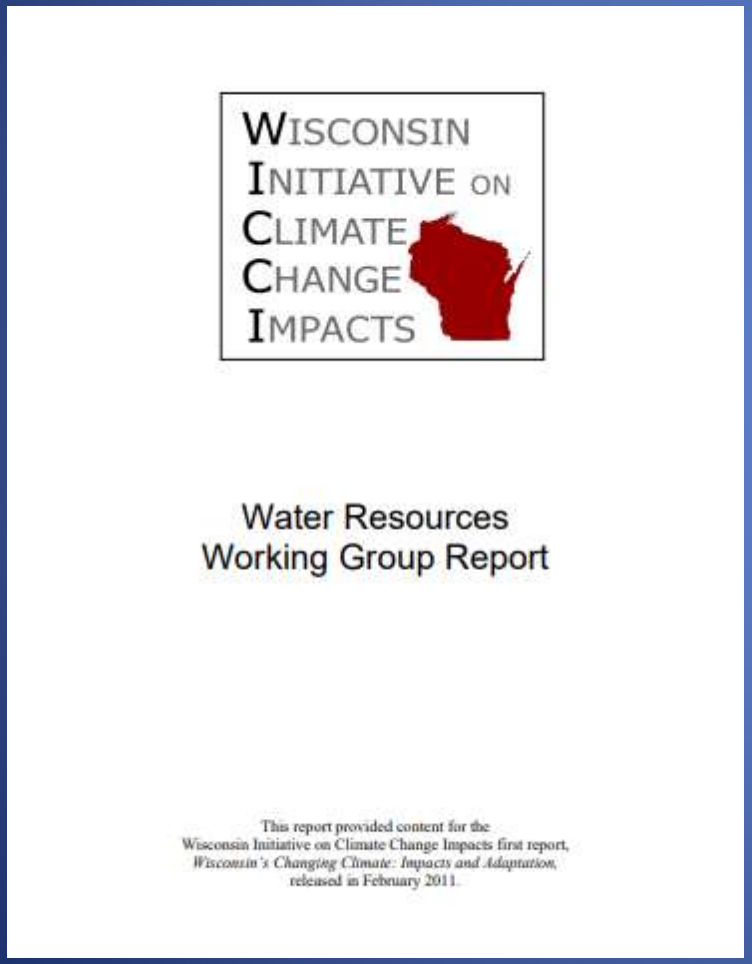
With a few exceptions, many dominant non-forested wetland plants in Wisconsin also occur well to the south, indicating they may be less sensitive to changes in temperature than to changes in the delicate balance in hydrologic regimes and nutrients. Those species that may be most vulnerable tend to be associated with communities that occur at the southern edge of their range in Wisconsin, such as Boreal Rich Fen, Shore Fen and, in the southern part of the state, Bog Relict and Alder Thicket.

Longer growing seasons could benefit invasive species like reed canary grass

CCVAs pertaining to lakes and streams

- CCVAs for aquatic communities not completed
- WICCI Water Resources working group developing in next 1-2 years
- Existing upland and wetland CCVAs can be used to assess watershed impacts

Other WICCI resources on lake and stream vulnerability



2011 Report

Other WICCI resources on lake and stream vulnerability

LAKE AND RESERVOIR MANAGEMENT
https://doi.org/10.1080/10402381.2019.1622612

Taylor & Francis
Taylor & Francis Group

Check for updates

Scientific advances and adaptation strategies for Wisconsin lakes facing climate change

Madeline R. Magee[a,b], Catherine L. Hein[b], Jake R. Walsh[a], P. Danielle Shannon[c,d], M. Jake Vander Zanden[a], Timothy B. Campbell[e,f], Gretchen J. A. Hansen[g], Jennifer Hauxwell[e], Gina D. LaLiberte[b], Timothy P. Parks[h], Greg G. Sass[i], Christopher W. Swanston[c,j] and Maria K. Janowiak[c,j]

[a]Center for Limnology, University of Wisconsin-Madison, Madison, WI, USA; [b]Wisconsin Department of Natural Resources, Madison, WI, USA; [c]Northern Institute of Applied Climate Science, USDA Northern Forests Climate Hub, Houghton, MI, USA; [d]Michigan Technological University, Houghton, MI, USA; [e]University of Wisconsin Sea Grant Institute, Madison, WI, USA; [f]University of Wisconsin-Extension Natural Resources Institute, Madison, WI, USA; [g]Department of Fisheries, Wildlife, and Conservation Biology, University of Minnesota, St. Paul, MN, USA; [h]Wisconsin Department of Natural Resources, Wausau, WI, USA; [i]Escanaba Lake Research Station, Office of Applied Science, Wisconsin Department of Natural Resources, Boulder Junction, WI, USA; [j]USDA Forest Service, Northern Research Station, Houghton, MI, USA

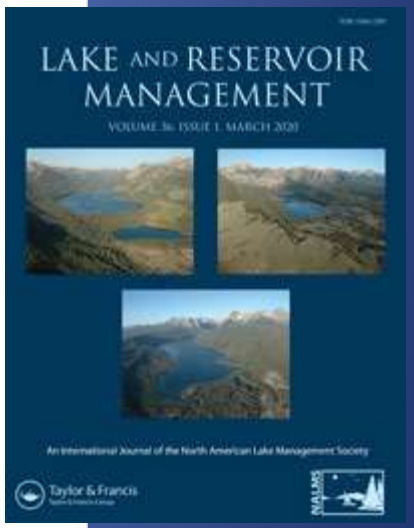
ABSTRACT

Magee, MR, Hein CL, Walsh JR, Shannon PD, Vander Zanden MJ, Campbell TB, Hansen GJA, Hauxwell J, LaLiberte, GD, Parks TP, Sass GG, Swanston CW, Janowiak MK. 2019. Scientific advances and adaptation strategies for Wisconsin lakes facing climate change. Lake Reserv Manage. XX:XXX–XXX.

Climate change threatens inland lakes, which are highly valued for their ecological and economic benefits. Here, we synthesize adaptation strategies that could offset climate impacts on Midwestern lakes. Our synthesis is based on results from the Wisconsin Initiative on Climate Change Impacts lake adaptation workshop, in which 48 researchers and managers with expertise on Wisconsin's inland lakes gathered to provide input on climate adaptation strategies. We identified recent scientific

KEYWORDS

AIS; climate adaptation; climate change; fisheries; inland lakes; lake levels; water quality



Magee et al., 2019 Lake and Reservoir Management 35:4, 364-381.
Contact Madeline Magee for more info: Madeline.Magee@wisconsin.gov

Menus of Adaptation Options

Forest Carbon Management

Forests

Urban Forests

Forested Watersheds

Wetlands

Agriculture

Tribal Perspectives

Recreation

Wildlife*

Coastal*

Use these menus with the **Adaptation Workbook**!

*In progress

What do Adaptation Menus offer?

- ✓ Key ecosystem characteristics and how climate change can affect them
- ✓ A logical framework that helps you consider possible adaptation responses
- ✓ Starts broad and gradually gets more specific

Adaptation Workshops

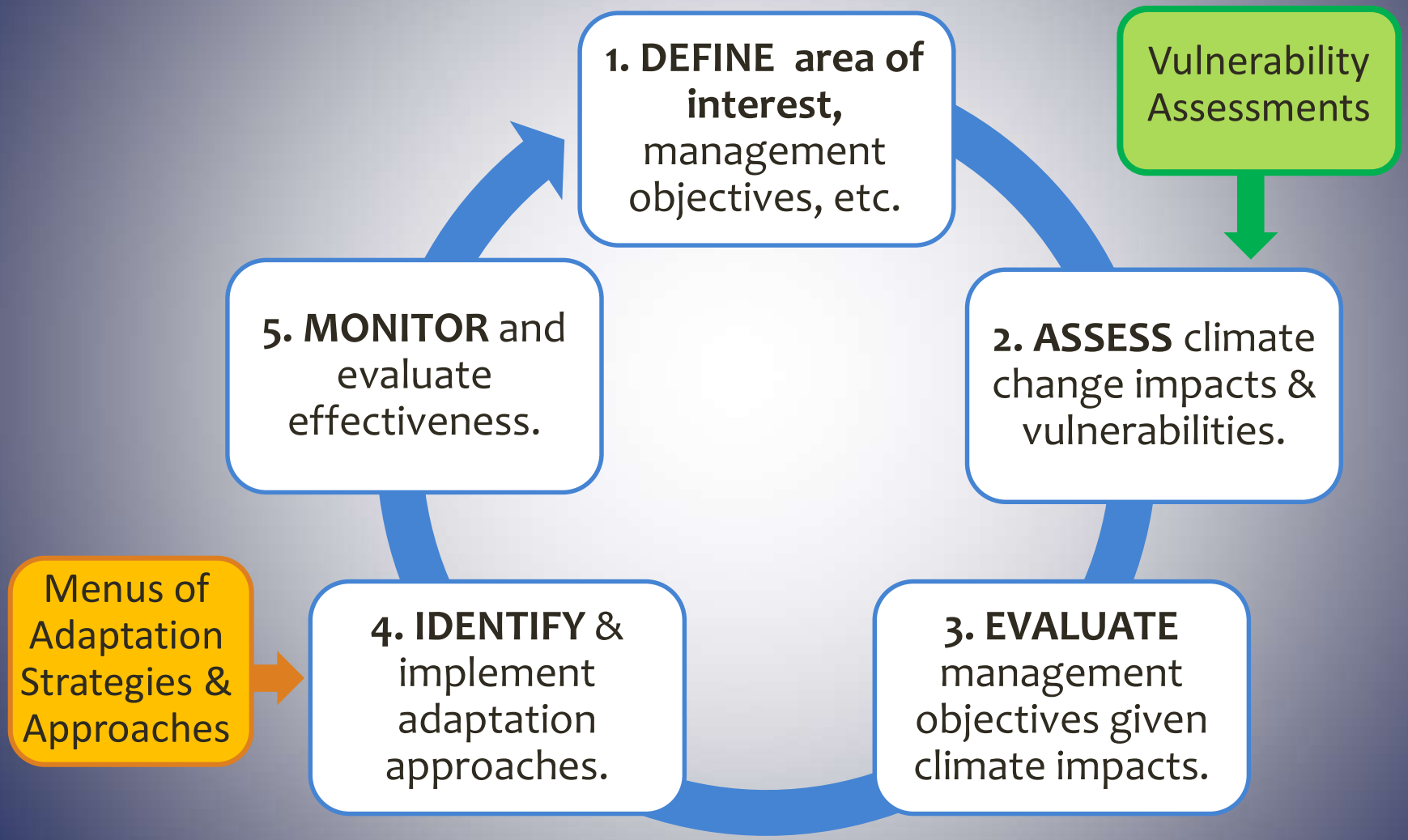
Adaptation Workbook

a climate change tool for land management and conservation

NIACS
Northern Institute of Applied Climate Science

adaptationworkbook.org

Adaptation Workbook Process

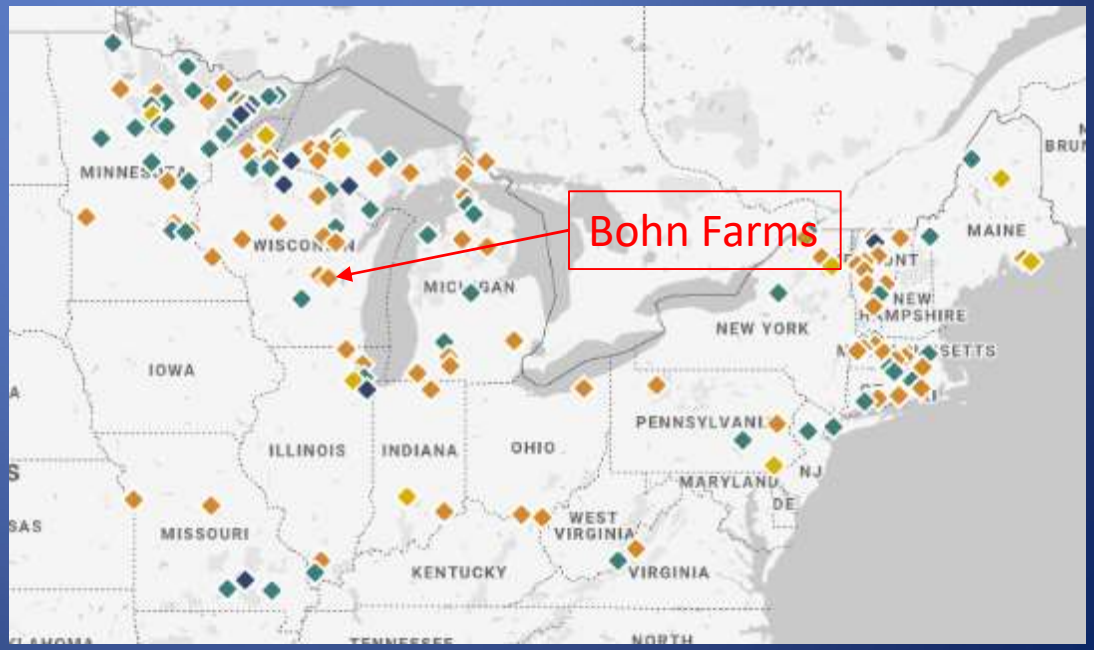


Swanston et al. 2016 (2nd edition) www.nrs.fs.fed.us/pubs/52760

Climate Adaptation Demonstration Sites

Goals:

- Real-life examples of approaches and tactics at work
- Diverse project types, sizes, and management goals
- Long-term monitoring
- Field tours



Demonstration sites on the NIACS Climate Change Response Framework website: adaptation.org

Bohn Farms Demo Site

Adaptation Workbook Results

Bohn Farms Demo Site

Adaptation Workbook Results

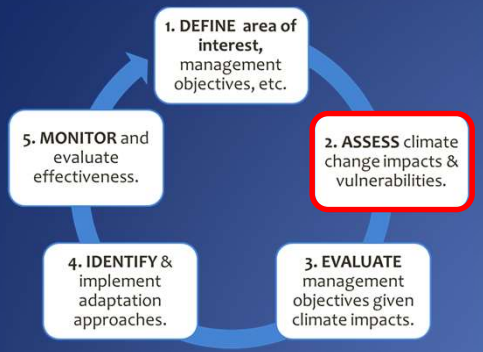
Step 1: DEFINE MANAGEMENT OBJECTIVES

Example Management Goal

- Restore drained cropland to diverse native herbaceous wetlands.

Example Management Objective

- Restore hydrology through grading and installation of water control features
- Plant wet prairie and sedge meadow species



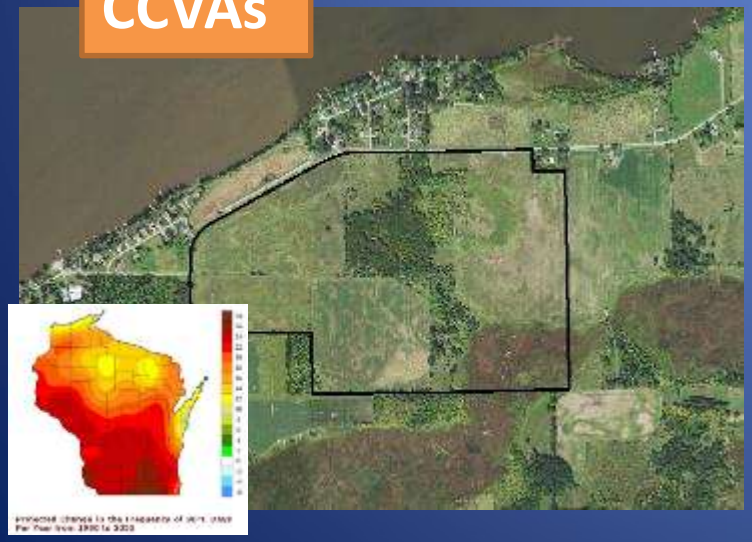
Bohn Farms Demo Site

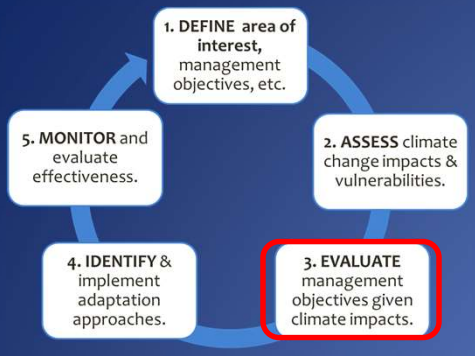
Adaptation Workbook Results

Step 2: ASSESS SITE VULNERABILITY

- More frequent and intense rain events
  - ↑ runoff
  - High in watershed
- Longer growing seasons with droughty conditions, extreme heat

CCVAs





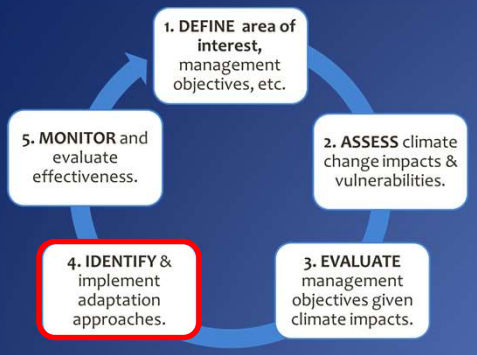
Bohn Farms Demo Site

Adaptation Workbook Results

Step 3: EVALUATE MANAGEMENT OBJECTIVES

Plant seed and plugs of wet prairie and sedge meadow species in former croplands??

Challenges	Opportunities
Heavy rainfalls could wash away seed, uproot plants during vulnerable life stages	Wetland plants adapted to fluctuating water levels
Drought could wipe out young plantings	Prairie plants resilient to heat and drought
↑ invasives	Northern edge of many species' ranges



Bohn Farms Demo Site

Adaptation Workbook Results

Step 4: IDENTIFY ADAPTATION TACTICS

Proposed Tactic	Benefits	Drawbacks/ Barriers	Practicability	Recommend?
Seed diverse mix of drought- and inundation-tolerant spp across gradients	Species will sort themselves out, diversity hedges bets for survival	Expense	High	Yes
Create hummocks and depressions through deliberate grading	More microsites for plants as water/moisture levels fluctuate	Expense	High	Yes

Bohn Farms Demo Site

Adaptation Workbook Results

Step 5: MONITOR EFFECTIVENESS

Tactic	Monitoring Variable	Evaluation Criteria	Implementation
Seed diverse mix of drought- and inundation-tolerant species across gradients	• Species diversity • Native cover	• Minimum of 20 native species • >75% cover of native wetland plants	• Timed meander surveys • Quadrats

Workshop Product: A completed Workbook!

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

What climate change impacts and vulnerabilties are are most imporant to this particular site?

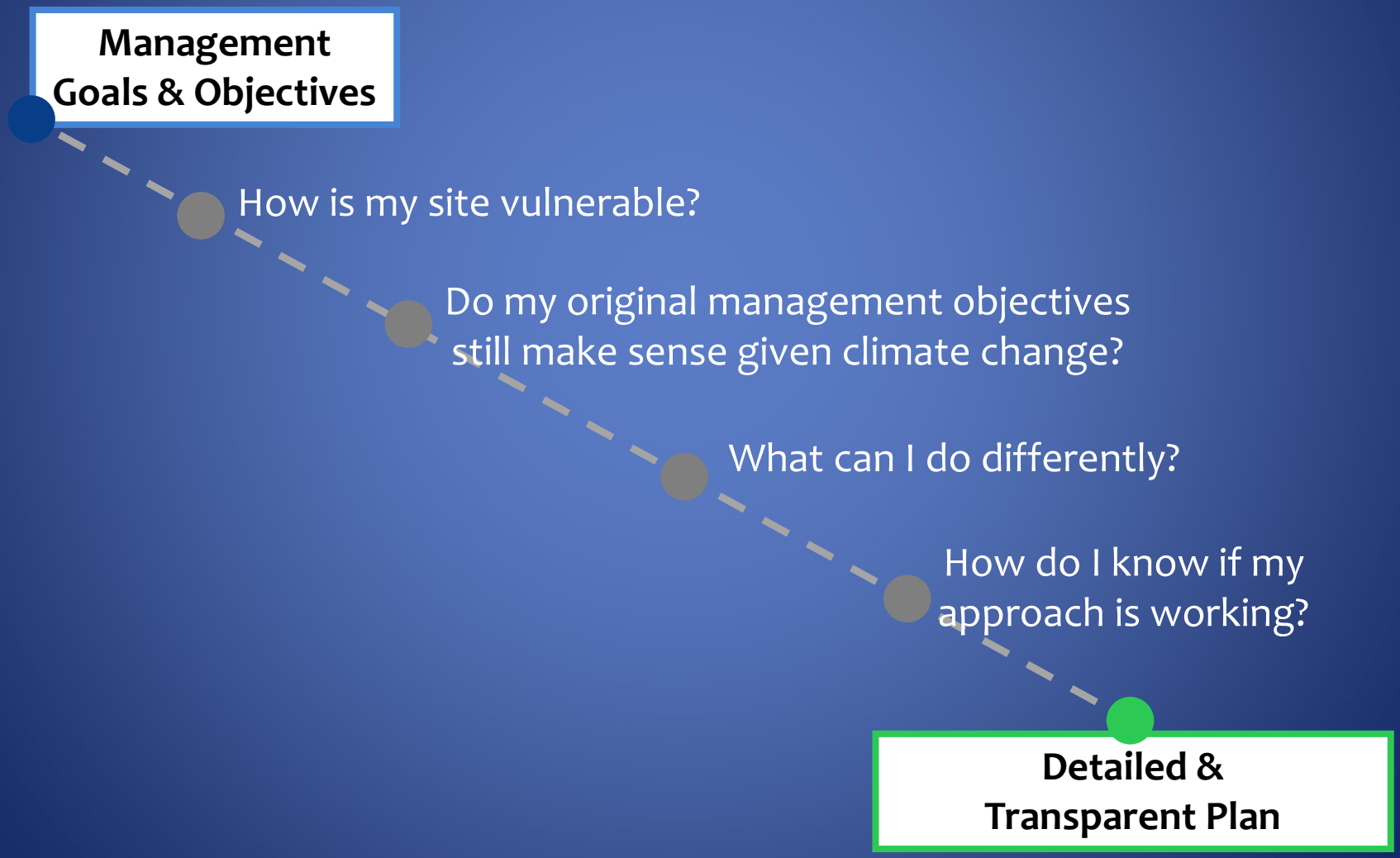
Ecosystem Type or Management Topic (from Step #1)	Regional Climate Change Impacts and Vulnerabilities	Climate Change Impacts and Vulnerabilities for the Project Area or Property	Vulnerability Determination
Wet Prairie *(Guide to thought process: How might your generic wet prairie planting list be vulnerable to climate change? Other factors relating to soils, hydrology, etc.?)*		Wet prairie species will be more flexible to accommodate fluctuating water levels, drought. Native prairie species are intrinsically adapted to drought. Prairie cord-grass (Spartina pectinata) already present, will likely fare well in future, can tolerate inundation. Plants like Glyceria may not due well if soils don't remain consistently saturated. Can include FACU species in seed mix to ensure all microtopographic niches are occupied. Will be more resilient with a high number of wet- to wet-mesic species.	Low-Medium
Sedge meadow		In reference sedge meadows near Bohn Farms, there is a lot of Canada bluejoint grass (Calamagrostis canadensis) and lake sedge (Carex lacustris), along with sedge meadow species associated with southern sedge meadow (rather than northern sedge meadow), so selecting species that trend southward will be important. But position in Tension Zone offers flexibility for using both northern and southern species. Threat of invasives high, since reed canary grass (Phalaris arundinacea) and Phragmites are already on site, and non-native cat-tails (Typha sp.) is nearby. Site lies high in watershed, will receive little runoff and	Medium

1-DEFINE goals and objectives | 2-ASSESS | 3-EVALUATE | 4-IDENTIFY | 5-MONITOR

Final Outcome:
A more climate-ready site and a new demonstration site!

Connecting the Dots

A clear train of thought shows ***intentionality***



Will your lacustrine or riparian wetland be our next demonstration site?

- Adaptation workshops are free and flexible
- 1 ½ - 5 days, typically

Contacts:

- Danielle Shannon, USDA Northern Forests Climate Hub Coordinator, dshannon@mtu.edu
- Amy Staffen, co-chair, WICCI Plants & Natural Communities Working Group, amy.staffen@wisconsin.gov

Where to Learn More

Northern Institute of Applied Climate Science (NIACS)

- *forestadaptation.org* (adaptation menus, demonstration sites, etc.)
- *adaptationworkbook.org* (Adaptation Workbook)
- *nrs.fs.fed.us/pubs/46393* (northern forest CCVA)

Wisconsin Initiative on Climate Change Impacts *wicci.wisc.edu*

- WICCI Plants and Natural Communities Working Group → CCVAs outside of northern forest
- WICCI Water Resources Working Group and others!

Questions?

amy.staffen@wisconsin.gov