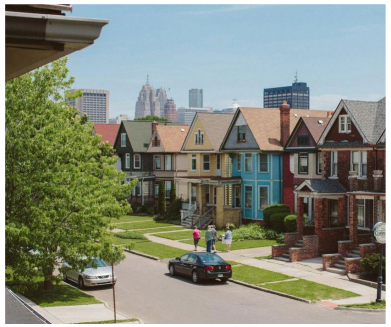
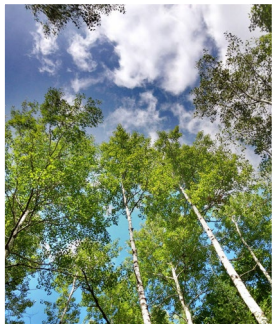
Forestry for Birds in a Changing Climate:
Adaptation Resources

October 2023





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WICCI
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Adaptation means taking action in preparation or in response to climate change.




Adaptation means taking action in preparation or in response to climate change (and still meeting your goals)







Adaptation actions are designed to **intentionally** address climate change impacts and vulnerabilities *in order to meet goals and objectives*

Climate Change Adaptation

If you want a single “answer” for how to respond to climate change, it’s

“It depends”

It depends on **where** you are working and **what** you’re trying to achieve.

Adaptation Resources

Where to get help?




WICCI

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wicci.wisc.edu

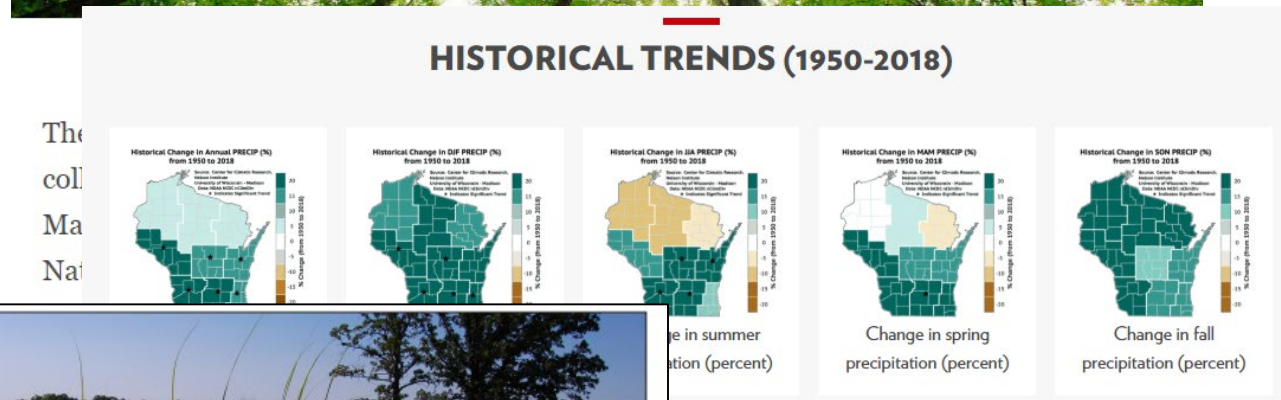
WICCI Climate Assessment Report

2021

The impacts of our warming climate on Wisconsin residents

Wisconsin Initiative on Climate Change Impacts

- Useful information!
- Forestry, Water Resources, Fisheries, Plants and Natural Communities, etc.
- Links to climate maps, recorded presentations, vulnerability assessments, etc



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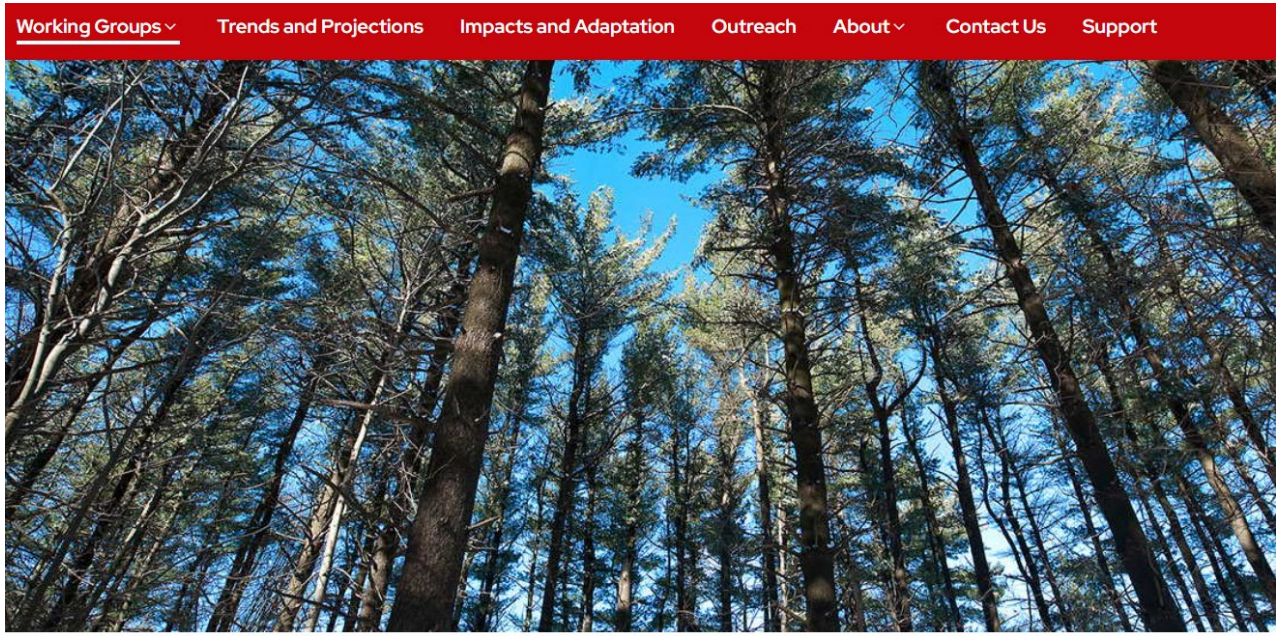
https://wicci.wisc.edu/

FORESTRY WORKING GROUP

wicci.wisc.edu/forestry-working-group/



Share information across the forestry community about climate change impacts, adaptation, and mitigation.

Help foresters and land managers develop real-world actions to prepare for a changing climate.

Climate Change Response Framework

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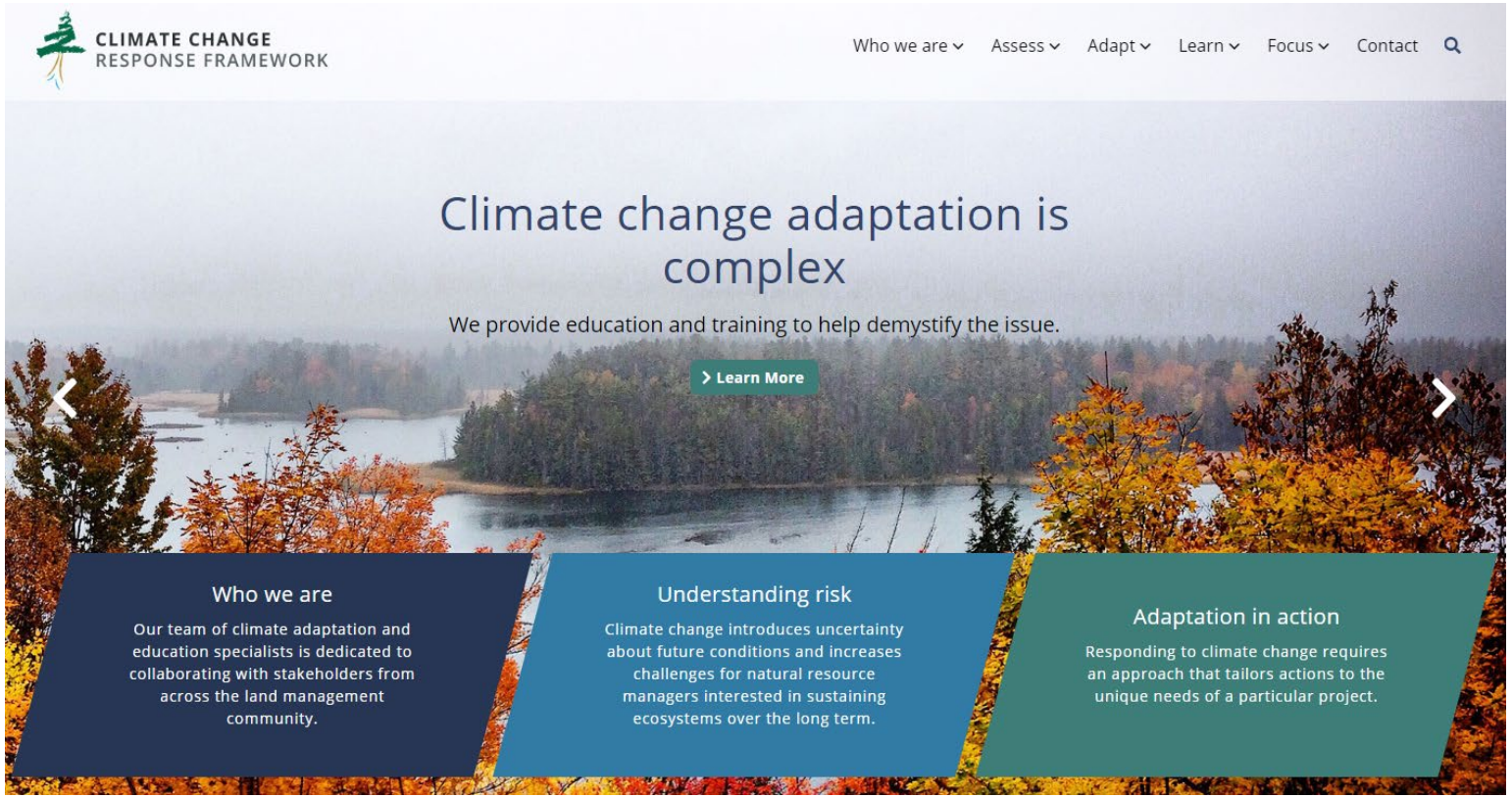


www.forestadaptation.org

Used throughout Upper Midwest and Northeast

Adaptation Workshops

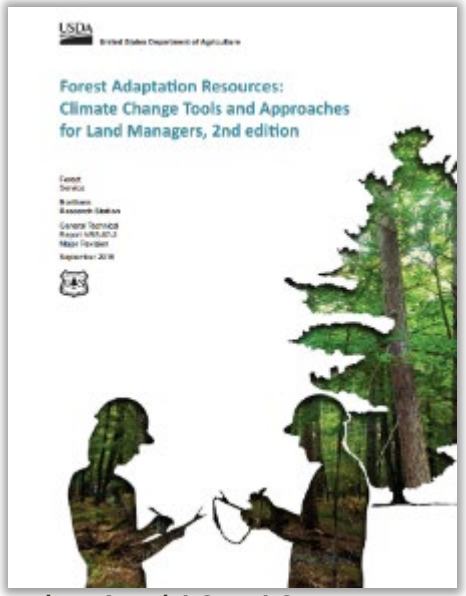
Forest Adaptation Resources

Adaptation workbook …

1) Process to identify climate impacts and how they might impact your goals

and

2) menu of adaptation strategies and approaches to select from



www.nrs.fs.fed.us/pubs/40543

- Designed for a variety of landowners with diverse goals
- Does not make recommendations
- Online version!

www.AdaptationWorkbook.org

Adaptation Menus

- Forests
- Urban Forests
- Agriculture
- Forested Watersheds
- Tribal Perspectives
- Forest Carbon Management
- Recreation
- Wetlands (non-forested)
- Wildlife
- Fire-adapted ecosystems

- Great Lakes Coastal Ecosystems
- Grasslands*

Menu of Adaptation Strategies and Approaches

Developed for forests

Strategy 1: Sustain fundamental ecological functions.
1.1. Reduce impacts to soils and nutrient cycling.
1.2. Maintain or restore hydrology.
1.3. Maintain or restore riparian areas.
1.4. Reduce competition for moisture, nutrients, and light.
1.5. Restore or maintain fire in fire-adapted ecosystems.

Strategy 2: Reduce the impact of biological stressors.
2.1. Maintain or improve the ability of forests to resist pests and pathogens.
2.2. Prevent the introduction and establishment of invasive plant species and remove existing invasive species.
2.3. Manage herbivory to promote regeneration of desired species.

Strategy 3: Reduce the risk and long-term impacts of severe disturbances.
3.1. Alter forest structure or composition to reduce risk or severity of wildfire.
3.2. Establish fuelbreaks to slow the spread of catastrophic fire.
3.3. Alter forest structure to reduce severity or extent of wind and ice damage.
3.4. Promptly revegetate sites after disturbance.

Strategy 4: Maintain or create refugia.
4.1. Prioritize and maintain unique sites.
4.2. Prioritize and maintain sensitive or at-risk species or communities.
4.3. Establish artificial reserves for at-risk and displaced species.

Strategy 5: Maintain and enhance species and structural diversity.
5.1. Promote diverse age classes.
5.2. Maintain and restore diversity of native species.
5.3. Retain biological legacies.
5.4. Establish reserves to maintain ecosystem diversity.

Strategy 6: Increase ecosystem redundancy across the landscape.
6.1. Manage habitats over a range of sites and conditions.
6.2. Expand the boundaries of reserves to increase diversity.

Strategy 7: Promote landscape connectivity.
7.1. Reduce landscape fragmentation.
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Strategy 8: Maintain and enhance genetic diversity.
8.1. Use seeds, germplasm, and other genetic material from across a greater geographic range.
8.2. Favor existing genotypes that are better adapted to future conditions.

Strategy 9: Facilitate community adjustments through species transitions.
9.1. Favor or restore native species that are expected to be adapted to future conditions.
9.2. Establish or encourage new mixes of native species.
9.3. Guide changes in species composition at early stages of stand development.
9.4. Protect future-adapted seedlings and saplings.
9.5. Disfavor species that are distinctly maladapted.
9.6. Manage for species and genotypes with wide moisture and temperature tolerances.
9.7. Introduce species that are expected to be adapted to future conditions.
9.8. Move at-risk species to locations that are expected to provide habitat.

Strategy 10: Realign ecosystems after disturbance.
10.1 Promptly revegetate sites after disturbance.
10.2. Allow for areas of natural regeneration to test for future-adapted species.
10.3. Realign significantly disrupted ecosystems to meet expected future conditions.

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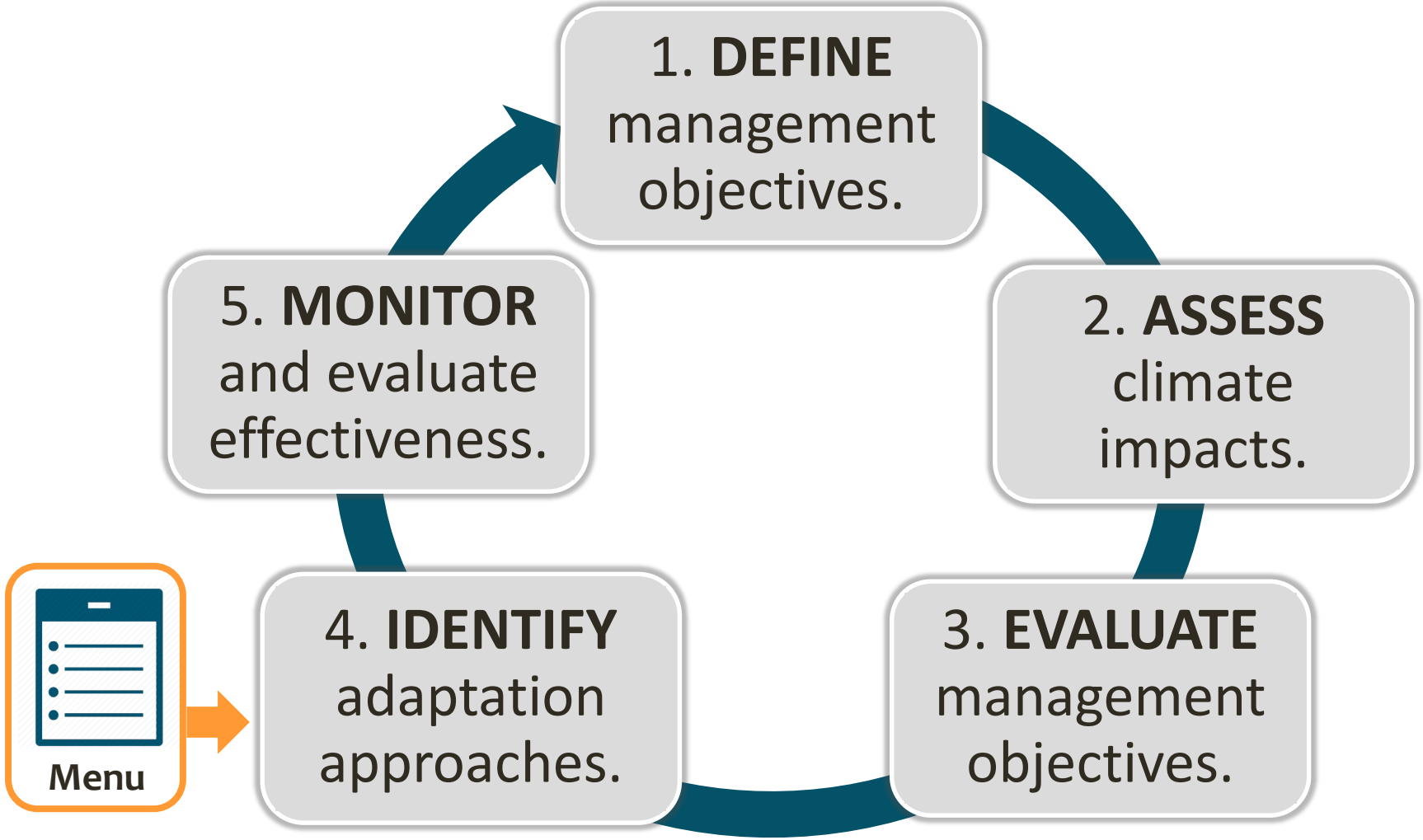
To be used in the Adaptation Workbook decision-support framework – Swanston et al, 2016. Forest Adaptation Resources: climate change tools and approaches for land managers, 2nd edition http://www.treesearch.fs.fed.us/pubs/52760 ***More information can be found at*** *www.forestadaptation.org/strategies*

www.adaptationworkbook.org

Adaptation Workbook



Adaptation Menus

Brunch

Classics

Lemon Ricotta Pancakes Whipped Mascarpone Maple, Berries	15	**AJ's Omelet** Fontal Cheese, Spinach, Mushrooms	14
Cornflake Crusted French Toast Berries, Maple Syrup	15	**Eggs Florentine** Spicy Capicola, House-Made Cheddar Biscuit, Spinach	15
Bacon, Egg & Cheese Bacon, Two Eggs, Taleggio Cheese, Ciabatta	14	**Porchetta Hash** Poached Egg, Calabrian Chili Hollandaise	16
Avocado Toast Poached Eggs, Tomatoes, Chili Flakes, Sea Salt	15	**Chia Pudding** Chia Seeds, Toasted Coconut, Banana, Strawberry	14
Chicken Parmigiana Spicy Marinara, Fresh Mozzarella	22	**Farmhouse Breakfast** Two Eggs, House-Made Cheddar Biscuit, Chicken Sausage	14
Squid Ink fettuccine Vongole Little Neck Clams, Garlic, White Wine, Butter, Chili	22	**Chicken Kale Caesar** Chicken, Kale, Croutons	16

Create Your Own Pasta

Shapes

Rigatoni Semolina, All-Purpose Flour, Olive Oil	14
Cavatelli All-Purpose Flour, Durum Flour, Eggs, Ricotta	15
Tagliatelle All-Purpose Flour, Durum Flour, Eggs	15
Gluten-Free Rigatoni Gluten-Free All-Purpose Flour, Olive Oil, Eggs	16
Spaghetti Semolina, Durum Flour, Olive Oil	15
Four Cheese Herb Ravioli Fontal, Ricotta, Parmesan, Pecorino	18

Sauces

Marinara San Marzano tomatoes, Garlic, White Wine, Basil, Chili	
Arrabiata All-Purpose Flour, Durum Flour, Eggs, Ricotta	+1
Broken Meatball House Tomato Sauce with the Addition of Broken Meatballs	+4
Sunday Sauce House Tomato Sauce with Short Rib, Sausage, Veal	+4
Roasted Garlic Pecorino Semolina, Durum Flour, Olive Oil	+2
Carbonara Pancetta, Eggs, Peas, Pecorino	+3

Sides

Pecorino Truffle Fries	8
Potato Hash	6
Bacon	6
Turkey Sausage	6
Field Greens	7
Two Eggs Any Style	6
Beignets	8
Baked Goods	10

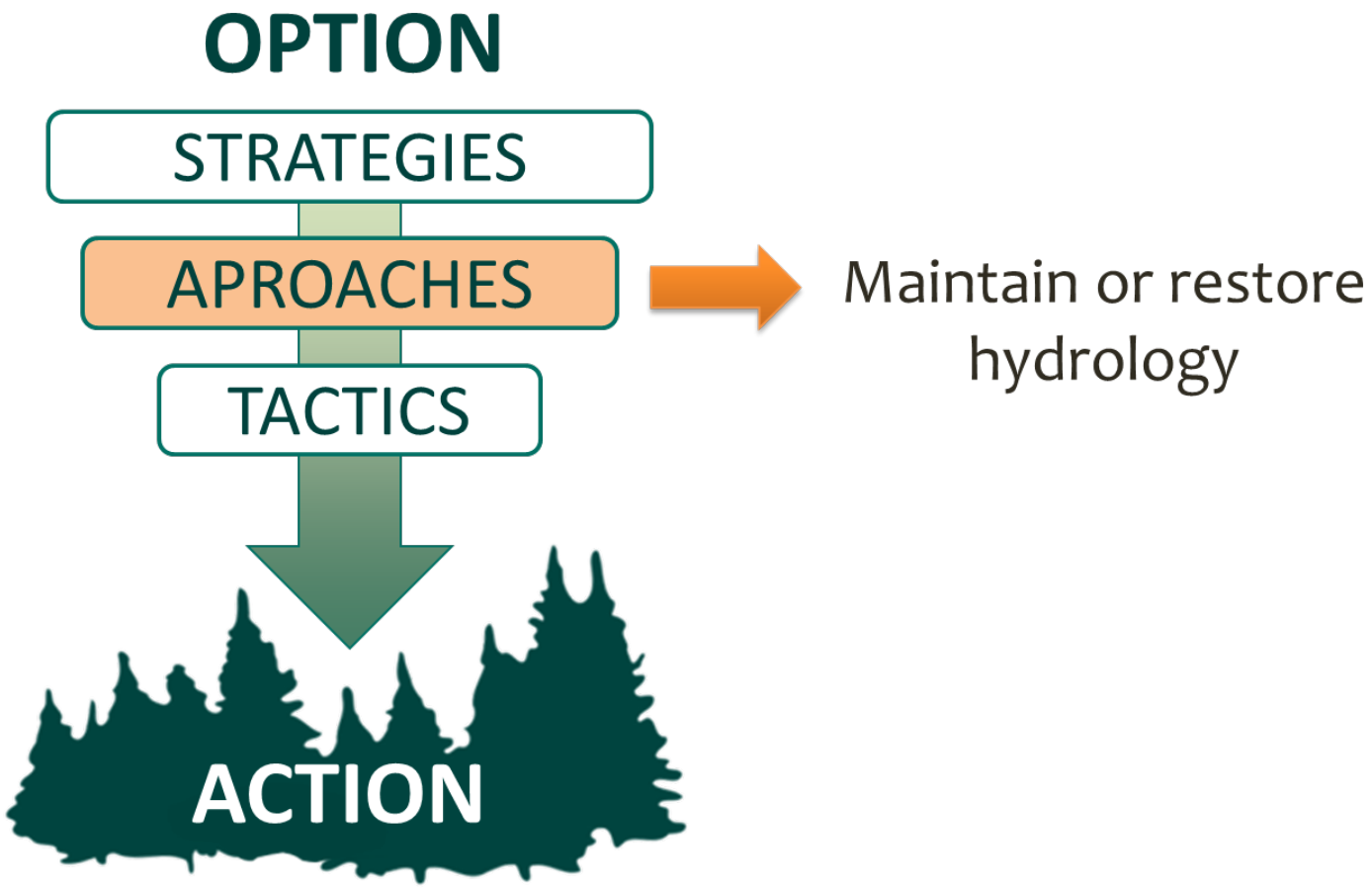
Brunch Cocktails

Bloody Mary Vodka, Spiced Fresh DOP Tomato Juice, Horseradish	10/45
Cointreau Spritz Cointreau Spritz, Aperol, Crème de Peche, Sparkling Wine	12/55
Green Side Reyka Vodka, Green Juice, Lemon	12/55
Morning Derby Bourbon, Grapefruit, Ginger, Carrot Juice	12/55
Sangria Red Wine, Fresh Fruit, Pisco, Crème de Peche	10/45
Firing Squad Milagros Tequila, Cointreau, Fresh Lime, Grenadine	12/55
Tall Mimosa Reyka Vodka, Cointreau, Jake's Mimosa Juice, Sparkling Wine	12/55

Adaptation Menu: example

Sustain fundamental ecological functions

Adaptation Menus: example



Adaptation Menu: example

Install water control structures at road crossing to maintain peatland water level

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Strategy 1: Sustain Fundamental Ecological Functions

Approaches:

- Reduce impacts to soils and nutrient cycling
- Maintain or restore hydrology
- Maintain or restore riparian areas
- Reduce competition for moisture, nutrients, light
- Restore or maintain fire in fire-adapted ecosystems

Tactic: In spruce grouse habitat,
ID roads that can affect hydrology

Reduce Impacts of Biological Stressors

Approaches:

- Maintain ability to restore or resist pests and pathogens
- Prevent introduction and establishment of invasive species and remove existing
- Manage herbivory to promote regeneration of desired species

Tactic: protect long-lived conifer seedlings with deer exclosures

Reduce risk and impacts of severe disturbances

Approaches:

- Alter forest structure and composition to reduce severity of wildfire, wind, and ice damage
- Establish fuel breaks to slow spread of fire
- Promptly revegetate sites after disturbance

Tactic: create fuel breaks along roads adjacent to KW habitat blocks

Maintain or Create Refugia

Approaches:

- Prioritize and maintain unique sites
- Prioritize and maintain sensitive or at-risk species, communities

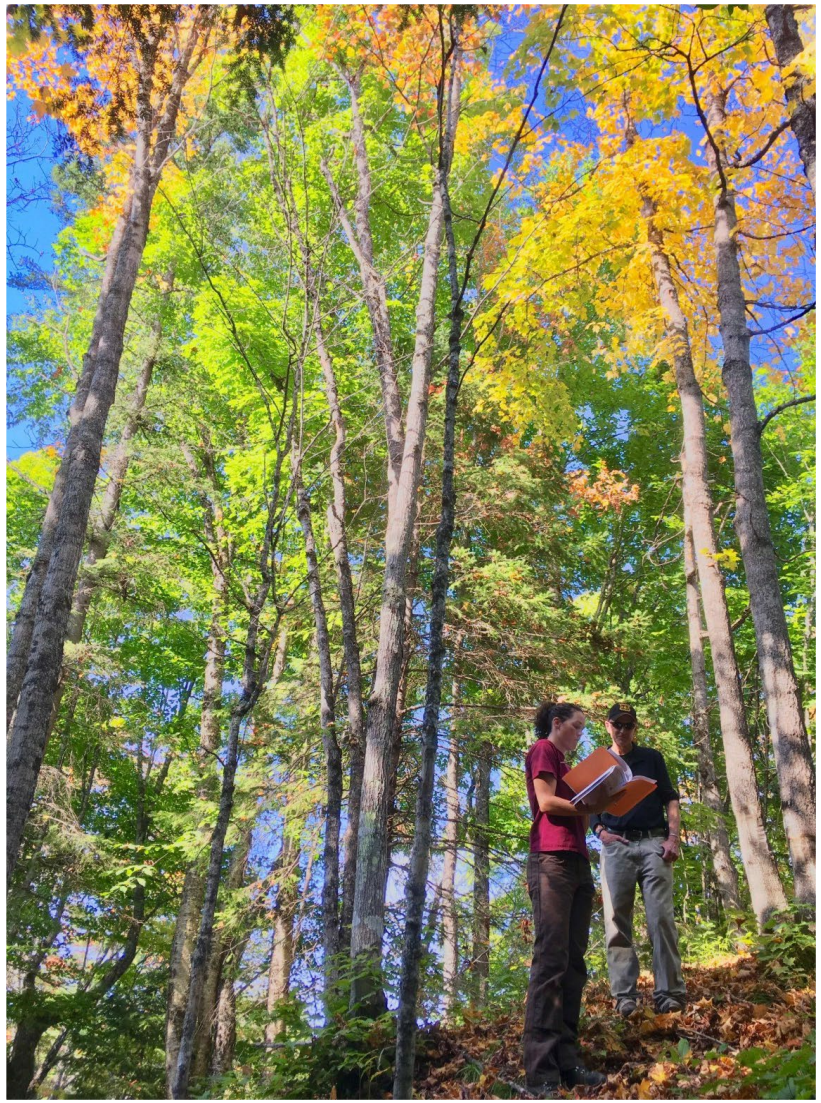
Tactic: re-route roads or trails away from occupied habitat to reduce risk of introducing invasive species

Maintain and enhance species & structural diversity

Approaches:

- Promote diverse age class
- Maintain and restore diversity of native species
- Retain biological legacies
- Establish reserves to maintain ecosystem diversity

Tactic: reserve conifer in transition zones between upland and lowlands



Increase ecosystem redundancy across the landscape

Approaches:

- Manage habitats over a range of sites and conditions
- Expand boundaries of reserves to increase diversity

Tactic: develop a network of reserves with adequate representation across ecological units

Promote landscape connectivity

Approaches:

- Reduce landscape fragmentation
- Maintain or create habitat corridors through restoration or reforestation

Tactic: restore or enhance habitat features in riparian areas

Maintain and enhance genetic diversity

Approaches:

- Use seeds, germplasm, and other genetic material from across a greater geographic range
- Favor existing genotypes that are better adapted to future conditions

Tactic: retain some survivors of die-back events rather than salvage all

Facilitate community adjustments thru species transitions

Approaches:

- Favor or restore native species that are expected to be adapted to future conditions
- Establish or encourage new mixes of native species
- Protect future-adapted seedlings and saplings

Tactic: release work around young oak, pine, and other drought-tolerant species

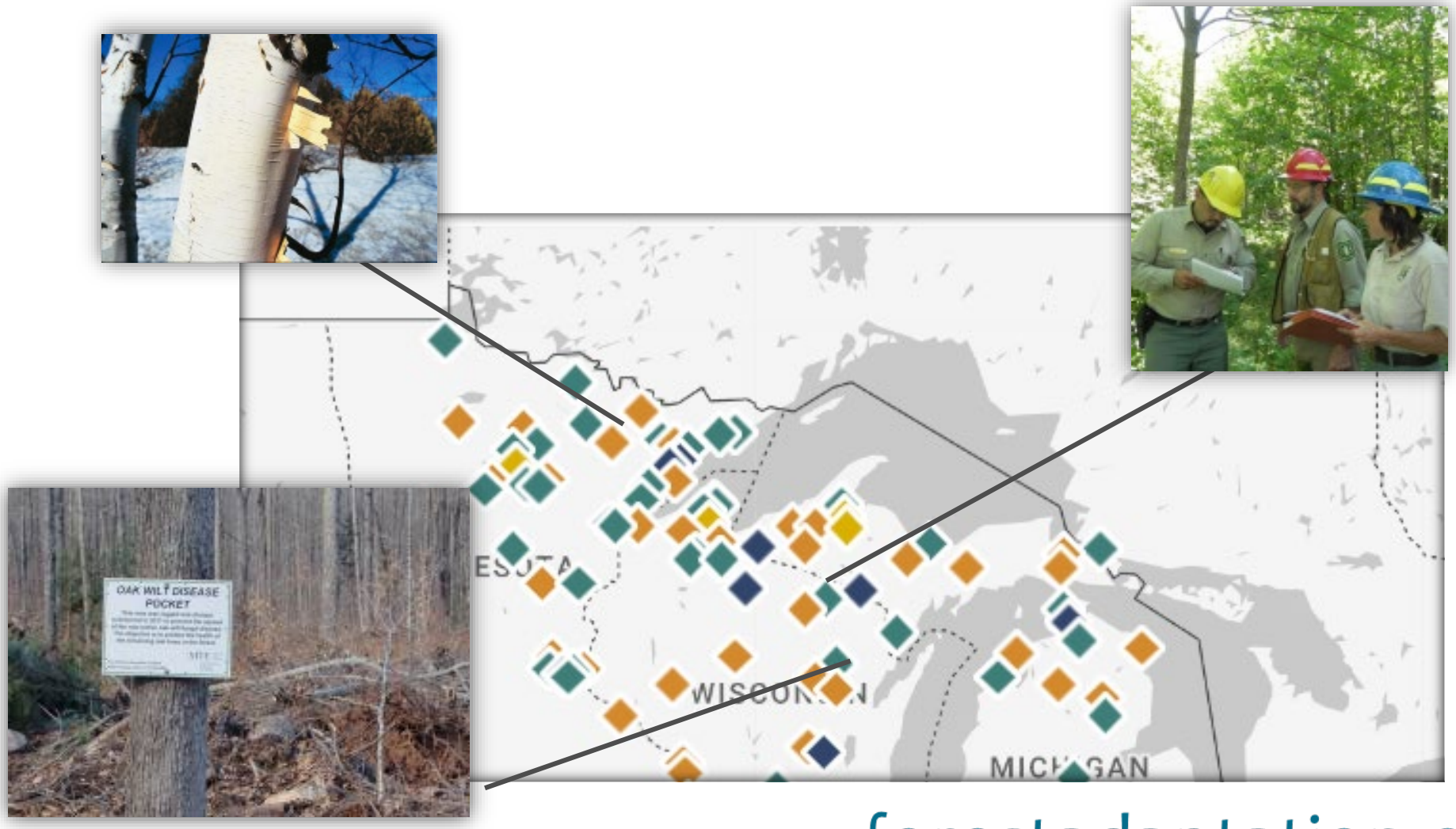
Realign ecosystems after disturbance

Approaches:

- Promptly revegetate sites
- Allow for areas of natural regeneration to test for future-adapted species

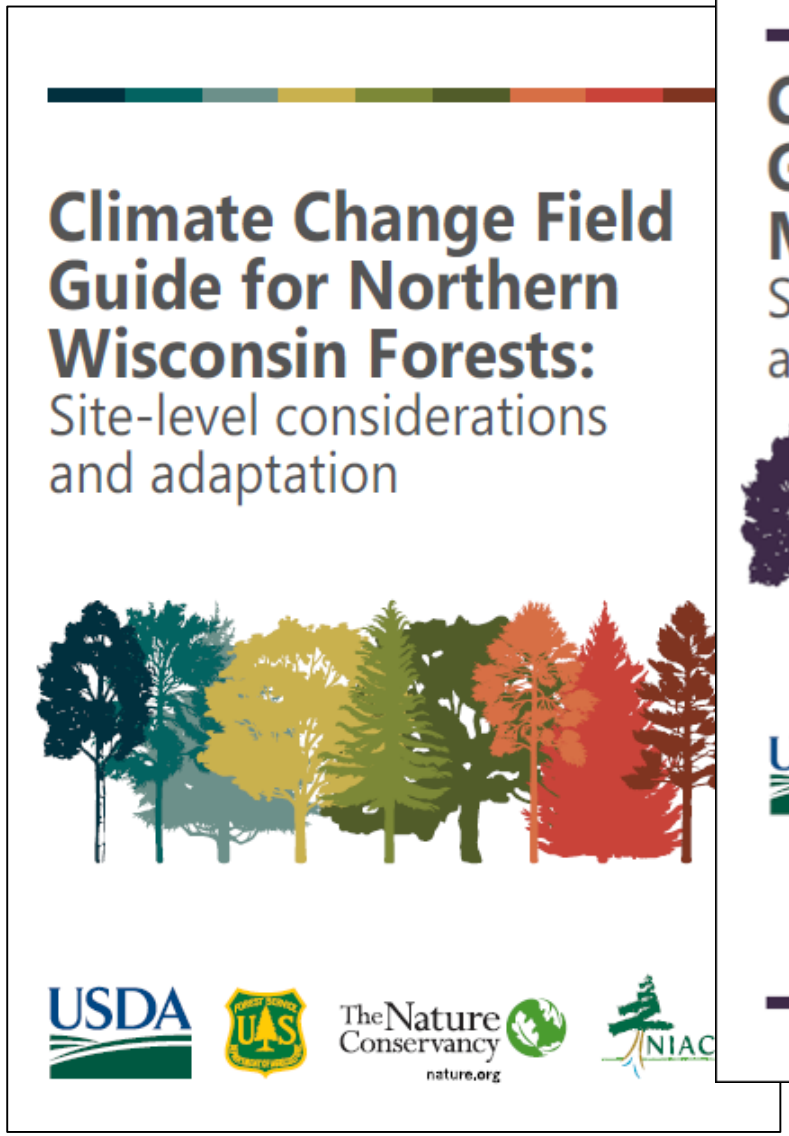
Tactic: plant future-adapted species

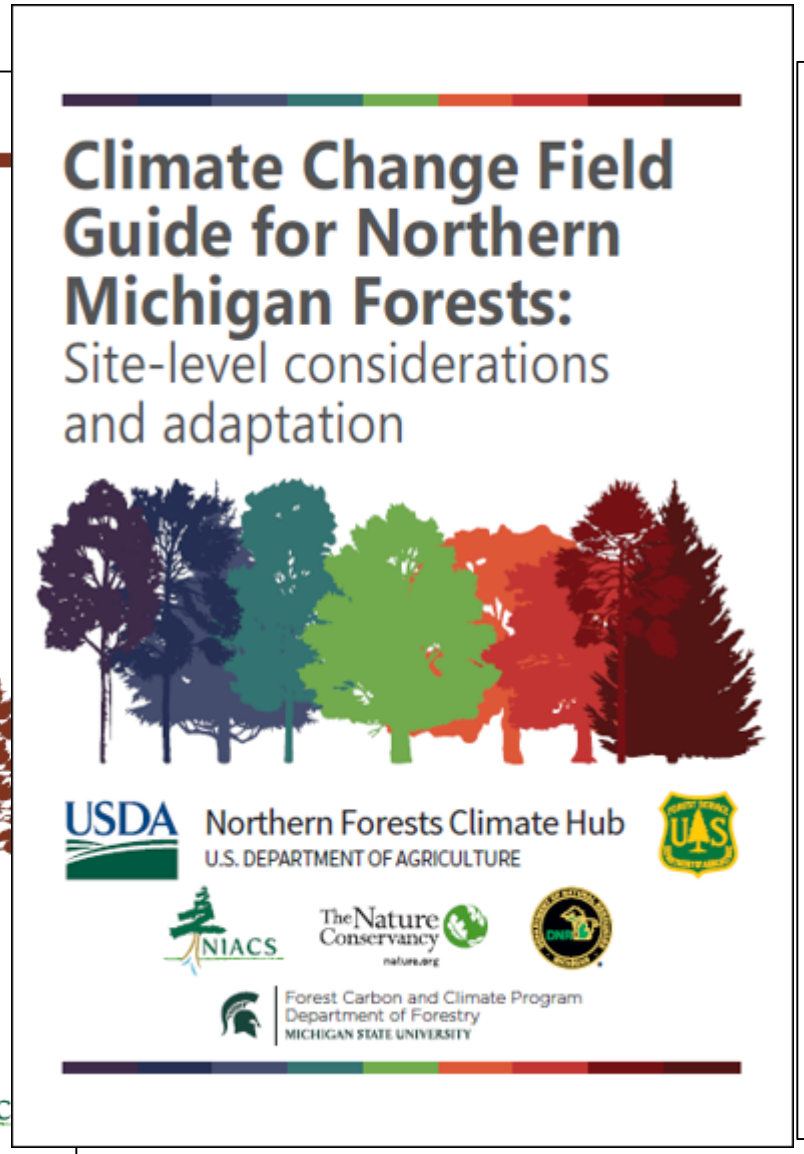
Adaptation Demonstrations

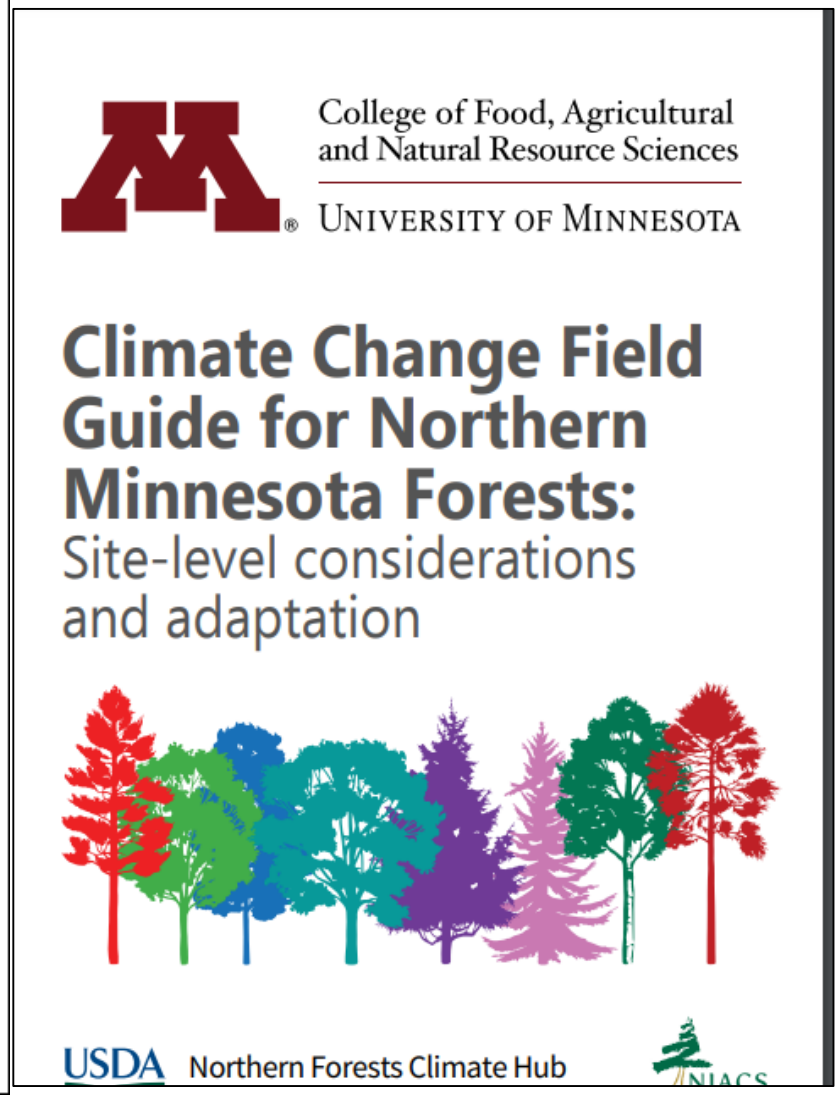


www.forestadaptation.org

Climate Change Field Guides







Impacts by Forest Type

OAK BARRENS

222 K, L, R

Related DNR Forest Cover Types:
Oak, Jack pine, Red pine, White pine

Community Description

Occurs on drought-prone sites with sandy, nutrient-poor soil, typically outwash or lake plains and sandy terraces or thin soils over bedrock.

Trees are scattered or in groves, supporting sand prairie species, blueberry, or huckleberry.

Regular surface fire was the primary disturbance driving open structure and composition (5-20 year interval).

Major tree species: Black oak, with possible white, bur, and northern pin oak.

OAK BARRENS

60

61

Climate Change Vulnerability

Overall Vulnerability:
Will this community experience declining health, reduced extent, or identity changes by 2100?

Moderate-Low

Confidence:
How much evidence is available from research and observations? Does the evidence tend to agree or conflict?

Medium-high evidence

Medium-high agreement

Climate Change Impacts: Neutral

The primary tree species in oak barrens (black, bur, and white oak) are expected to maintain or gain suitable habitat over the next century.

Increasing drought risk may slow or reduce the risk of mesic species encroachment in oak barrens.

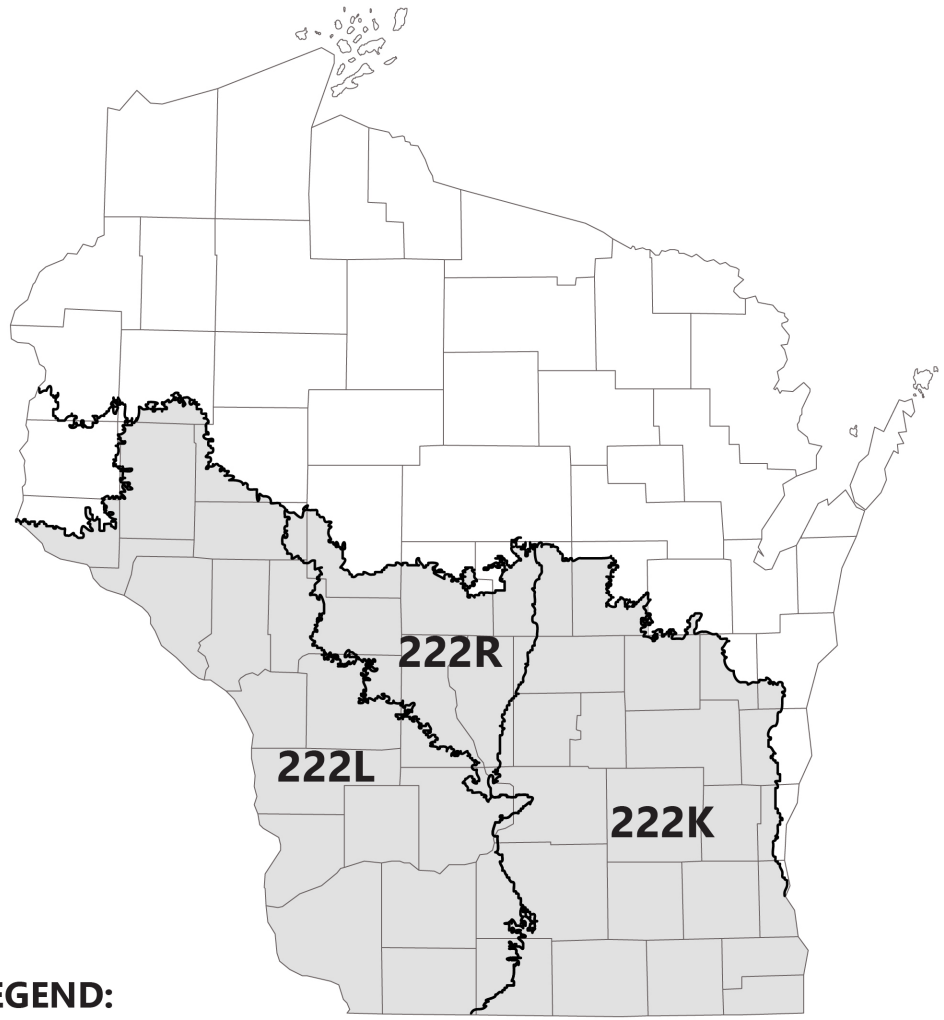
Species such as spotted knapweed, bluegrasses, brambles, or Pennsylvania sedge that can limit overall site diversity may benefit from longer growing seasons.

Shifting conditions may make it more difficult to apply prescribed fire in this community using conventional approaches.

https://wicci.wisc.edu/forestry-working-group/

Tree Species Projections by Eco Section

SPECIES	ADAPT	ABUN	LOW CLIMATE CHANGE (RCP 4.5) HABITAT CHANGE	LOW CLIMATE CHANGE (RCP 4.5) CAPABILITY	HIGH CLIMATE CHANGE (RCP 8.5) HABITAT CHANGE	HIGH CLIMATE CHANGE (RCP 8.5) CAPABILITY
Mockernut hickory	+	–	★		★	
Northern pin oak	+	•	▼	○	▼	○
Northern red oak	+	+	●	△	▼	△
Northern white-cedar	•	+	▼	▽	●	▽
Osage-orange	+	–	★		★	
Paper birch	•	•	▼	▽	▼	▽
Pecan*	–	–	★		★	
Pignut hickory	•	–	★		★	
Pin cherry*	•	+	▼	▽	▼	▽
Post oak	+	–	★		★	
Quaking aspen	•	•	▼	▽	▼	▽
Red maple	+	•	▼	○	▼	○
Red mulberry*	•	•	●	○	●	○
Red pine	–	•	▼	▽	▼	▽
River birch*	•	+	▼	▽	▼	▽
Sassafras*	•	–	★		★	
Scarlet oak	•	–	★		★	



https://forestadaptation.org/learn/resource-finder/tree-species-projections-ecological-sections-southern-wisconsin

Northwoods forests will be affected by a changing climate during this century, but individual tree species will respond uniquely to climate change, depending on their particular silvics and ecological tolerances. These handouts summarize general climate change projections for tree species across several large landscapes in Minnesota, Wisconsin, and Michigan based on future projections from the **Climate Change Tree Atlas**. The general trends derived from these models can be combined with local knowledge and management experience to judge risk on a particular site. Find the **regional vulnerability assessments** for a detailed analysis and summary.

The following documents provide summarized lists of projected tree species responses to climate change.

- Northern Minnesota
- Northern Wisconsin and the Western Upper Peninsula of Michigan
- Eastern Upper Peninsula and Northern Lower Peninsula of Michigan
- Southern Michigan

Climate Change projections for tree species for MN, WI, MI

Forestadaptation.org

This region's forests will be affected by a changing climate and other stressors during this century. A team of managers and researchers created an assessment that describes the vulnerability of forests in northern Wisconsin and western Upper Michigan (Janowiak et al. 2014). This report includes information on observed and future climate trends, and also summarizes key vulnerabilities for forested natural communities. The Landscape Change Research Group recently updated the Climate Change Tree Atlas, and this handout summarizes that information. Full Tree Atlas results are available online at www.fs.fed.us/nrs/atlas/. Two climate scenarios are presented to "bracket" a range of possible futures. These future climate projections (2070 to 2099) provide information about how individual tree species may respond to a changing climate. Results for "low" and "high" emissions scenarios can be compared on the reverse side

CLIMATE CHANGE CAPABILITY

POOR CAPABILITY	
American hornbeam	Ohio buckeye
American mountain-ash	Pin cherry
Balsam fir	Red pine
Balsam poplar	River birch
Black ash	Serviceberry
Black maple	Striped maple
Black spruce	Tamarack (native)
Black willow	White sprice
Eastern hemlock	Yellow birch
Mountain maple	

FAIR CAPABILITY	
Eastern white pine	Paper birch
Jack pine	Quaking aspen
Northern white-cedar	

Tree species projections for **NW and UP**

Forestadaptation.org

Lessons from Adaptation Efforts

1) **Many management actions are also good for forest adaptation to climate change**

   Look for win-wins and no-regrets.

2) **There are a wide range of potential adaptation actions.**

   Even small steps are an important start.

3) **We are all learning, and need to learn from each other.**

   Collaborate and communicate.

4) **View all management through a climate change filter**

Thank you!

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Northern Institute of Applied Climate Science

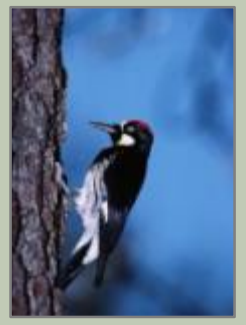
WISCONSIN'S greenfire
VOICES FOR CONSERVATION

WICCI
WISCONSIN INITIATIVE ON CLIMATE CHANGE IMPACTS

Adapt.

Adaptation = taking action to prepare forests for climate change.






Adaptation activities can build on sustainable management, conservation, and restoration of forests

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

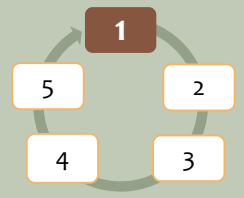
Oak-Pine Management at Woodboro Lakes Wildlife Area, Oneida County

wicci.wisc.edu/forestry-working-group/

Demonstration Projects

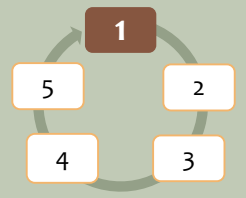
Mature aspen stands

www.climateframework.org/node/218



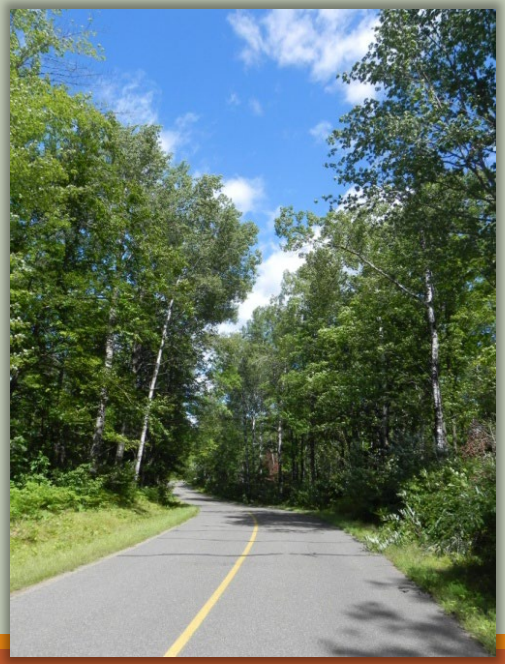
Step 1: DEFINE location, management goals and objectives, and time frames.

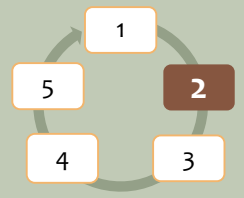
- **Where are you working?**



Step 1: DEFINE location, management goals and objectives, and time frames.

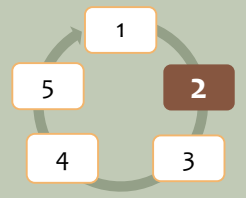
- **What are your management goals and plans for this area?**





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

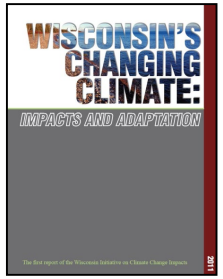
How might the area be uniquely affected by climatic change and subsequent impacts?

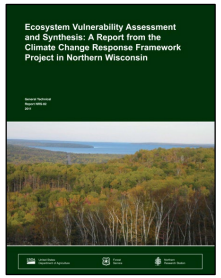


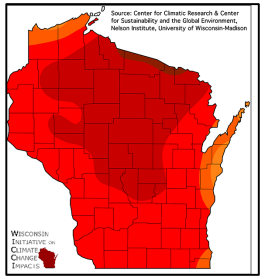
Step 2: ASSESS site specific climate change impacts and vulnerabilities

Broad-scale Impacts & Vulnerabilities

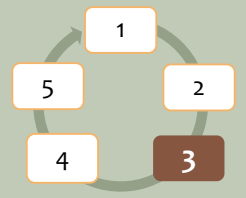
- Warmer temps, altered precip, drier summers
- Declines in many common northern species





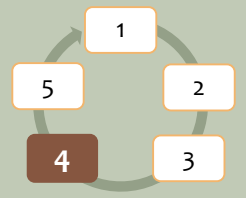


How might broad impacts be different in the area of interest?



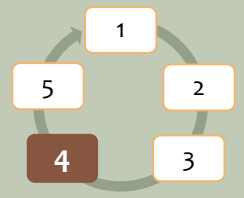
Step 3: EVALUATE management objectives and feasibility

- **What management challenges or opportunities might occur?**
- **Can current management meet management goals?**
- **Do goals need to change?**



Step 4: IDENTIFY and adaptation approaches and tactics

What actions can be taken to enhance the ability of the area to cope with change and meet management goals?



Step 4: IDENTIFY and adaptation approaches and tactics

Adaptation Approach	Tactic	Consider:	Recommend Tactics?
•Favor or restore native species that are expected to be better adapted to future conditions.	•Thin roadside aspen •Plant white pine and red oak (to become minor component) •Favor future-adapted species on site	•Benefits •Drawbacks •Barriers •Practicality	Yes Yes

Adaptation Options

Resistance

Resilience

Transition