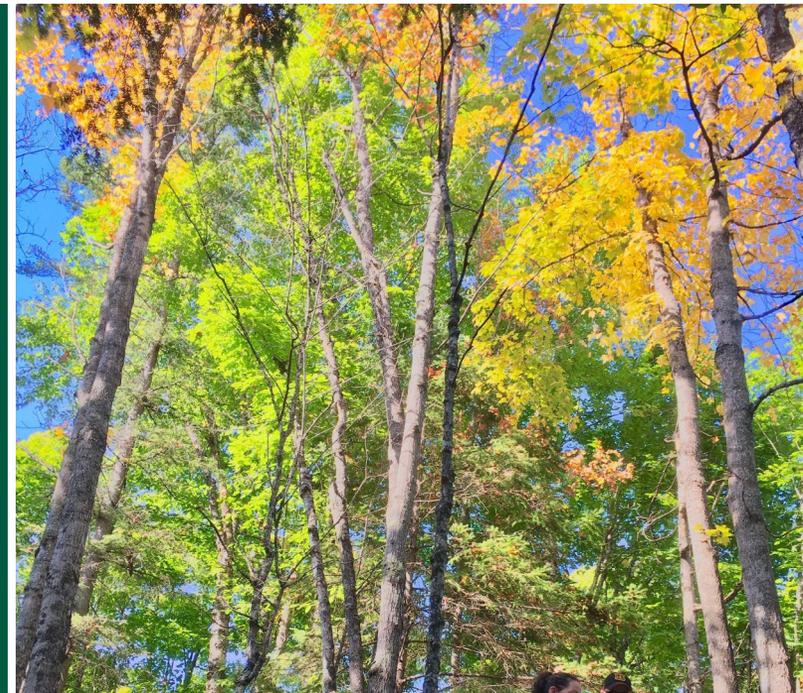


# Northern Institute of Applied Climate Science

ASAP Principles of Adaptation  
May 2022



# Northern Institute of Applied Climate Science

Climate

Carbon

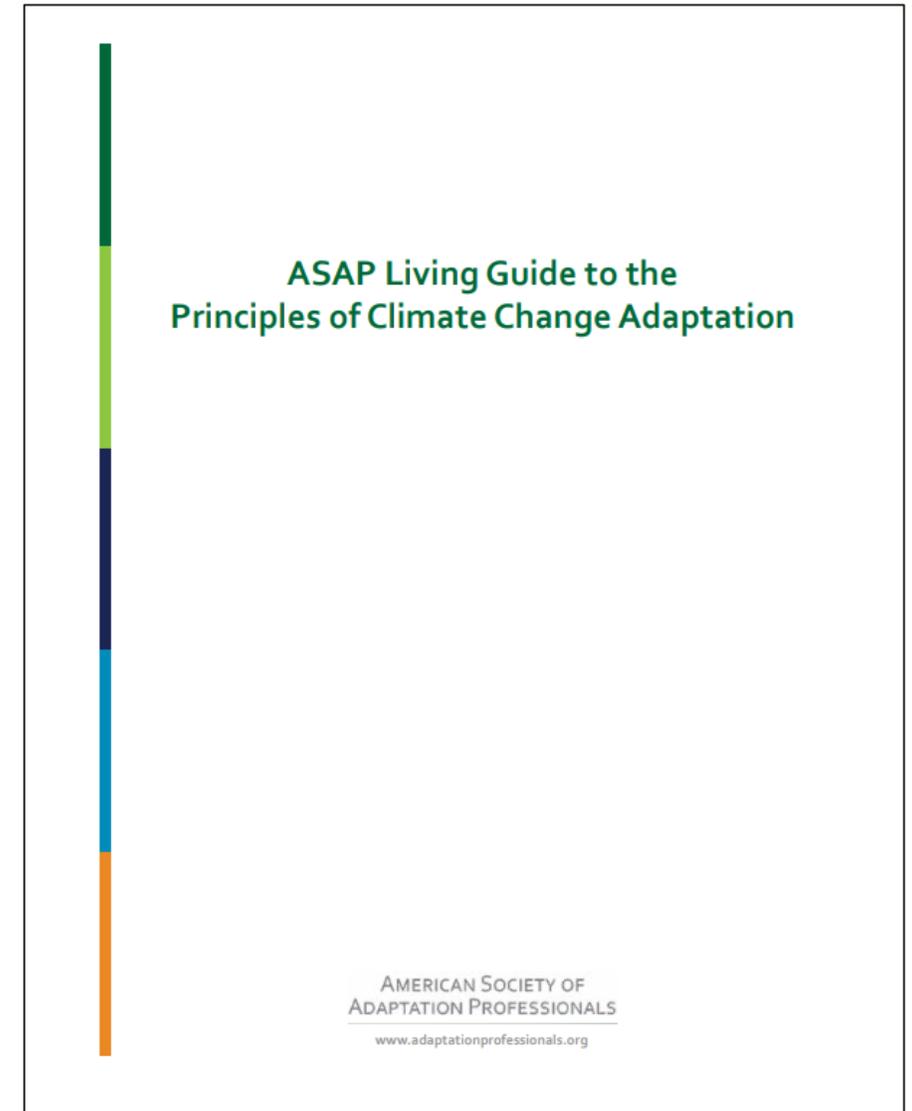
The Northern Institute of Applied Climate Science (NIACS) develops synthesis products, fosters communication, pursues science, and provides technical assistance in climate change adaptation and carbon management.

**Multi-institutional collaborative chartered by USDA Forest Service, universities, and non-profit and tribal conservation organizations**



# Living Guide Principles

- Recognize context
- Use best available science and knowledge
- Network and learn together



# Adaptation Menus: What are they?



A “menu” of possible actions that allows you to decide what is *most relevant for a particular location and set of conditions.*

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

<i>Create Your Own Pasta</i>			
<i>Shapes</i>		<i>Sauces</i>	
<b>Rigatoni</b> Semolina, All-Purpose Flour, Olive Oil	14	<b>Marinara</b> San Marzano tomatoes, Garlic, White Wine, Basil, Chili	
<b>Cavatelli</b> All-Purpose Flour, Durum Flour, Eggs, Ricotta	15	<b>Arrabiata</b> All-Purpose Flour, Durum Flour, Eggs, Ricotta	+1
<b>Tagliatelle</b> All-Purpose Flour, Durum Flour, Eggs	15	<b>Broken Meatball</b> House Tomato Sauce with the Addition of Broken Meatballs	+4
<b>Gluten-Free Rigatoni</b> Gluten-Free All-Purpose Flour, Olive Oil, Eggs	16	<b>Sunday Sauce</b> House Tomato Sauce with Short Rib, Sausage, Veal	+4
<b>Spaghetti</b> Semolina, Durum Flour, Olive Oil	15	<b>Roasted Garlic Pecorino</b> Semolina, Durum Flour, Olive Oil	+2
<b>Four Cheese Herb Ravioli</b>	18	<b>Carbonara</b>	+3

<i>h Cocktails</i>	
mato Juice, Horseradish	10/45
ne de Peche, Sparkling Wine	12/55
mon	12/55
Carrot Juice	12/55
Crème de Peche	10/45
resh Lime, Grenadine	12/55
's Mimosa Juice, Sparkling Wine	12/55



# Adaptation Menu

## Published:

- Forestry
- Urban Forestry
- Forested Watersheds
- Tribal Perspectives
- Agriculture
- Forest Carbon Management
- Recreation
- Non-Forested Wetlands
- Inland Glacial Lake Fisheries
- Wildlife Management
- Fire-Adapted Ecosystems

## In Preparation:

- Grasslands
- Great Lakes Coastal Ecosystems (*in review*)
- Ocean Coastal Ecosystems

## 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.
- 7.2. Maintain and create habitat corridors through reforestation or restoration.

### 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.



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](http://www.forestadaptation.org/strategies)

Adaptation menus available at: [www.forestadaptation.org/strategies](http://www.forestadaptation.org/strategies)

# Example: Wildlife Adaptation Menu

## *Strategies in the menu:*

Populations

- 1) Maintain and enhance **genetic diversity**
- 2) Establish and maintain **connectivity** between populations
- 3) Facilitate **shifts in the geographic range** of the species in anticipation of future conditions
- 4) Manage interspecific and biotic **interactions**
- 5) Maintain a sustainable **population size** by managing reproduction, survival, and dispersal
- 6) Adjust **harvest regulations** to manipulate populations
- 7) Plan for and reduce human **disturbance** and human-wildlife **conflict**
- 8) Restore and maintain sources of **food, water, and cover** as components of habitat
- 9) Adjust management of food, water, and cover to align with expected **future conditions**
- 10) Establish and enhance **protected areas** or habitat reserves
- 11) Promote wildlife habitat conservation on lands **outside of protected areas**
- 12) Intentionally chose to **take no action**
- 13) Engage **human communities** in wildlife conservation

Habitat

Xtra

# Example: Wildlife Adaptation Menu

## *Example Approaches and Tactics*

### **3. Facilitate shifts in the geographic range of the species in anticipation of future conditions**

#### **3.1. Establish corridors and minimize barriers to movement to new suitable habitats**

*Tactic: Create highway crossing structures that span barriers to northward movement.*

*Tactic: Connect mature northern or boreal forest habitats that are oriented north-south across the landscape to facilitate northward migration of northern flying squirrels.*

#### **3.2. Prepare suitable habitat in anticipation of future introduction, reintroduction, or natural range shift of a species**

*Tactic: Provide technical assistance to enable private landowners to create grassland habitat for quail and other grassland birds.*

*Tactic: Identify and improve anticipated future stopover or wintering habitat for migratory birds.*

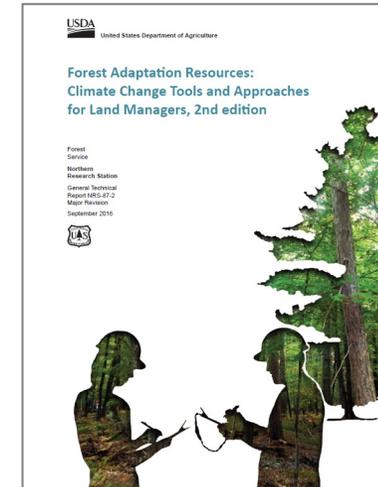
#### **3.3. Move and release individuals into a population where conditions are now suitable and expected to improve**

*Tactic: Release wild turkeys from mid-Atlantic states into New England.*

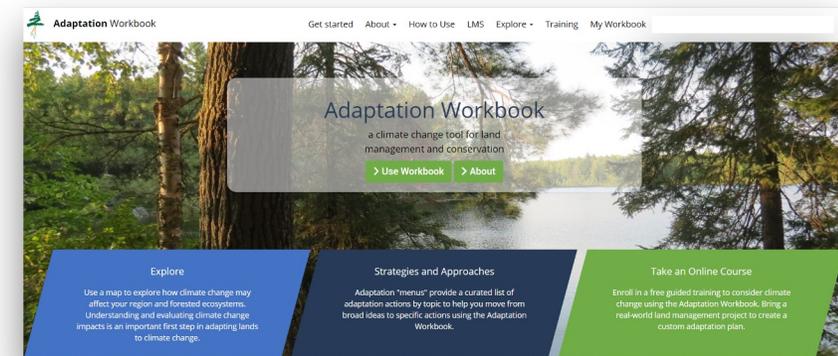
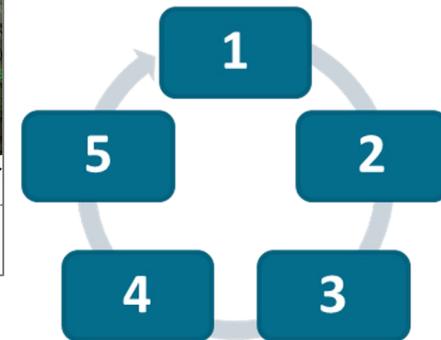
*Tactic: Move eastern tiger salamanders from populations in south-central Minnesota to populations in north-central Minnesota, where conditions may be more suitable as the prairie-forest border shifts to the northeast.*

# Climate Adaptation Workbook and Adaptation Resources

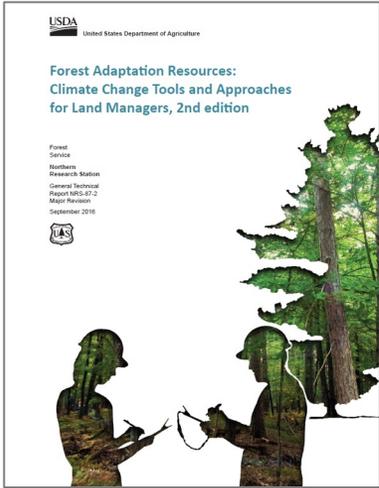
- Flexible 5-step workbook designed for a variety of landowners with diverse goals
- Works at project level
- Centers around manager's expertise, and judgement
- Creates **clear rationale** for actions by connecting them to **broader adaptation ideas**
- **Does not make recommendations**
- **Includes:**
  - Adaptation workbook
  - Adaptation strategies for different resource areas (menus)



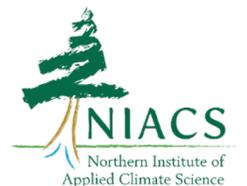
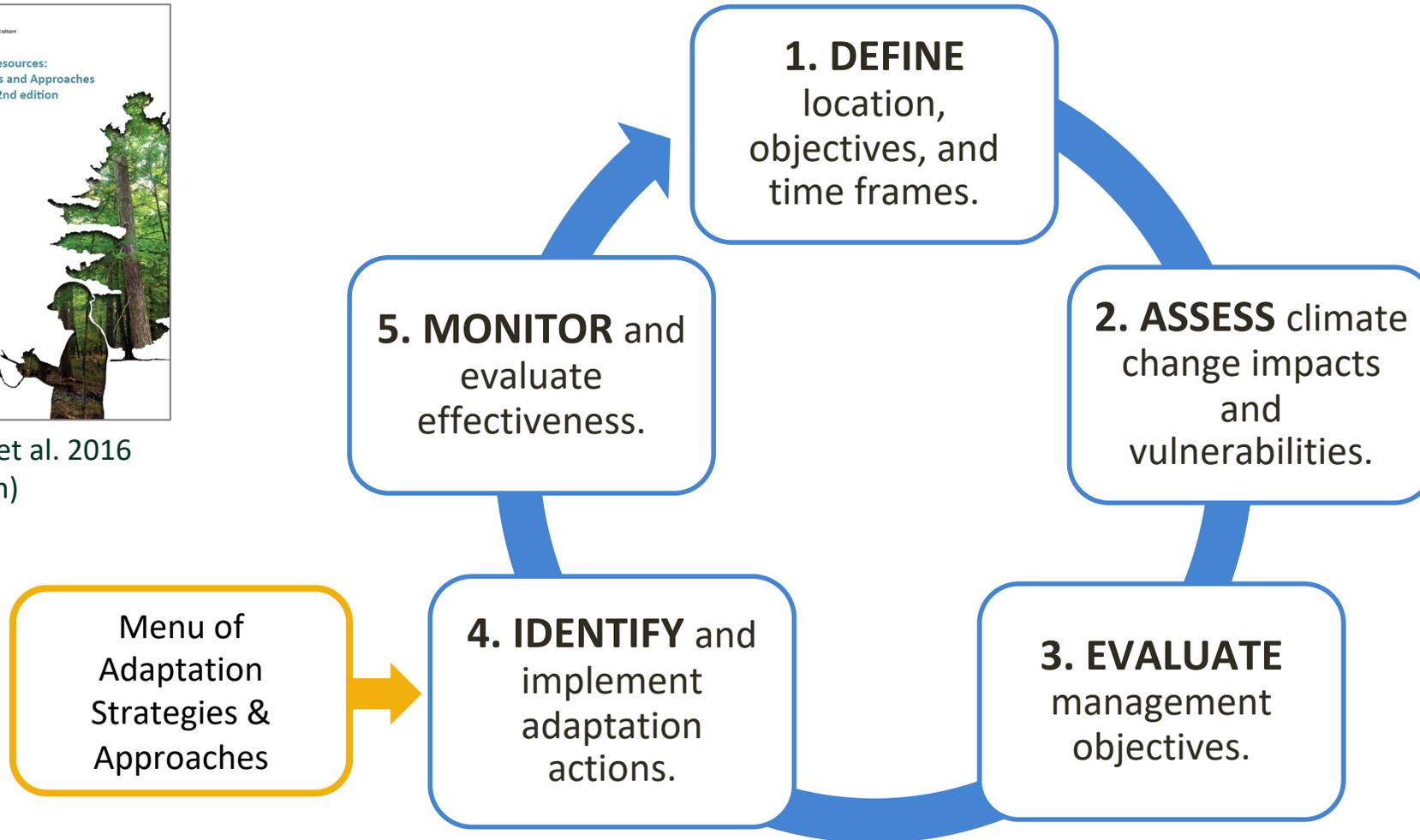
Swanston et al. 2016  
(2<sup>nd</sup> edition)



# Adaptation Workbook



Swanson et al. 2016  
(2<sup>nd</sup> edition)



# Adaptation Menu Development

- Lit review and synthesis
- Binning, organization
- Testing with managers
- Publication

## Recommendation

## Count

Establish and enhance protected areas

596



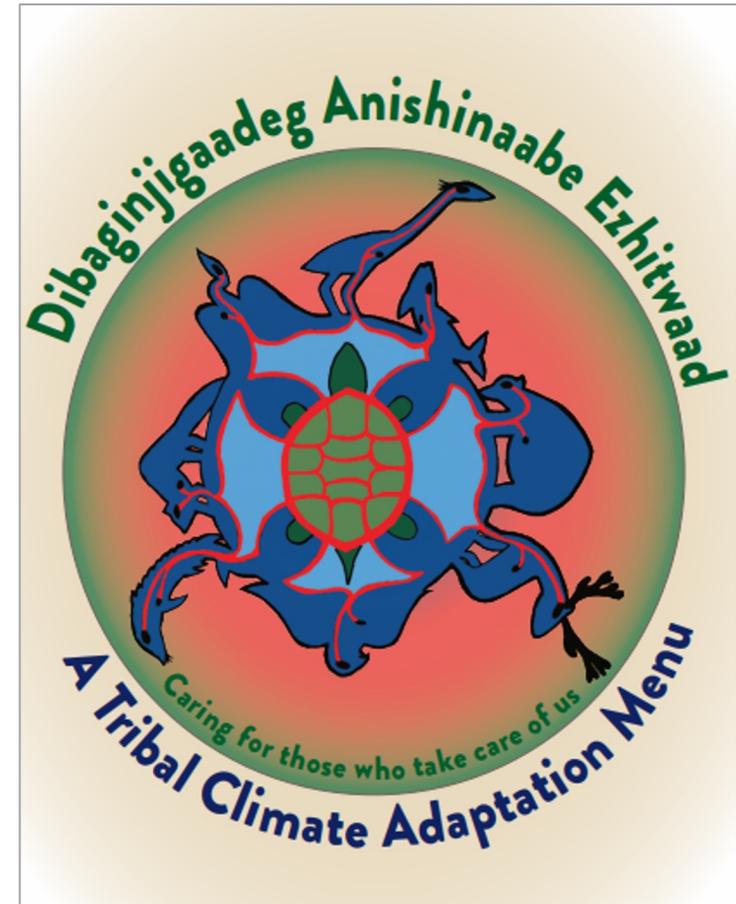
Total

2306

# Traditional Ecological Knowledge

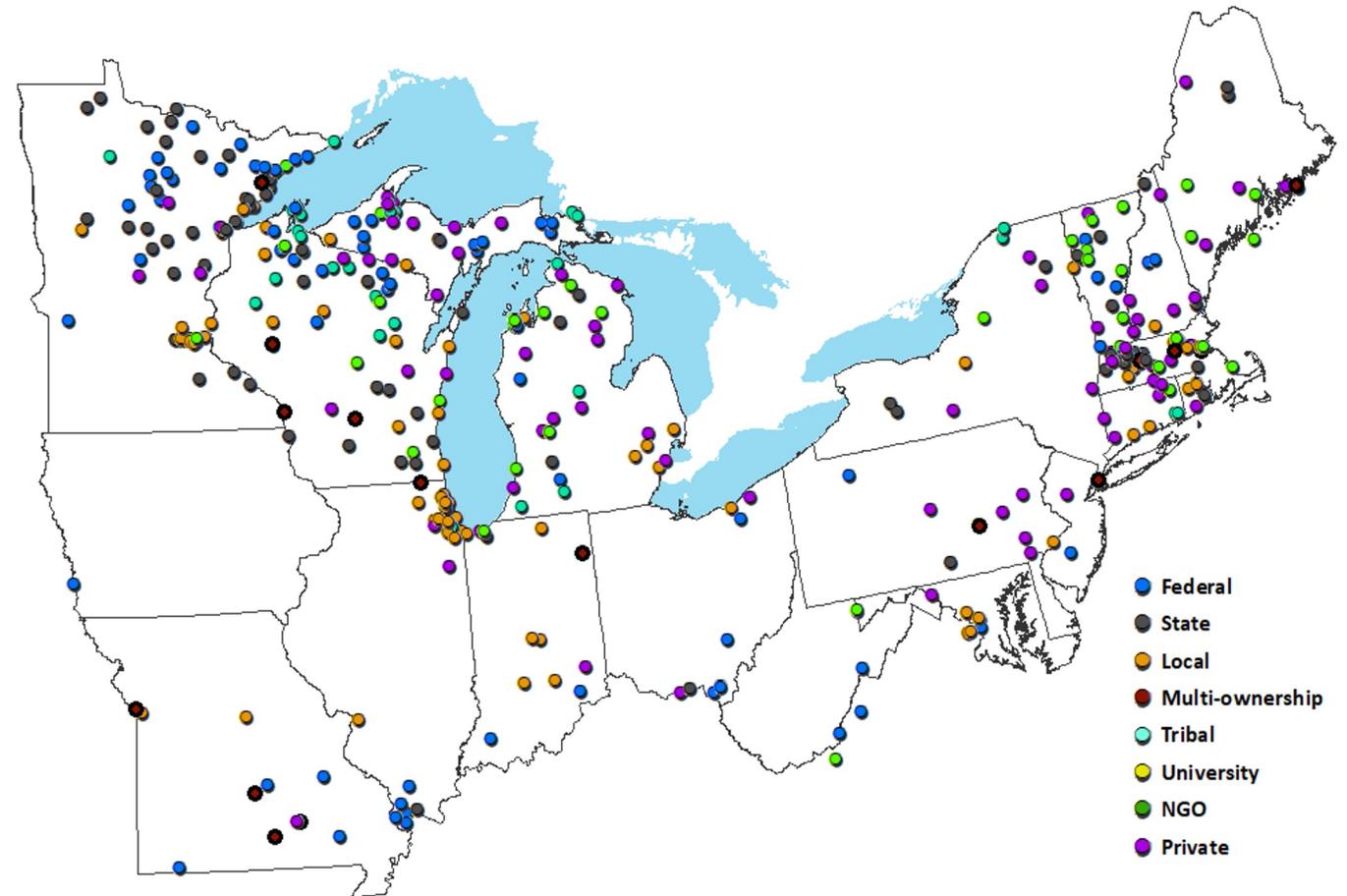
Best available science and information

- An adaptation planning tool that integrates Indigenous knowledge, culture, science and perspectives with western science and perspectives
- Helps facilitate culturally appropriate climate adaptation between Tribes and non-Tribal partners
- Created by a diverse team!



# Real World Adaptation Projects

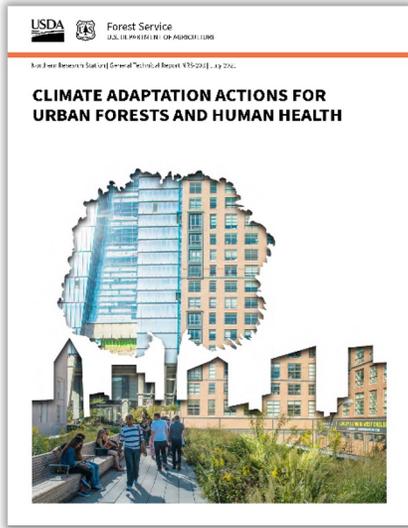
- **Adaptation Demonstrations**
  - 500+ examples of climate-informed management via the Climate Change Response Framework ([www.forestadaptation.org](http://www.forestadaptation.org))



# Thank you!



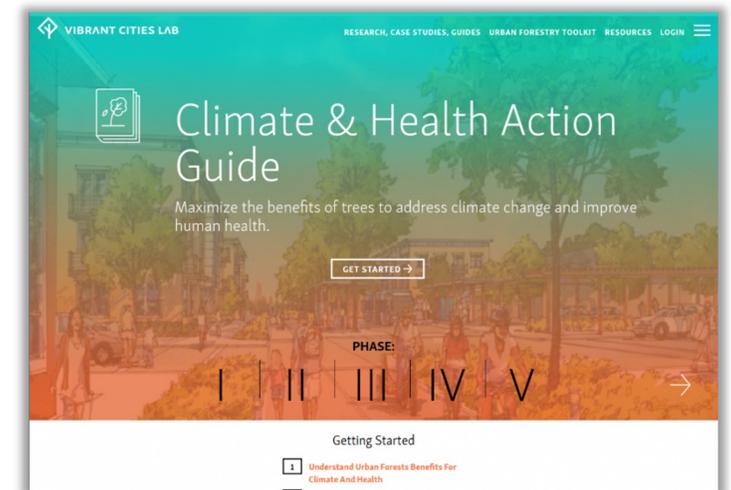
# Urban & Community Forestry Resources



New FS technical report (GTR-NRS-203) contains an **Urban Forest Climate and Health Adaptation Menu** highlighting urban forestry actions for climate adaptation, carbon, and human health benefits.

Updates 2016 menu with additional information on human health and carbon mitigation!

**Climate & Health Action Guide** on the Vibrant Cities Lab provides a quick overview of the Adaptation Workbook process, adaptation menu, and more.



Links available at: [www.forestadaptation.org/climate-health](http://www.forestadaptation.org/climate-health)

# “Adaptation Planning”

*Most managers aren't looking for rules or prescriptions...*

**More useful:** Tools that support flexibility and decision-making, and connect **climate adaptation concepts** to a discipline of natural resource mgmt.

*Folks manage ecosystems from a variety of perspectives, such as...*

Wildlife habitat management



Forestry



Recreation

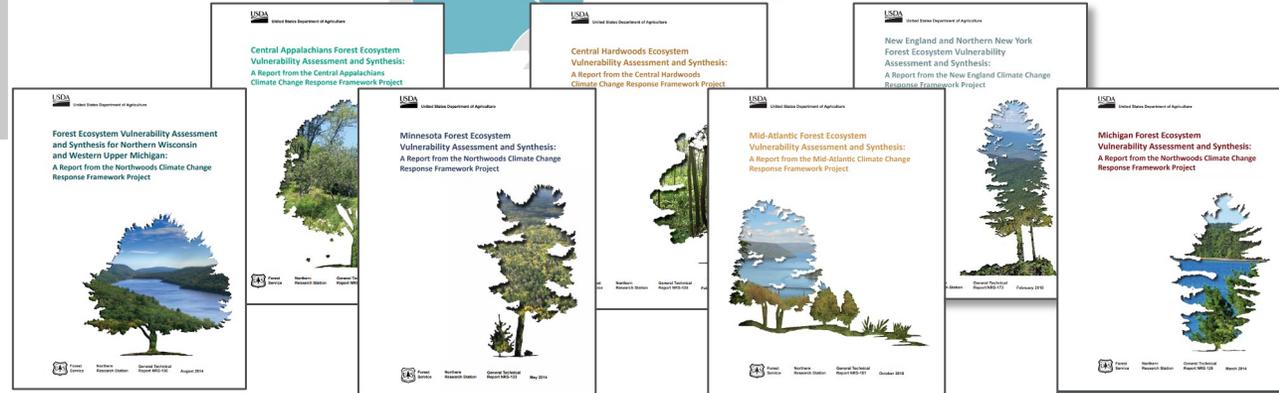
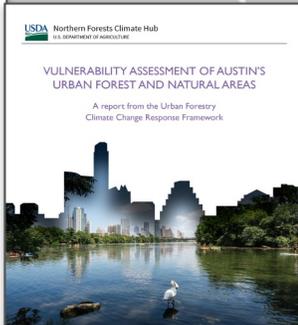
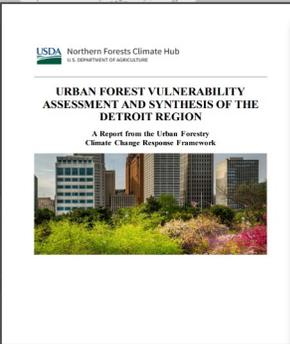
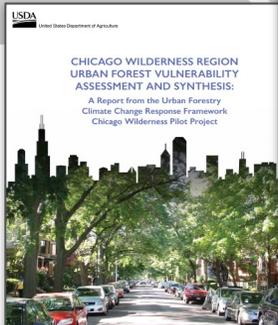
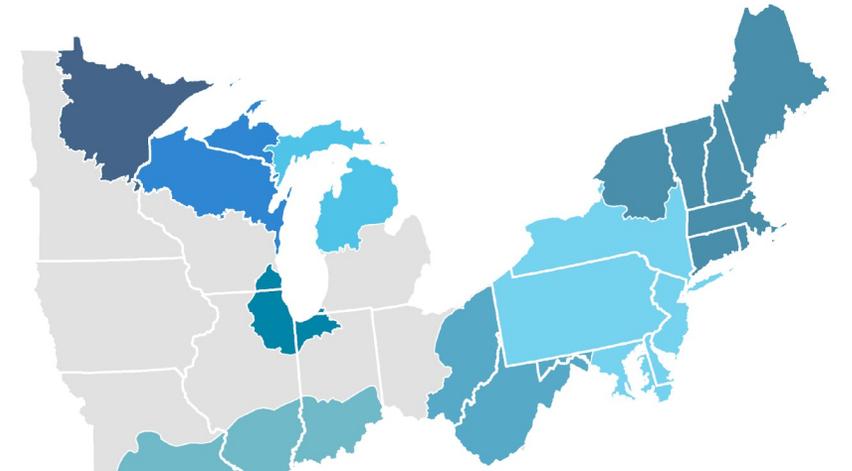


# Synthesize Climate Change Impacts

## Urban Adaptation Areas:



## Vulnerability Assessment Regions:



[www.forestadaptation.org/urban](http://www.forestadaptation.org/urban)

[www.forestadaptation.org/vulnerability-assessment](http://www.forestadaptation.org/vulnerability-assessment)

# Resources for Professionals & Landowners

**Oak Resiliency Assessment**

Home Assessment Why Oak? Resources About Contact

\*This content is all preliminary, draft material that will be undergoing continuous review\*

The Oak Resiliency Assessment Tool allows you to consider how resilient oak-dominated forest stands on your property or a property you manage are to climate change and various stressors. When you start an assessment, you will provide a brief description of the property and forest stand and locate the area you are assessing. You will then answer a series of questions about stressors that may be impacting the forest and characteristics that influence the adaptive capacity of the forest. Once you complete the assessment, the tool will generate a report with the forest's vulnerability and more information regarding the major forest stressors and potential management actions. You can then use this report to inform your management decisions and include it in the property's forest management plan.

**Start Stand Assessment**

Introduction

**Oak Resiliency Assessment Tool**

Tutorial Video

Climate Change and Adaptation: New England and Northern New York Forests

Home Changing Climate Effects on Forests Forest Vulnerability Adaptation Stories Credits

**Changing Climate**

Our climate is changing in ways that we have never experienced before. Some of these changes can be seen in the forests around our homes. The winters are bringing warmer weather, with fewer opportunities to ski, snowshoe, ice skate, or enjoy other winter sports. Warmer winters and earlier springs also cause extreme flooding that damages roads and homes, as well as impacts on local plants and wildlife. Understanding how the climate is changing provides the foundation for understanding how forests and people will be affected, and how we can help safeguard these places for future generations.

Click on a section or scroll through to understand the

**Protect Your Woods for Tomorrow**

**A Tool to Assess Risk in a Changing Climate**

Whether you spend time outside in your woods or just enjoy the beauty of your trees and wildlife from the window, you likely love your woods and want to keep it healthy.

Forests are always changing and adapting to new conditions. Some changes, like the progression of green summer leaves to bright red and gold fall foliage, or the annual return of migratory songbirds, are expected.

Other shifts, such as earlier spring leaf-out or an increase in nuisance plants such as buckthorn, are only visible when comparing differences in woodlands across many years or decades.

Our climate is changing, resulting in altered weather patterns, rising temperatures and shifts in seasonal precipitation patterns. Actions you take today can help your forest be resilient, healthy and productive in the face of future climate changes.

This publication can serve as a tool to help you assess the resilience of your woods in a quick and easy manner. It contains background information on the important characteristics of resilient and healthy forests and provides examples of potential adaptation strategies. The included scorecards can be used in the field to evaluate the resilience of your woods, which you can use on your own or to start a conversation with a forester.

**Forest Resilience:** The capacity of a forest to respond to a disturbance by resisting damage or stress and recovering quickly.

USDA Forest Service

**CLIMATE ADAPTATION ACTIONS FOR URBAN FORESTS AND HUMAN HEALTH**

**Dibaginijgaadeg Anishinaabe Ezhitwad**

**A Tribal Climate Adaptation Menu**

Caring for those who take care of us

College of Food, Agricultural and Natural Resource Sciences  
UNIVERSITY OF MINNESOTA

**Climate Change Field Guide for Northern Minnesota Forests: Site-level considerations and adaptation**

USDA Northern Forests Climate Hub  
NIACS

# Tribal Engagement

- 5 in-person workshops (35 projects)
- Incorporated into National Forest NEPA project planning (IDT meetings)
- Working with Tribal Nations and R9 National Forests to advance Tribal Forest Protection Act projects
- Manoomin project (NOAA Funding)
- 2019 Climate Adaptation Leadership Award Winner
- 2022 Minnesota Climate Adaptation Award Winner

