Forest carbon stewardship:
The nexus of climate adaptation and mitigation

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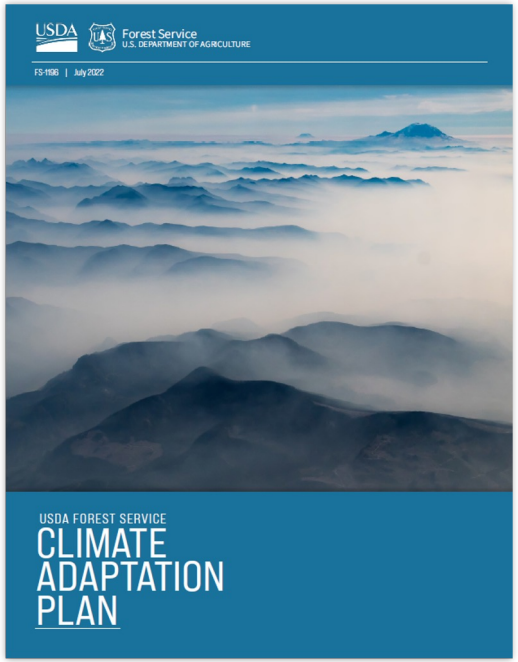
OFFICE OF THE SECRETARY
WASHINGTON, DC 20250

SECRETARY'S MEMORANDUM 1077-004
June 23, 2022

Climate Resilience and Carbon Stewardship of America's National Forests and Grasslands

2. ACTIONS

b. Develop Policy Recommendations for Climate Resilience and Carbon Stewardship on National Forest System Lands.



CARBON STEWARDSHIP

Thoughtful carbon stewardship does not seek to maximize carbon at the expense of forest health but rather to optimize carbon ***within the context of ecosystem integrity and climate adaptation.***

What is Carbon Stewardship?

Biogenic carbon: Carbon contained within biological materials (e.g., plants, soils, and water bodies) that is part of the natural carbon cycle, including photosynthesis, storage in biomass (living and dead) and soils, and release through respiration and fire.

Carbon science

Planning

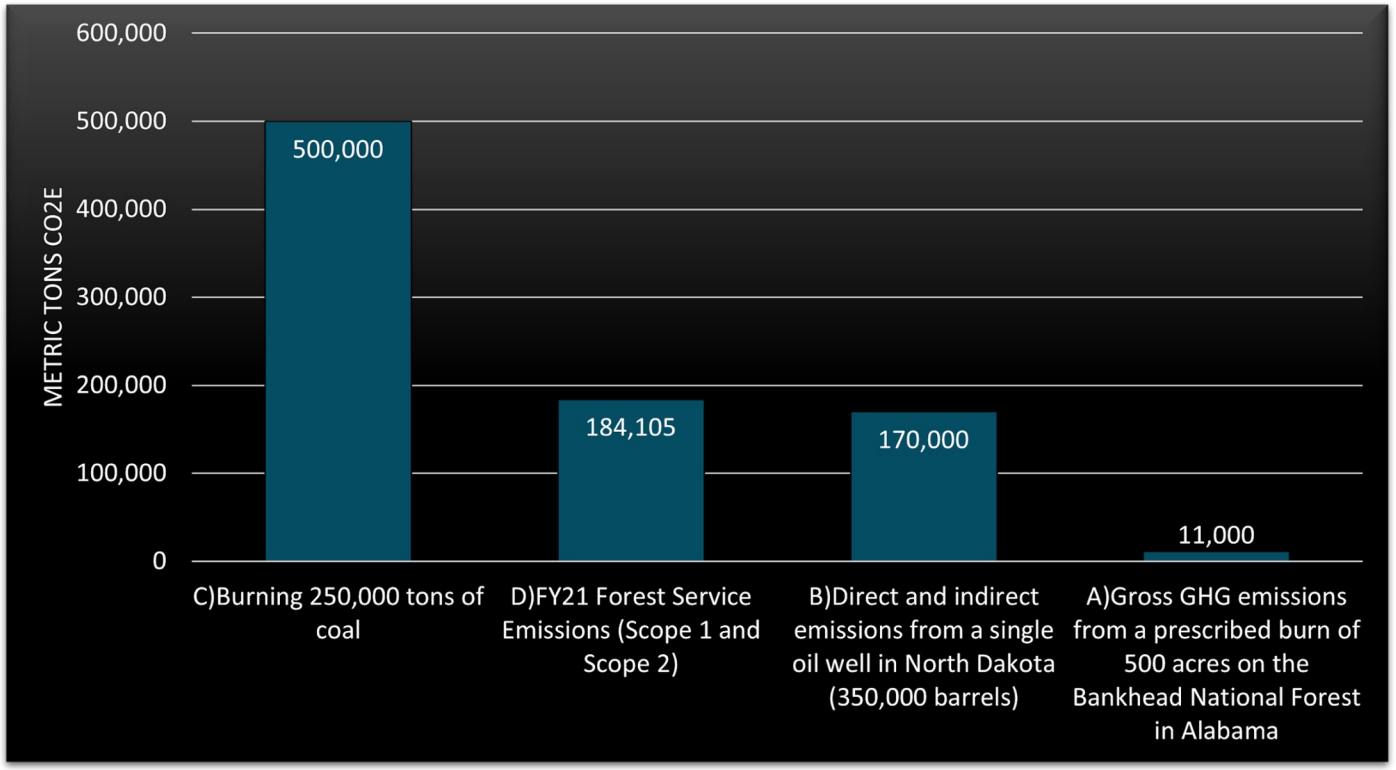
Actions

What Carbon Stewardship isn't…

☐ ~~Maximizing carbon in ecosystems regardless of other management objectives~~

☑ **Considering biogenic carbon within the context of multiple uses and benefits**

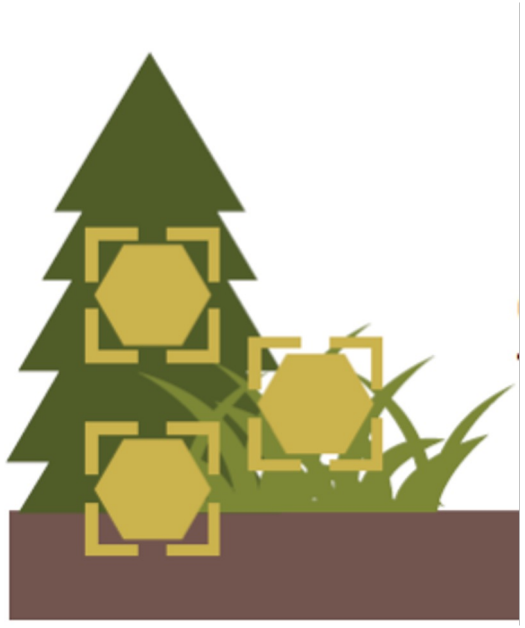
What Carbon Stewardship isn't…



What is Carbon Stewardship?

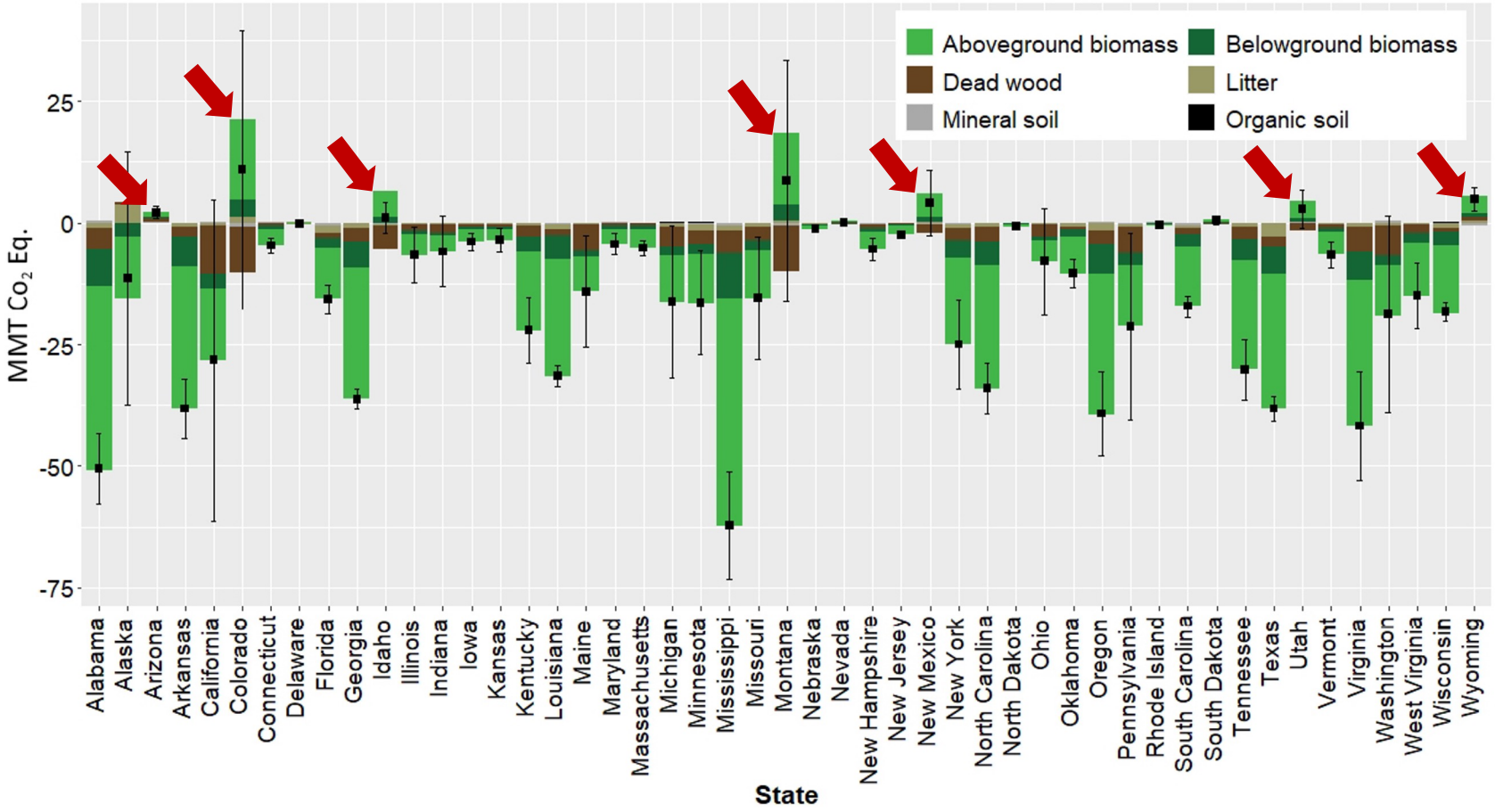
carbon uptake

carbon stability



carbon storage

Carbon Stability



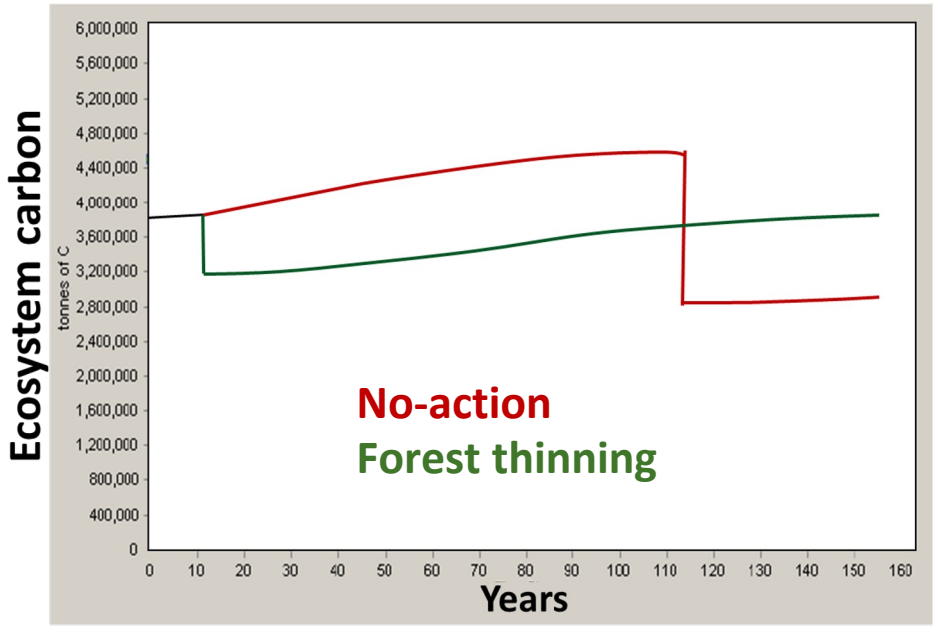
7 U.S. western states are **carbon sources** to the atmosphere, largely due to the effects from:

- legacies of fire suppression
- drought
- pine beetle
- wildfire

Domke et al. 2023 GHG emissions and removals from forest land, woodlands, urban trees, and harvested wood products in the U.S., 1990-2021. Resource Bulletin WO-101. USDA Forest

Carbon Stability

Fuels reduction treatments: Reducing high risk of catastrophic wildfire



reduced emissions

Optimizing Forest Management Stabilizes Carbon Under Projected Climate and Wildfires

D.J. Krofcheck[1], C.C. Remy[1], A. R. Keyser[1], and M.D. Hurteau[1]

Managing for disturbance stabilizes forest carbon

Matthew D. Hurteau[a,1], Malcolm P. North[b], George W. Koch[c], and Bruce A. Hungate[c]

Near-term investments in forest management support long-term carbon sequestration capacity in forests of the United States

John W. Coulston[a,*], Grant M. Domke[b], David M. Walker[c], Evan B. Brooks[d] and Claire B. O'Dea[e]

Principle #1: Integration of climate adaptation to minimize risks to carbon

vulnerability rating

Principle #1: Integration of climate adaptation to minimize risks to carbon

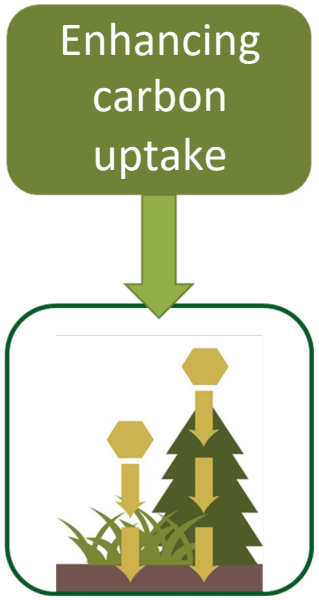
Adaptation is the adjustment of systems in response to climate change.

Ecosystem-based adaptation activities build on the sustainable management, conservation, and restoration.

Principle #1: Integration of climate adaptation to minimize risks to carbon

Existing Carbon Pools

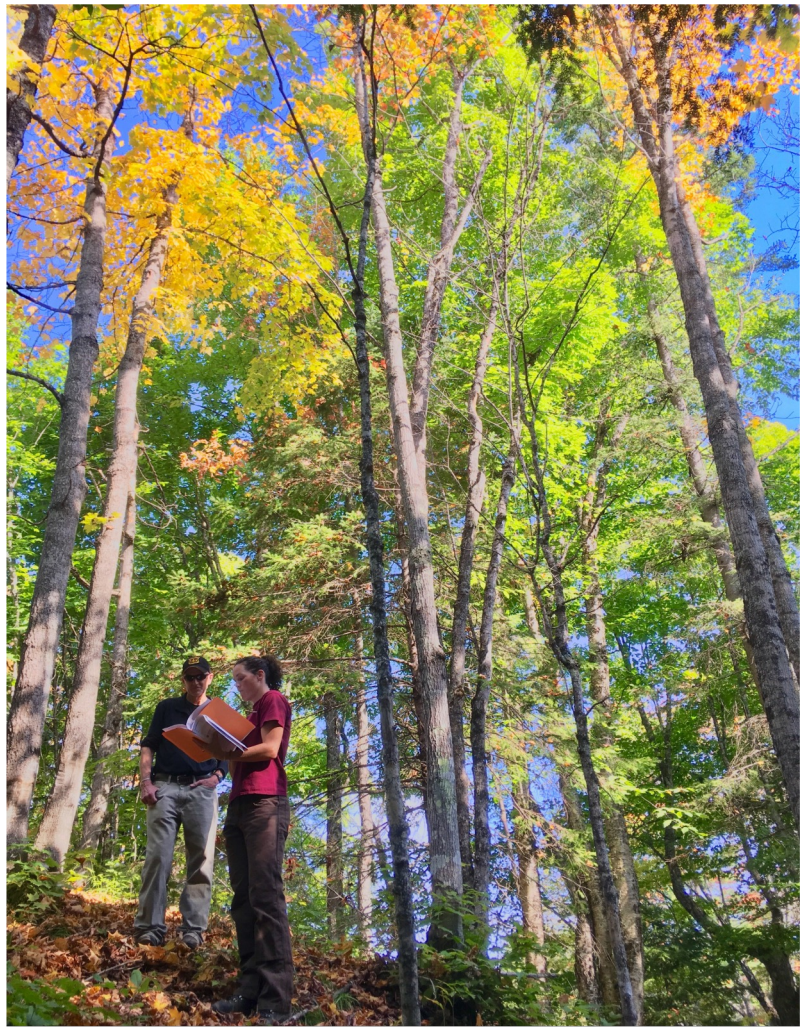
- Improving forest health
- Enhancement of carbon in soil, litter, and coarse woody debris or standing dead pools



Forest Productivity & Regeneration

- Enhancing growth of existing mature trees
- Improving tree regeneration to increase future productivity

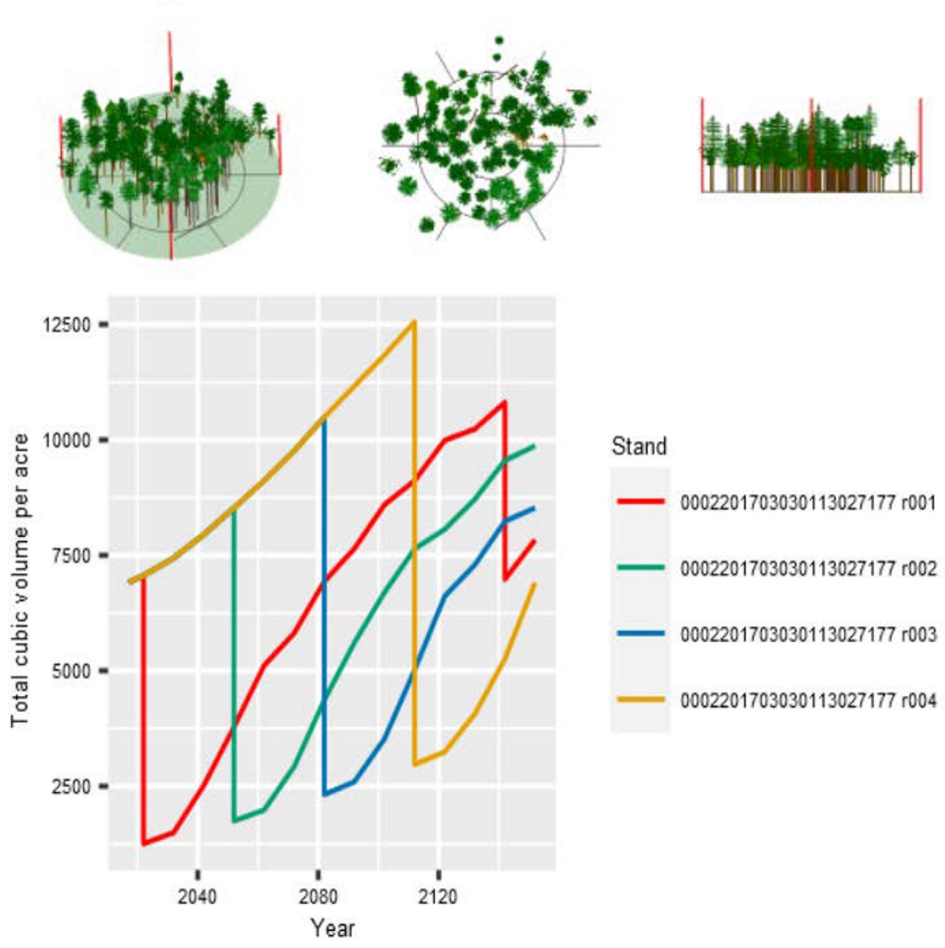
Principle #2: Fostering ecological integrity and climate resilience



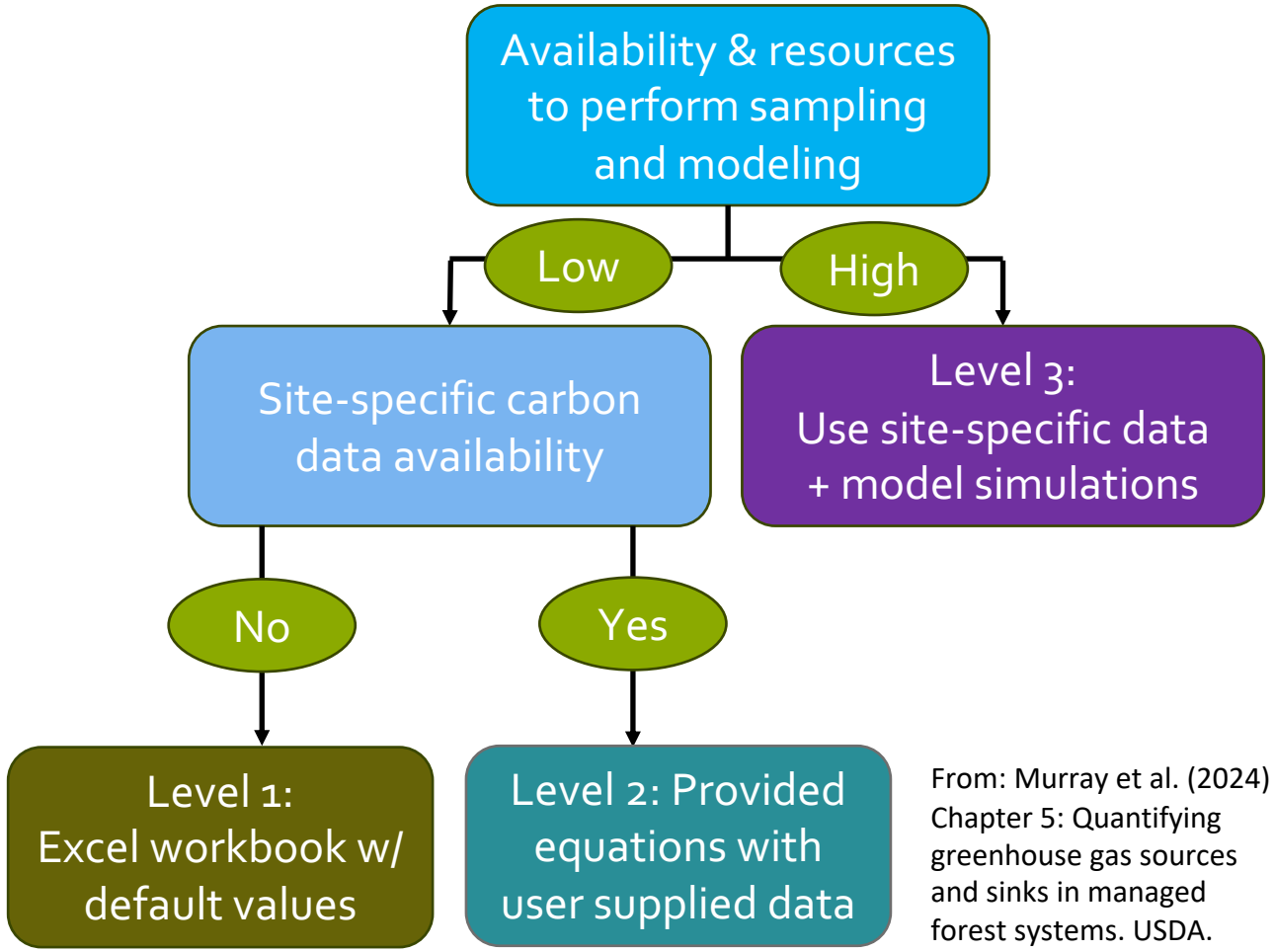
Principle #3: Integrated resource management that aligns with multiple uses

**Understanding tradeoffs can be critical!*

Principle #4: Based on carbon and climate science



Model-based quantification can vary in intensity:

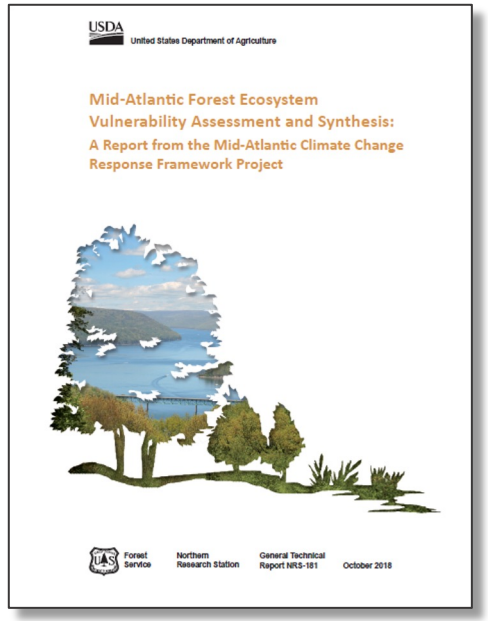


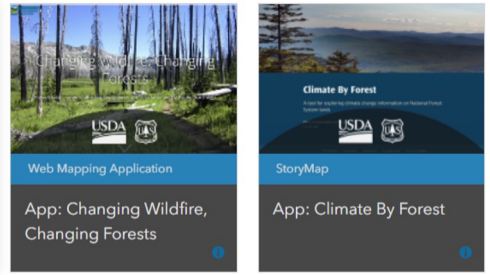
From: Murray et al. (2024) Chapter 5: Quantifying greenhouse gas sources and sinks in managed forest systems. USDA.

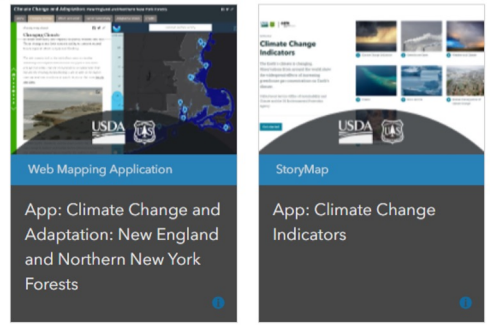
Principle #4: Based on carbon and climate science

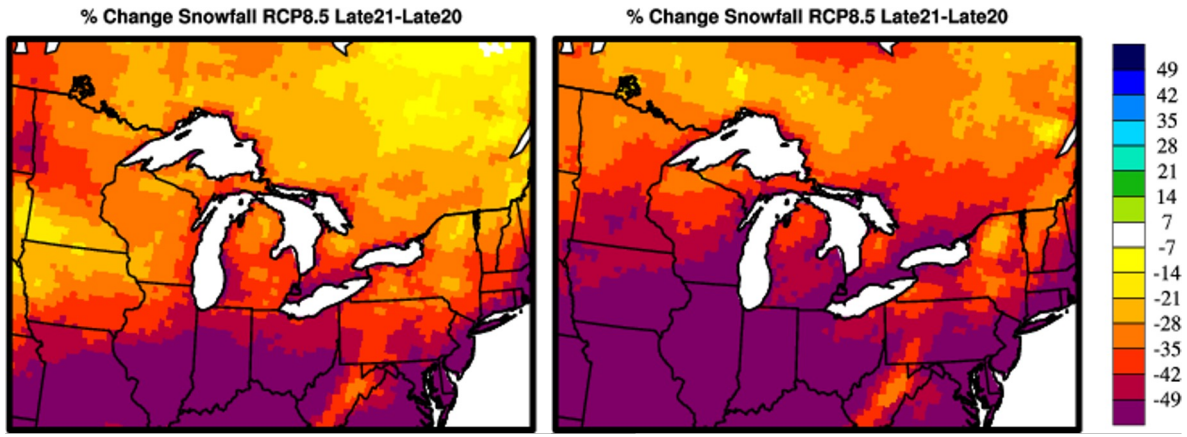
Ecosystem Vulnerability Assessment & Synthesis

- Focus on tree species and forest ecosystems
- Examine a range of future climates
- Developed through scientist-manager collaboration
  - Place-based
  - Model-informed
  - Expert-driven
- <u>Does not make recommendations</u>





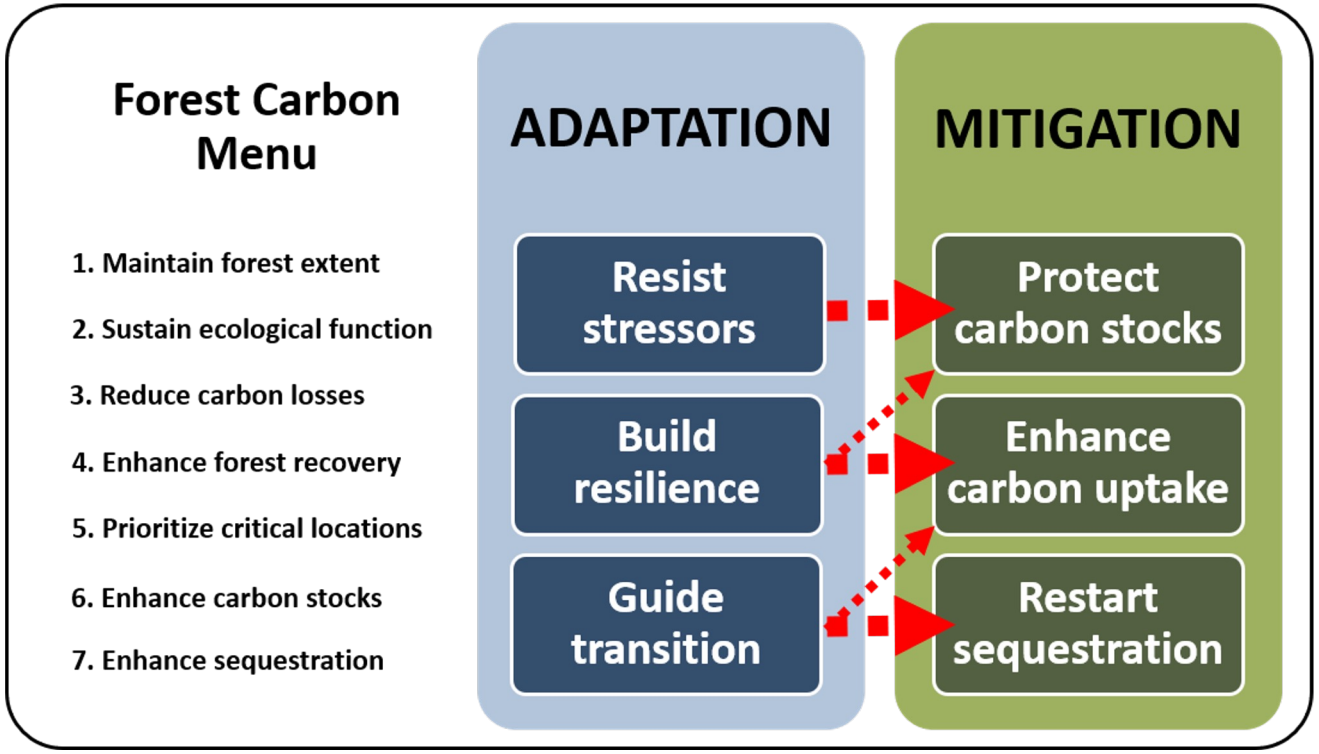




Principle #4: Based on carbon and climate science

Menu of Strategies and Approaches for Forest Carbon Management

Builds from practices for sustainable forest management

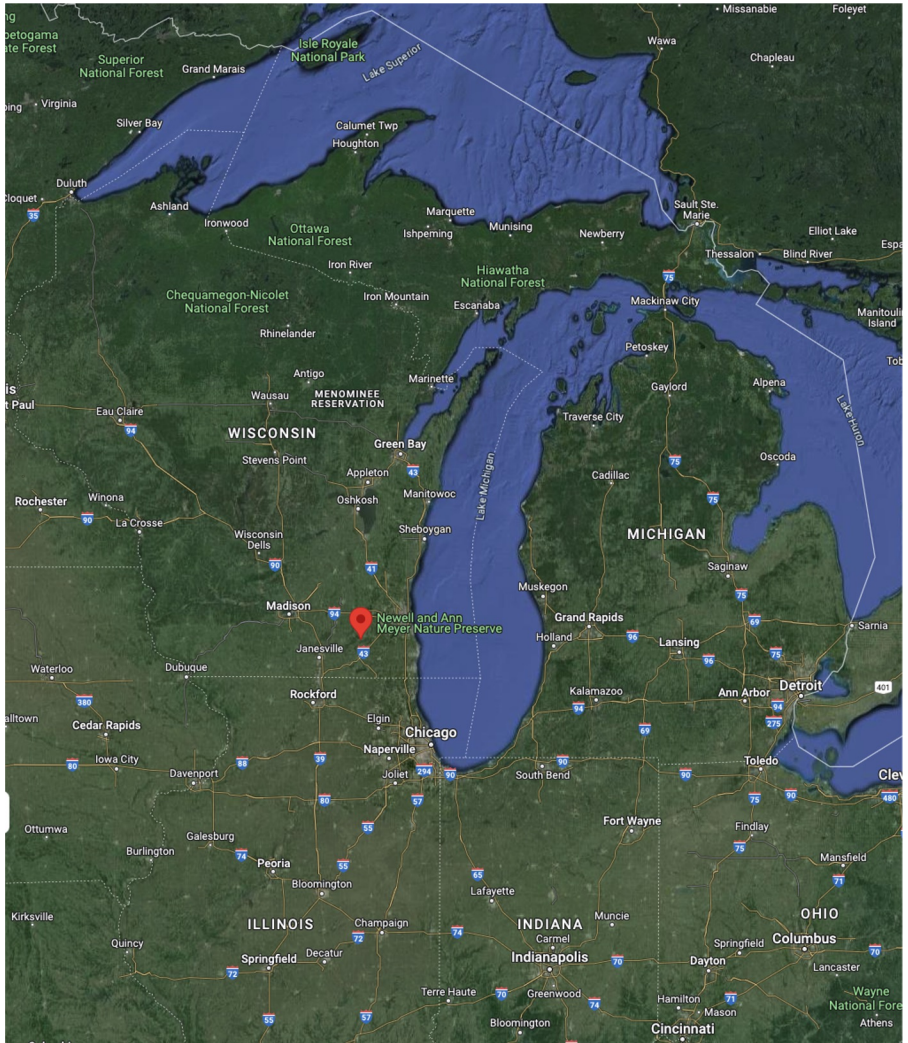


Ontl *et al.* 2019; www.fs.usda.gov/research/treesearch/59214 **www.ForestAdaptation.org/carbon**

Case study: climate adaptation & carbon mitigation in oak savanna management

WHERE?

- The Nature Conservancy Preserve
- Mukwonago River Watershed, Southeastern Wisconsin
- 652 acres, including oak savanna/woodlands, wetlands, prairie (part of bigger patchwork of managed natural lands)



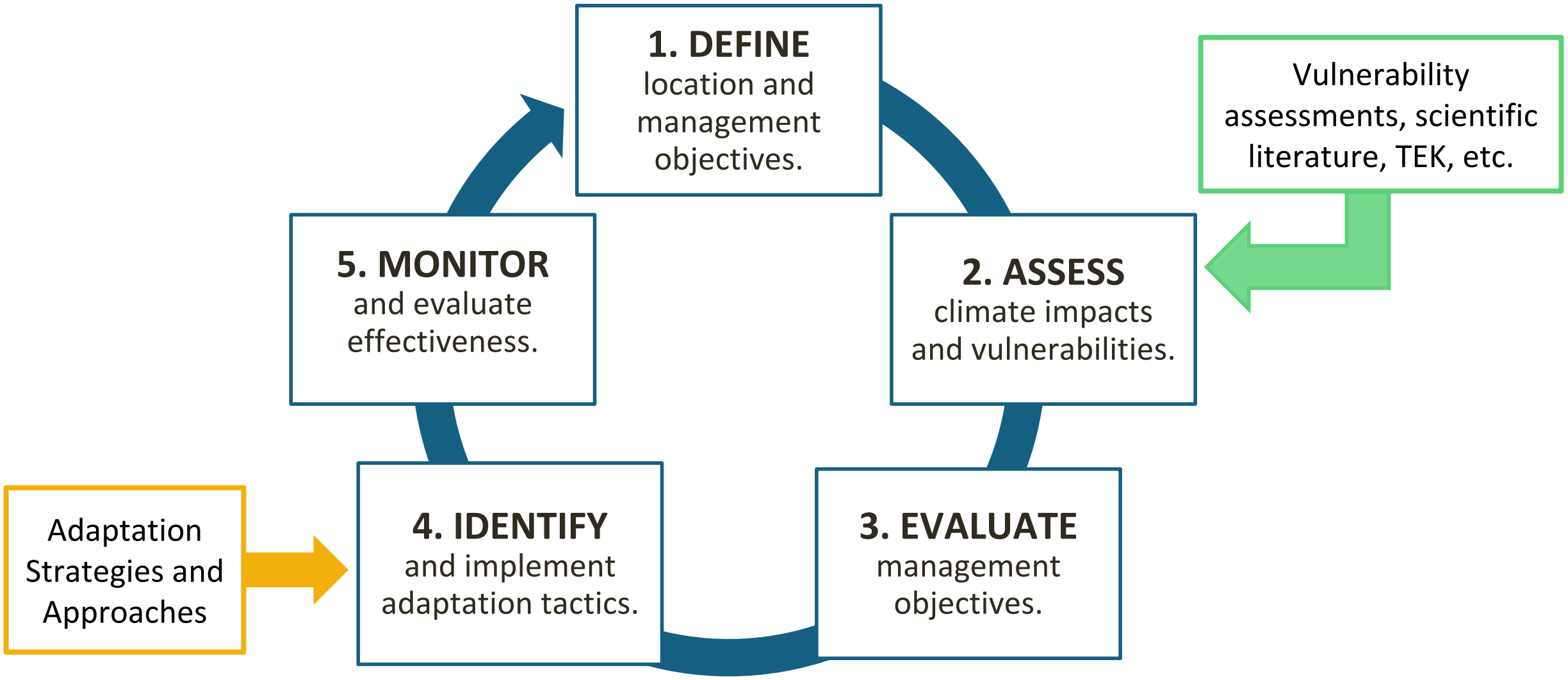
Case study: climate adaptation & carbon mitigation in oak savanna management

WHAT?

Meyer Project Goals:

- **How can we manage for climate adaptation and for carbon benefits?**
- What does the best available research and knowledge tell us about the nexus of adaptation and mitigation?
- What are knowledge gaps where future research is needed?

Adaptation Workbook



www.adaptationworkbook.org & doi.org/10.2737/NRS-GTR-87-2

Case study: climate adaptation & carbon mitigation in oak savanna management

WHO?

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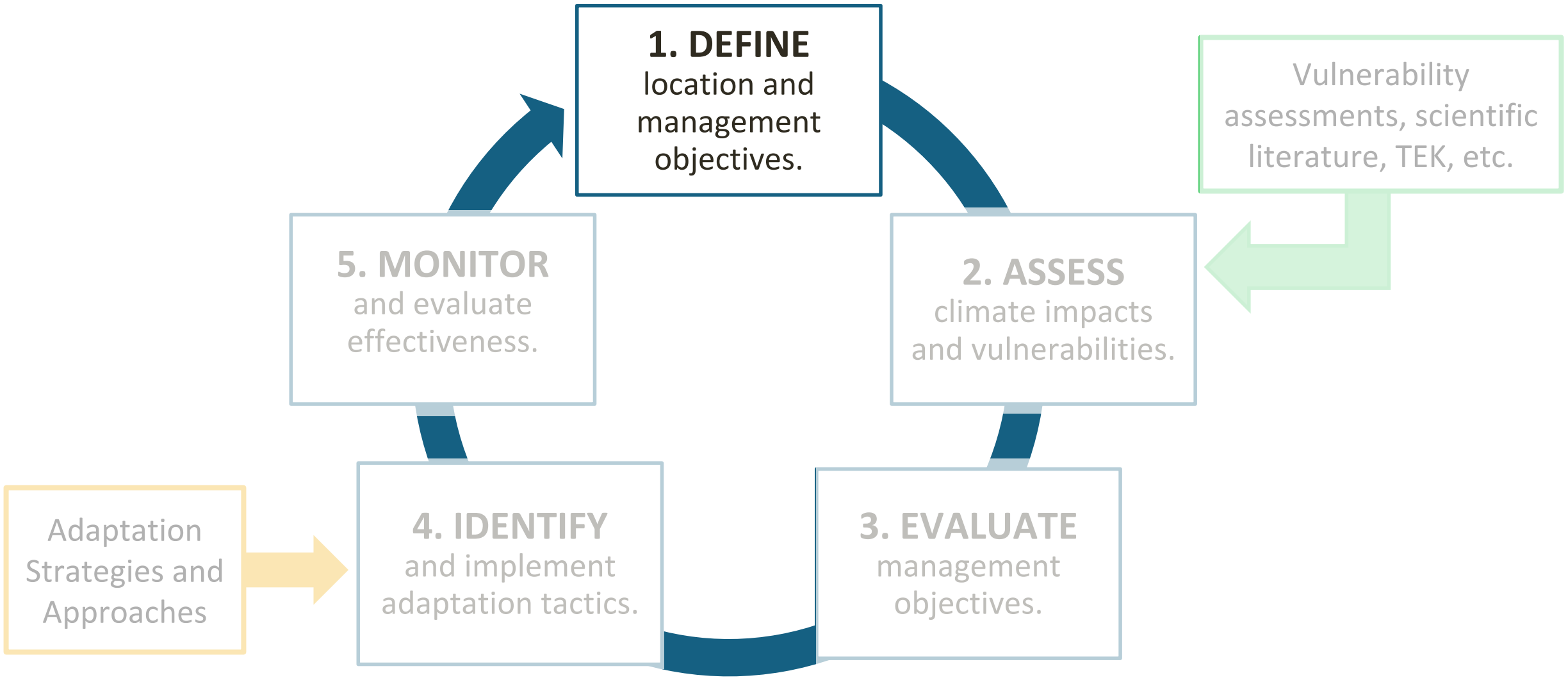
NIACS

Brian Miner
Southeast WI Stewardship Coordinator
The Nature Conservancy

Ann Calhoun
Baraboo Hills Project Coordinator
The Nature Conservancy

Adaptation Workbook



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1. Define Management Goals

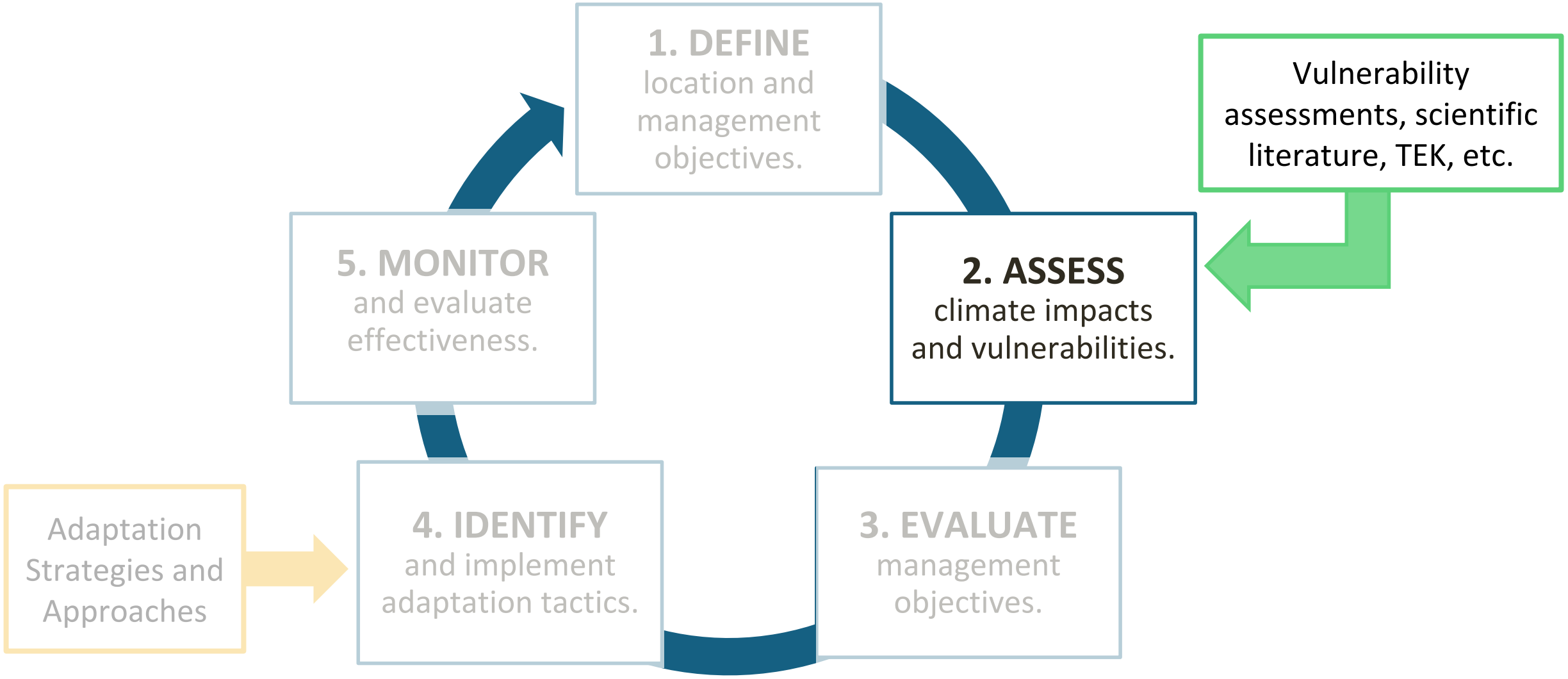
First draft of goals:

1. Maintain and increase biodiversity
2. Optimize carbon on the landscape

Revised to more clear and specific goals:

1. Maintain and increase savanna-dependent plant community structure and composition
2. Look for opportunities to optimize (but not maximize) carbon uptake and storage

Adaptation Workbook



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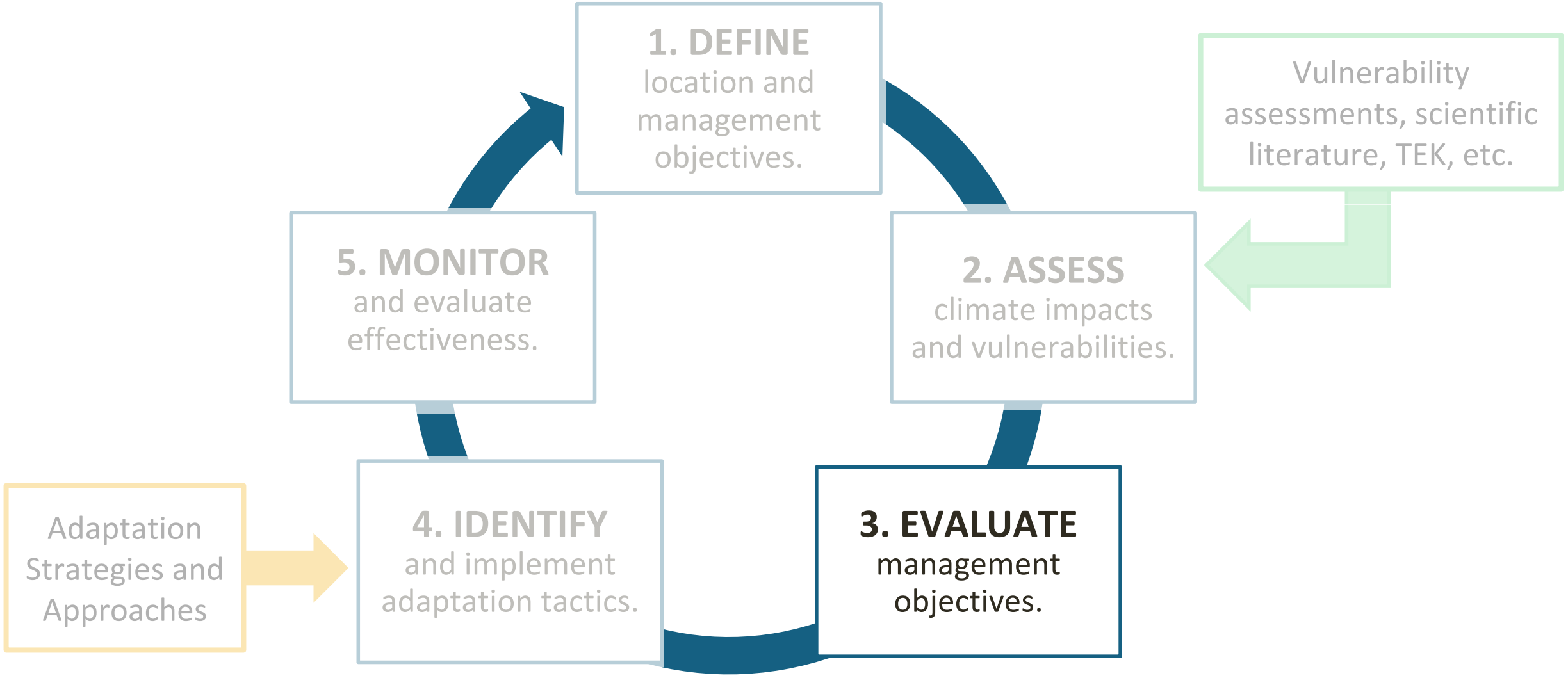
2. Assess climate change vulnerabilities and impacts

- Woody encroachment, invasive species
- Disease ⇆ climate change
- Challenges (and opportunities) for prescribed burns
- Oak regeneration?

Vulnerability: moderately low/moderate

Oak savannas are well-adapted to warmer + droughty climate but how competitive will forest species be in future climate?

Adaptation Workbook



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3. Evaluate management objectives

Currently unmanaged degraded oak savanna with woody encroachment

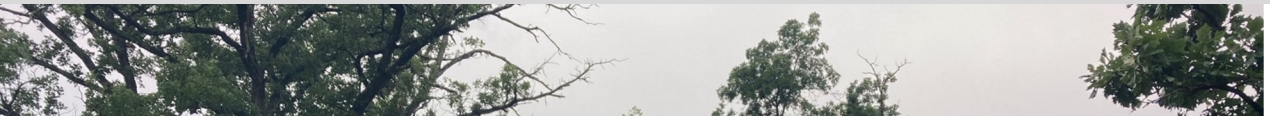
3. Evaluate management objectives

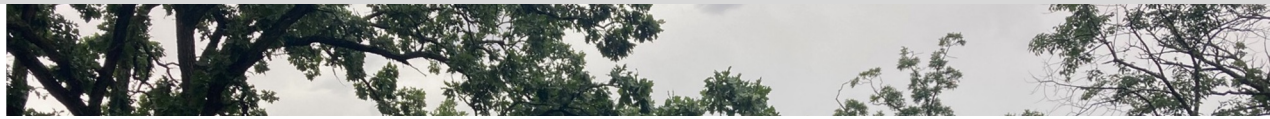
Currently managed degraded oak savanna with woody encroachment

3. Evaluate management objectives

Secondary mesic forest – point of no return

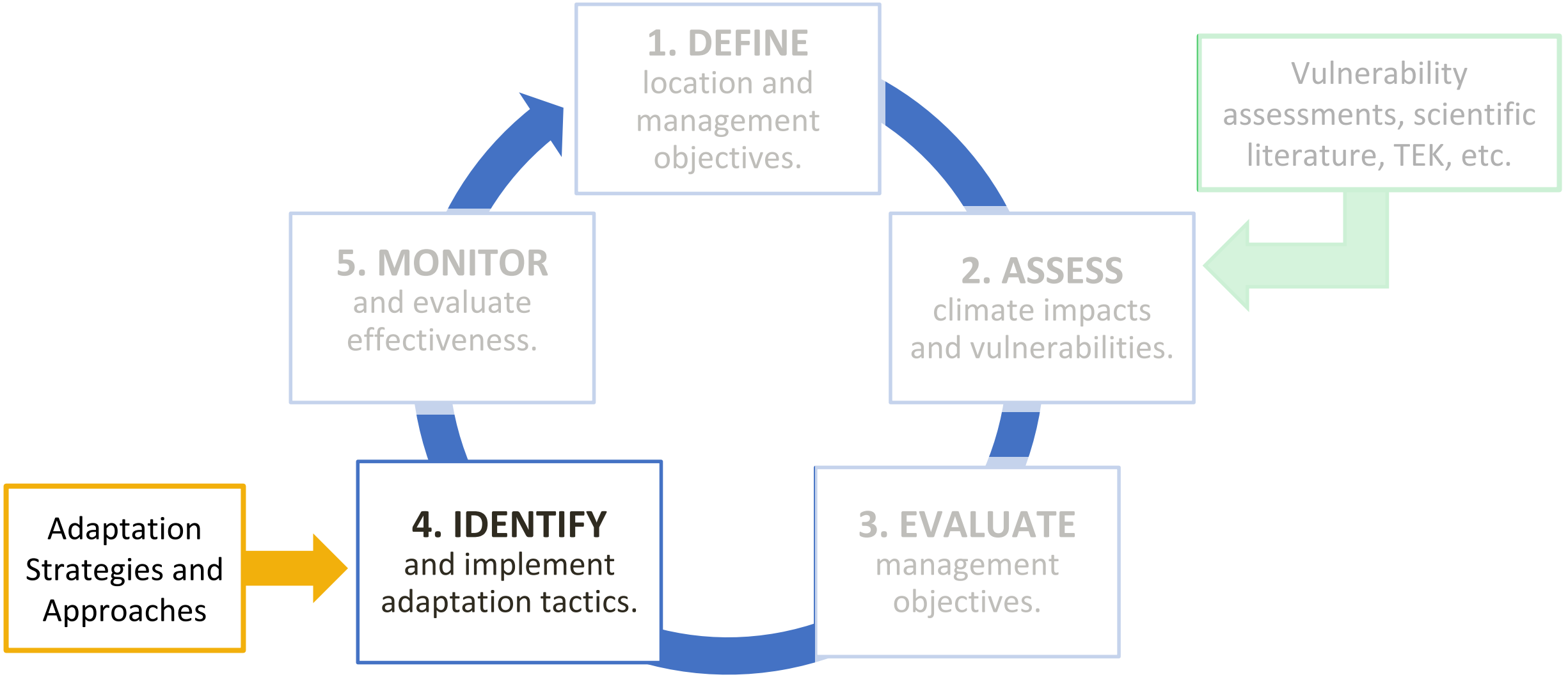
3. Evaluate management objectives



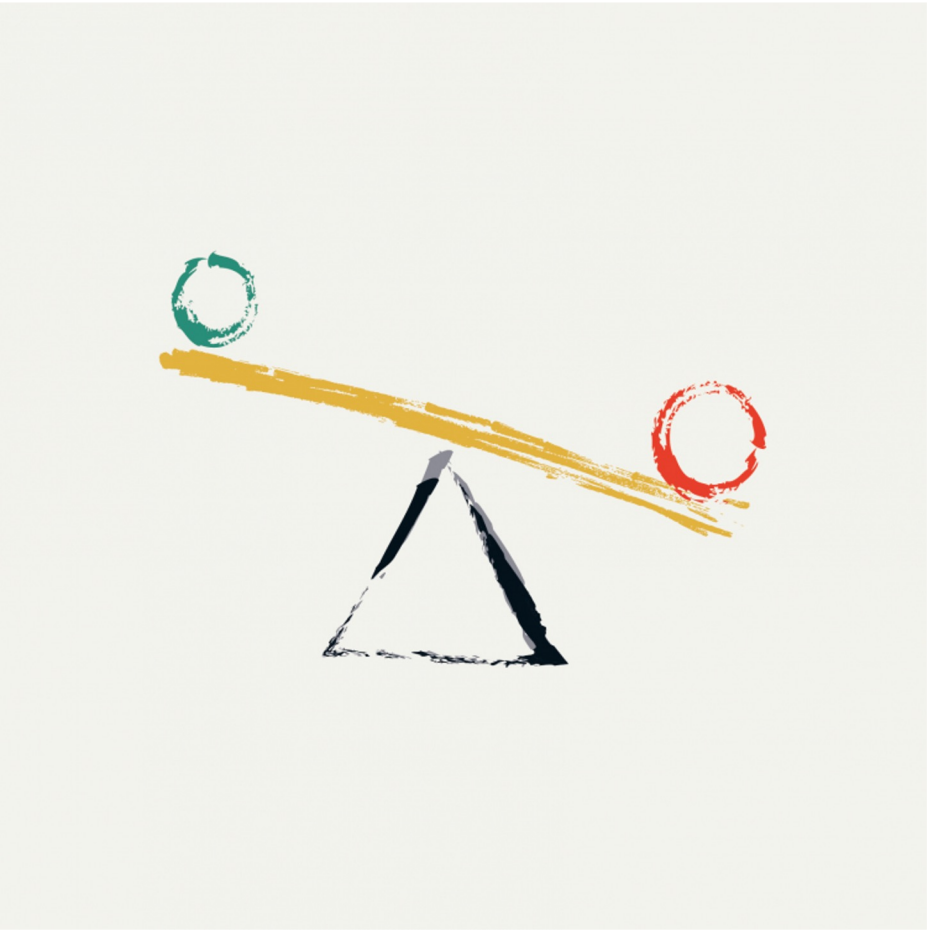


Currently managed high diversity oak savanna

4. Identify and implement adaptation actions



Trade-offs: Considering carbon alongside other goals



We focused on:

- Management effects on ecosystem outcomes
  - (not land use change)
- Specific ecological trade-offs only
  - (Not externalities – e.g., GHG emissions from management actions such as gas to drive vehicles)

Trade-offs activity

Management action starts (and continues through time)

Woody subcanopy removal (e.g., buckthorn)

Aboveground carbon pool

Carbon pool size

Woody biomass growth; canopy closure

Potential die-off v
drought-intoleran
species

ent

Understory and ground cover develops

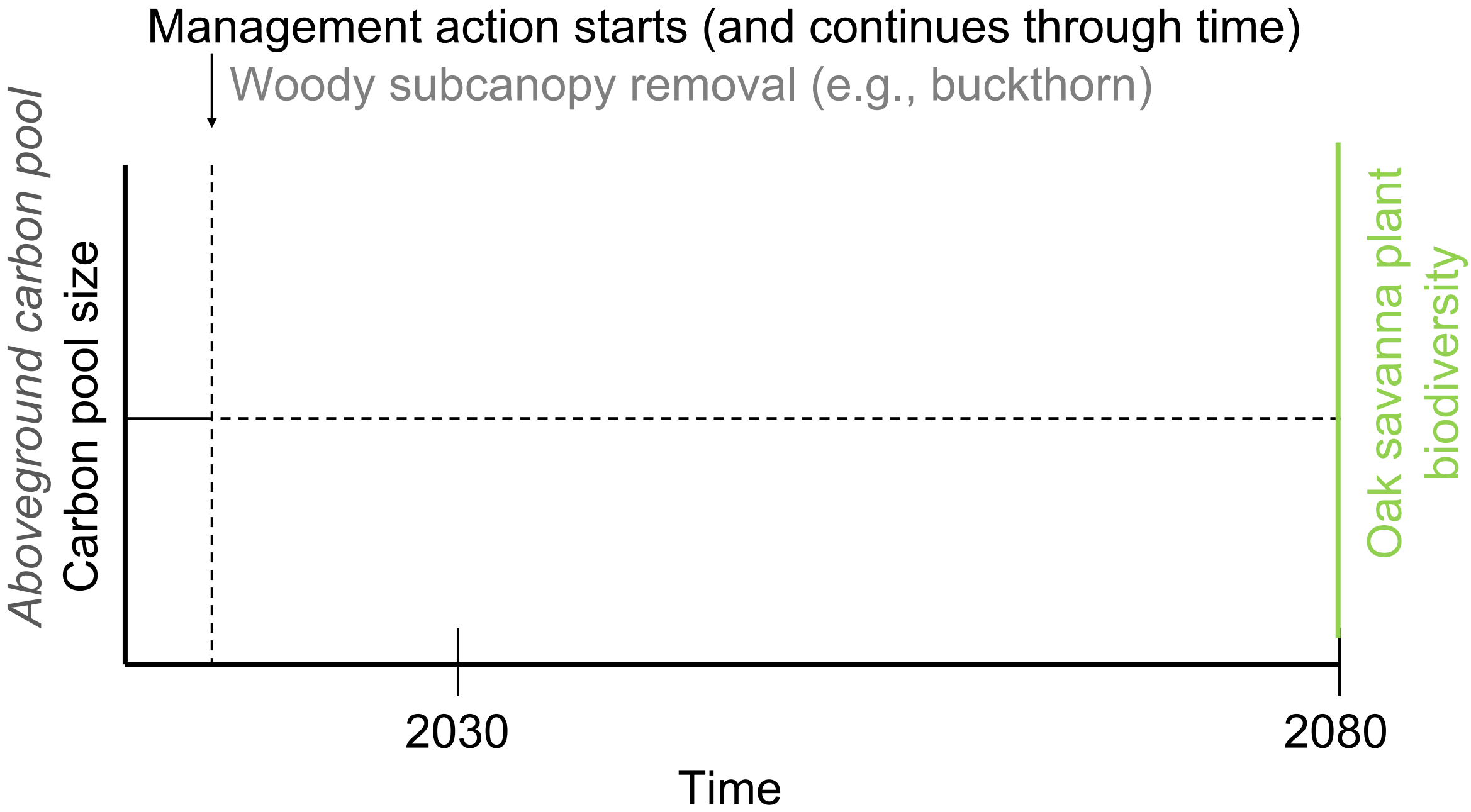
Woody biomass removal

2030

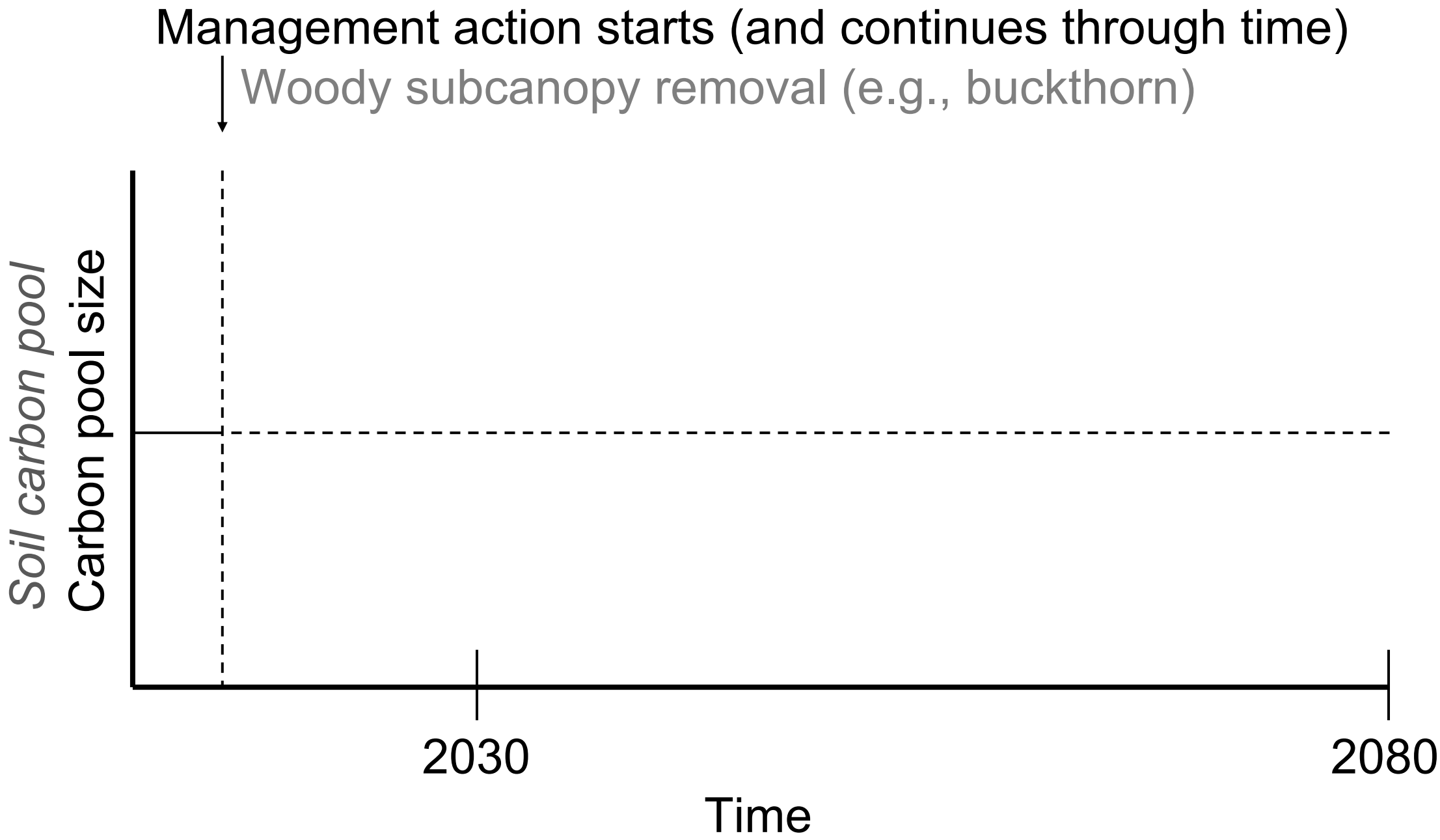
2080

Time

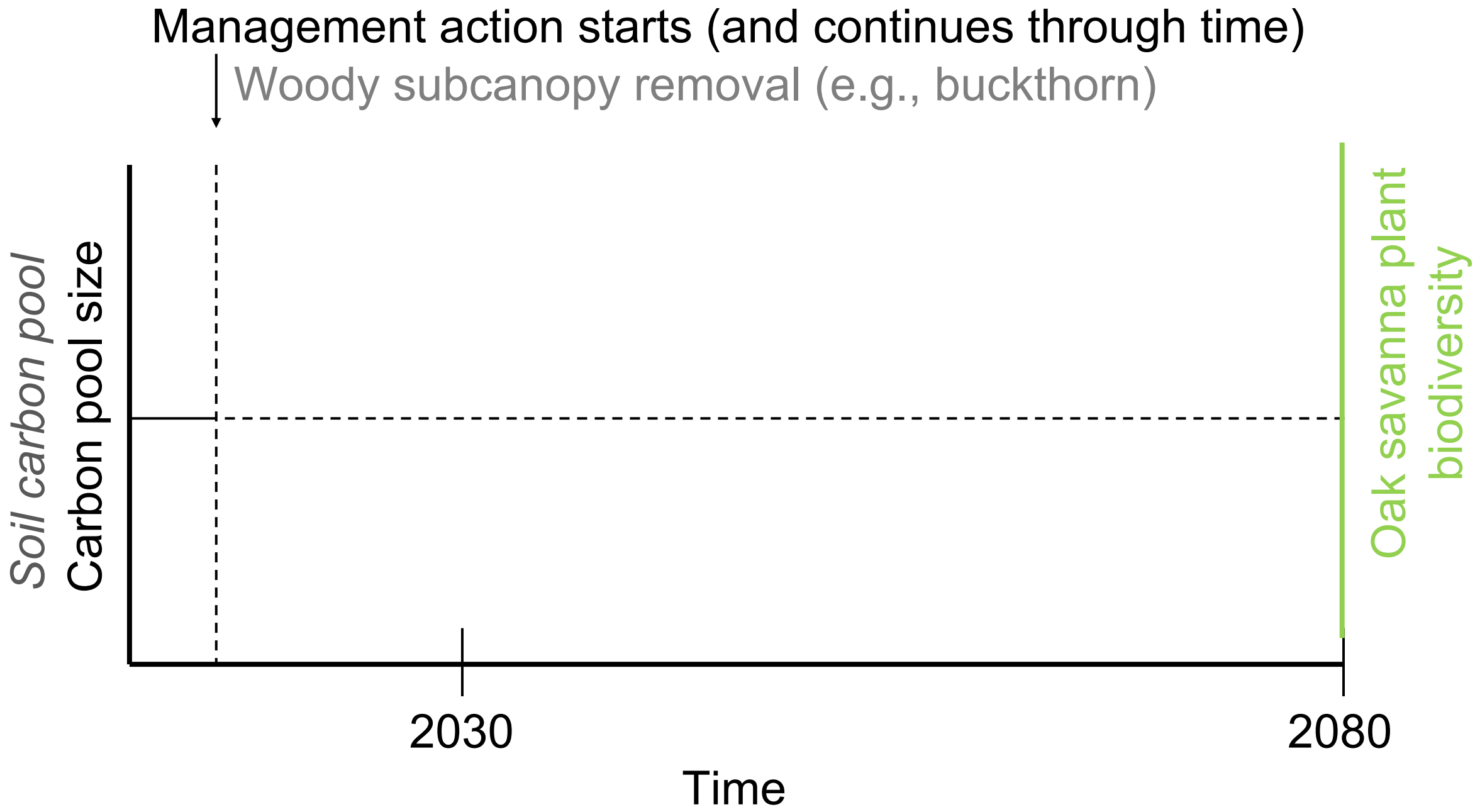
Trade-offs activity



Trade-offs activity

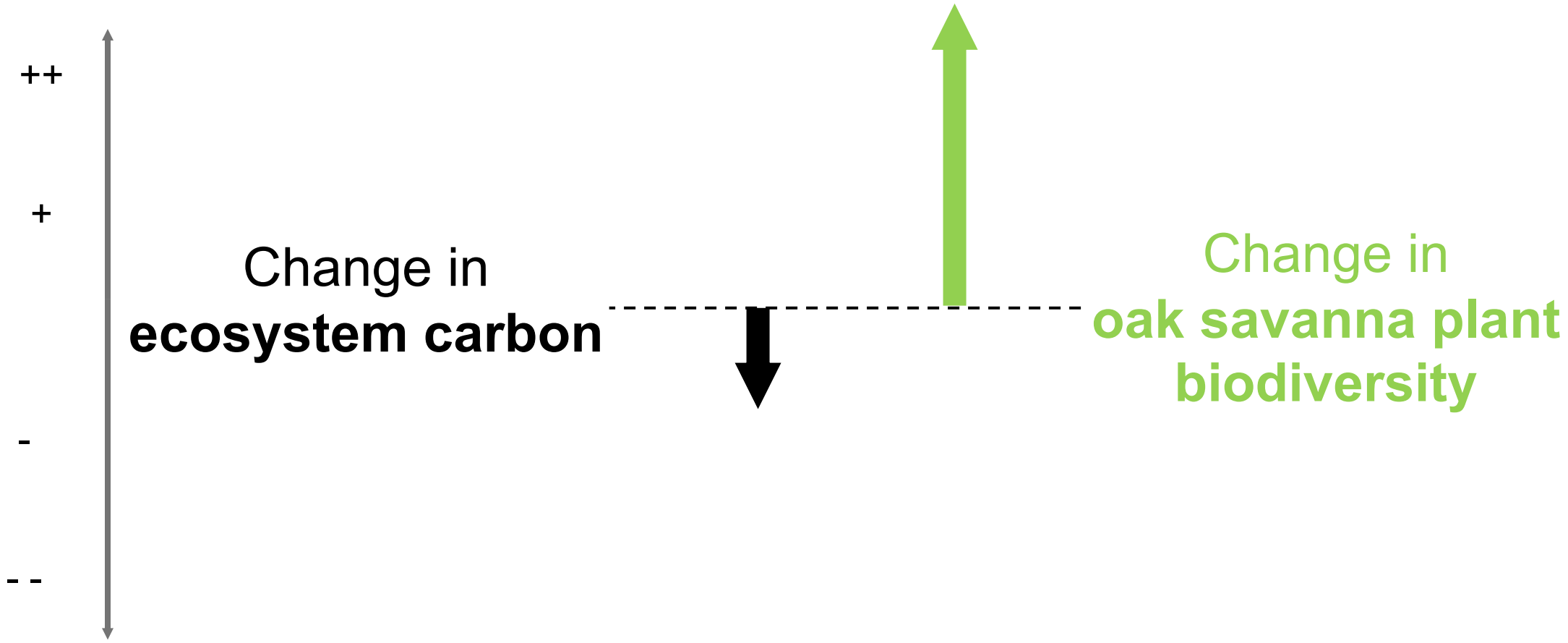


Trade-offs activity



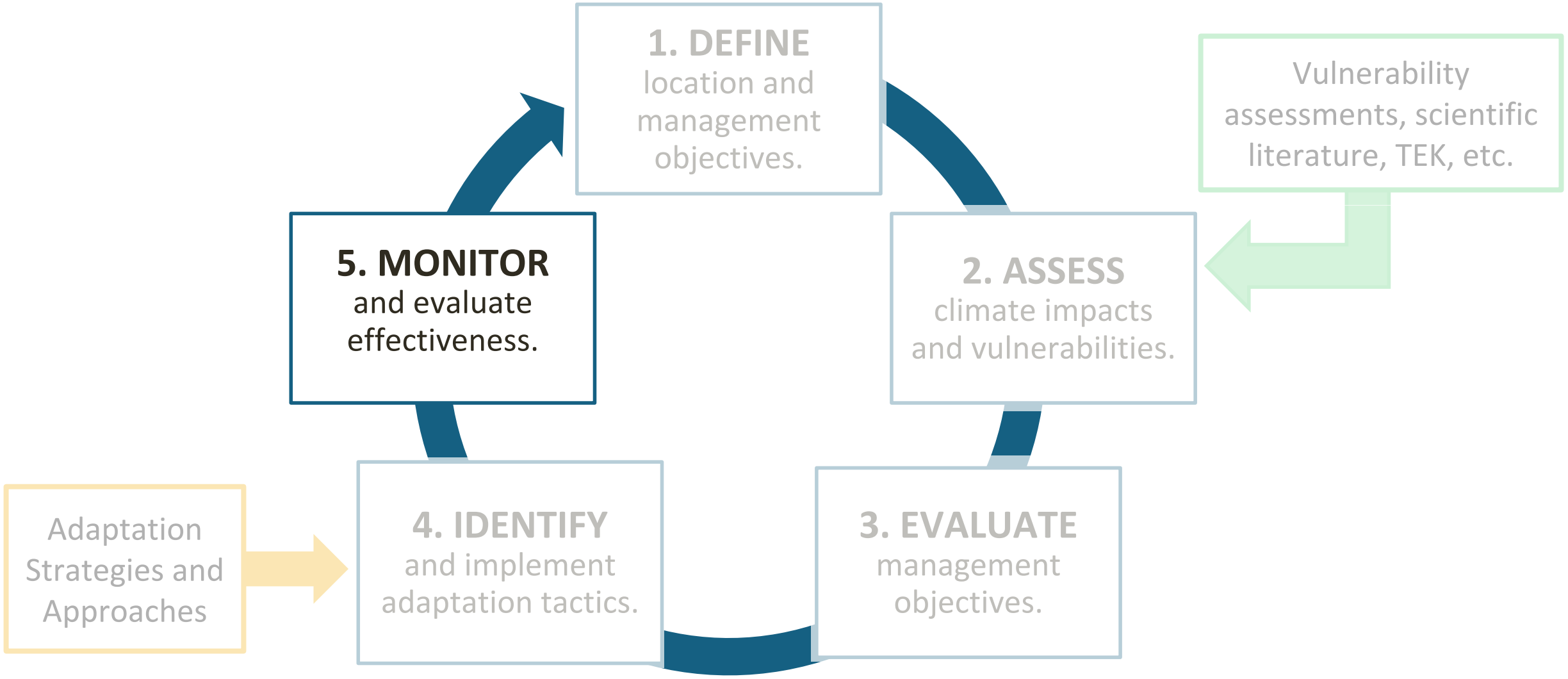
Trade-offs activity: direction and magnitude?

Woody subcanopy removal (e.g., buckthorn)



Case study: TNC Meyer Preserve, Wisconsin

Adaptation Workbook



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5. Monitor and evaluate management actions and trade-offs

VS.

- What carbon pools are changing significantly (over project timeline)?
- What can regionally relevant research tell you about your site?
- Opportunities for carbon estimation:
  - Vegetation surveys
  - Fuels surveys
  - Back of the envelope calculations (allometry)

Elevator Pitch:
Carbon management as one piece of the puzzle

1. Our management goals include _____ and carbon. Carbon is **one of multiple management goals**.

1. To achieve these multiple goals, we are focused on **optimizing (not maximizing)** carbon with the context of ecosystem integrity and climate adaptation.

1. **Climate adaptation** often supports climate mitigation. Many climate adaptation actions address risks to ecosystem health that sustain or improve the capacity of systems to sequester carbon.