Carbon Stewardship:
The Nexus of Climate Adaptation & Mitigation

USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE

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National Forest System
Washington Office

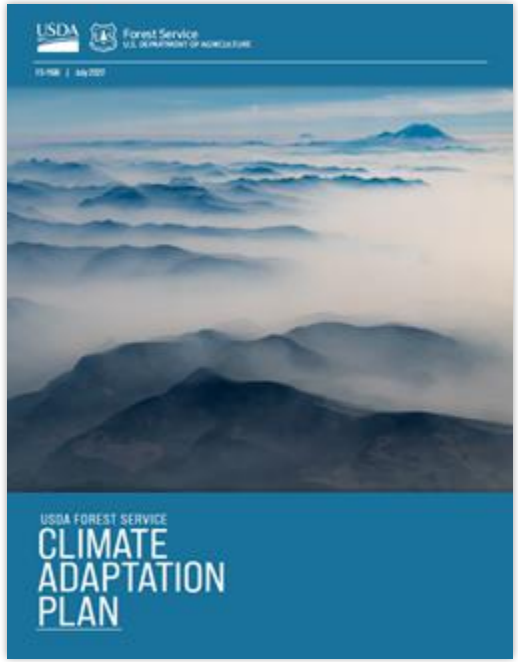
Why Carbon Stewardship?

U.S. DEPARTMENT OF AGRICULTURE
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

ACTION 2b:
Develop policy recommendations for climate resilience and carbon stewardship on National Forest System lands



CARBON STEWARDSHIP

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?

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

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




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 data

Land Management Planning

Actions

What is Carbon Stewardship?

Carbon data

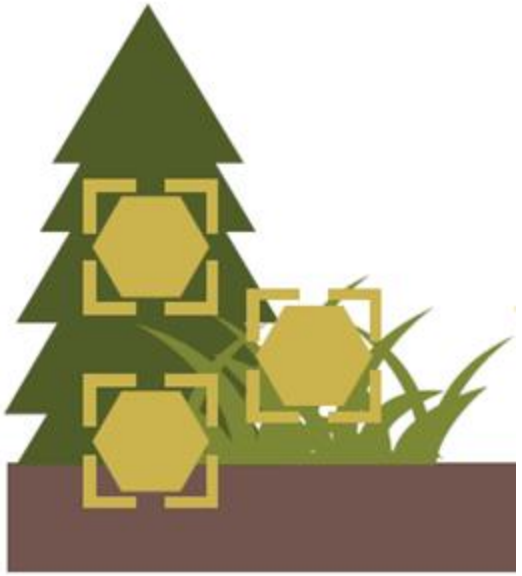
Land Management Planning

Actions

What is Carbon Stewardship?

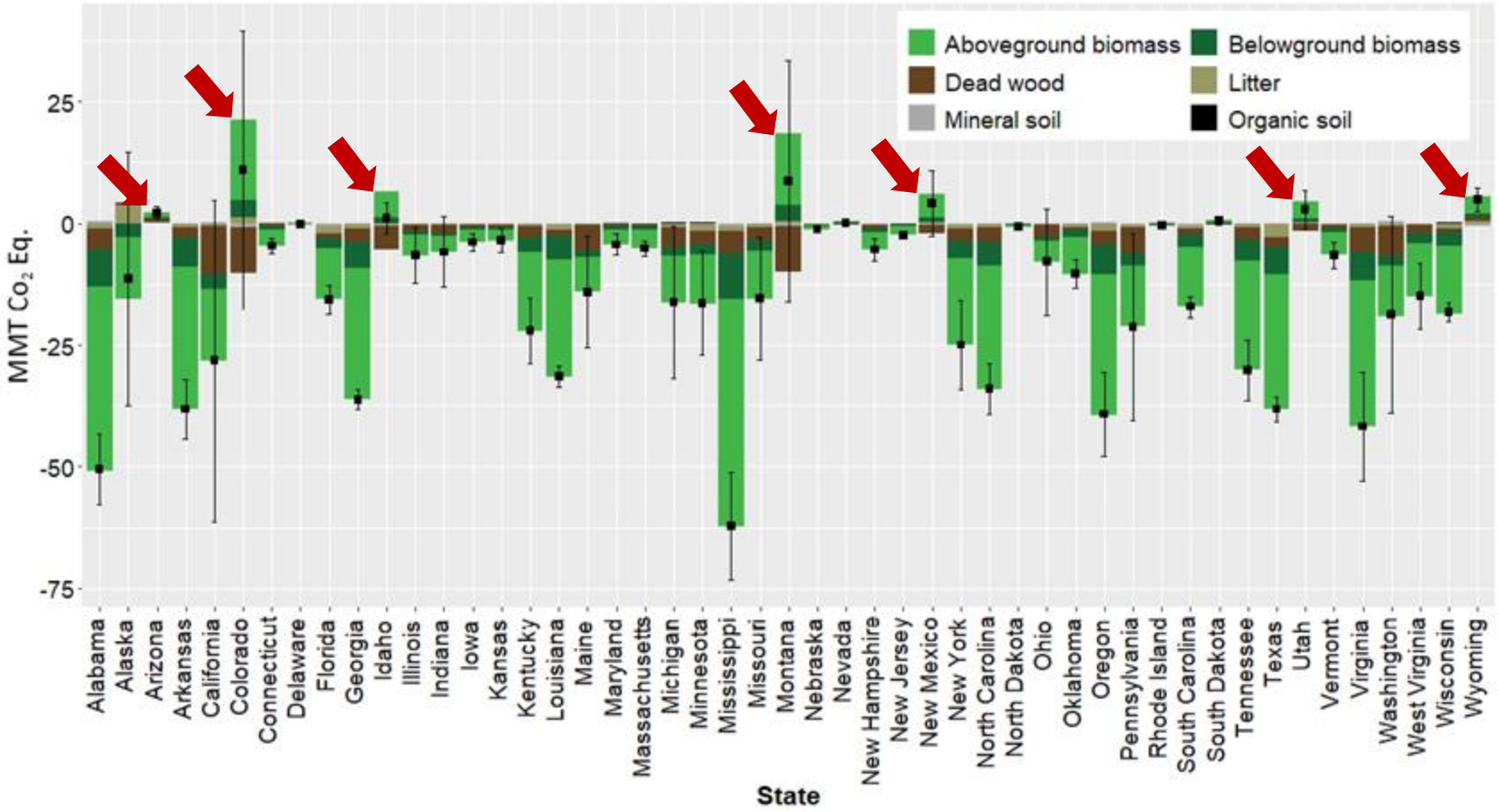
carbon uptake

carbon stability



carbon storage

The Importance of Carbon Stability



EXAMPLE:
Seven U.S. western states are **carbon sources** to the atmosphere, largely from the effects of:

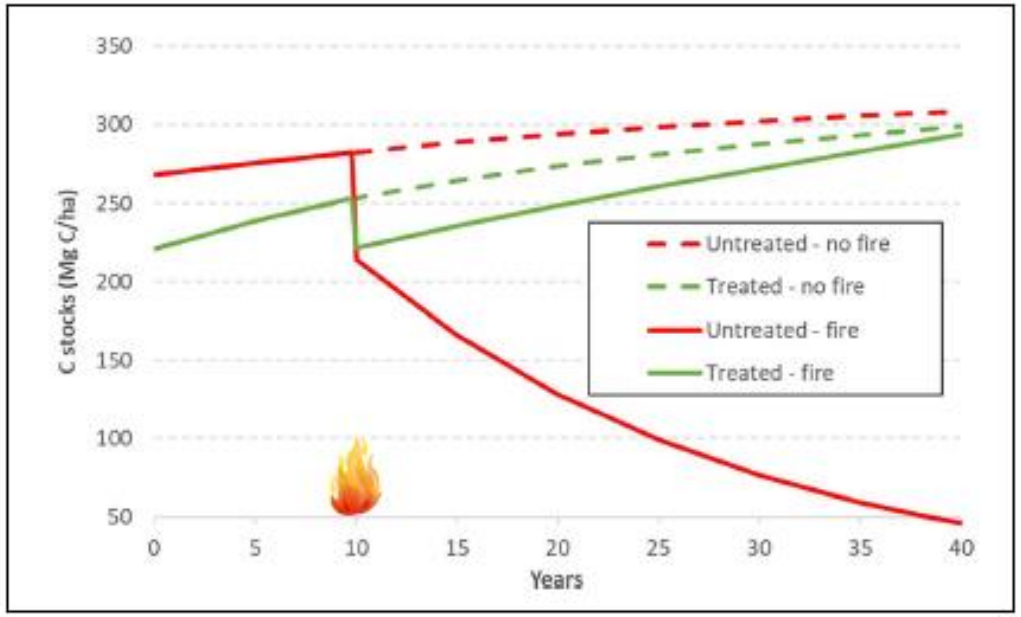
- legacies of fire suppression
- drought
- insects
- wildfire

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 Service.

Carbon Stability

Climate Risk: Drought, Wildfire

Fuels reduction treatments: Forest thinning + prescribed fire



Buchholz et al. 2022

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]

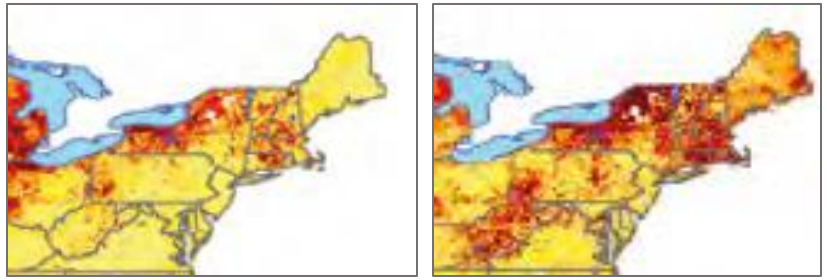
Image: Steve Rondeau, Klamath Tribe, Nature.org

Carbon Stability in the Mid-Atlantic

Climate Risk: Drought

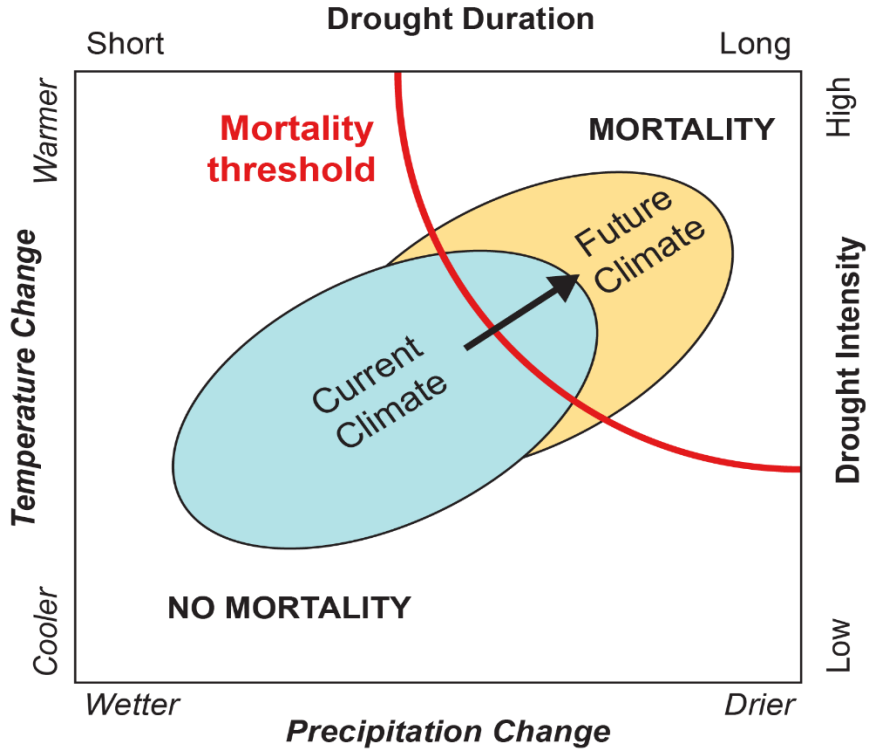
Cumulative Drought Severity Index
Mid-century (2040-2069)

RCP 4.5 RCP 8.5



CDSI
Months
0
1 - 90
91 - 180
181 - 270
271 - 450
451 - 630
631 - 810
811 - 1080

Matthews et al. 2018



NCA3 2014

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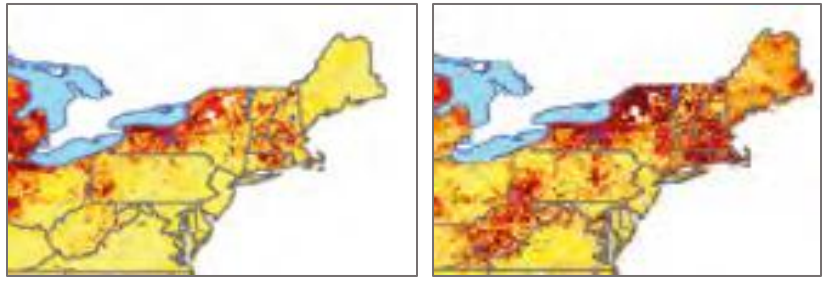
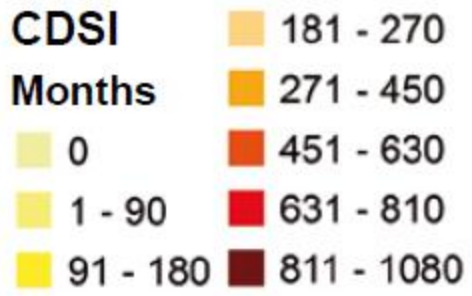




Matthews et al. 2018

Density-dependent vulnerability of forest ecosystems to drought

Alessandra Bottero*,[1,2], Anthony W. D'Amato[1,3], Brian J. Palik[2], John B. Bradford[4], Shawn Fraver[5], Mike A. Battaglia[6] and Lance A. Asherin[6]

Effects of thinning on drought vulnerability and climate response in north temperate forest ecosystems

Anthony W. D'Amato,[1,5] John B. Bradford,[2] Shawn Fraver,[1,4] and Brian J. Palik[3]

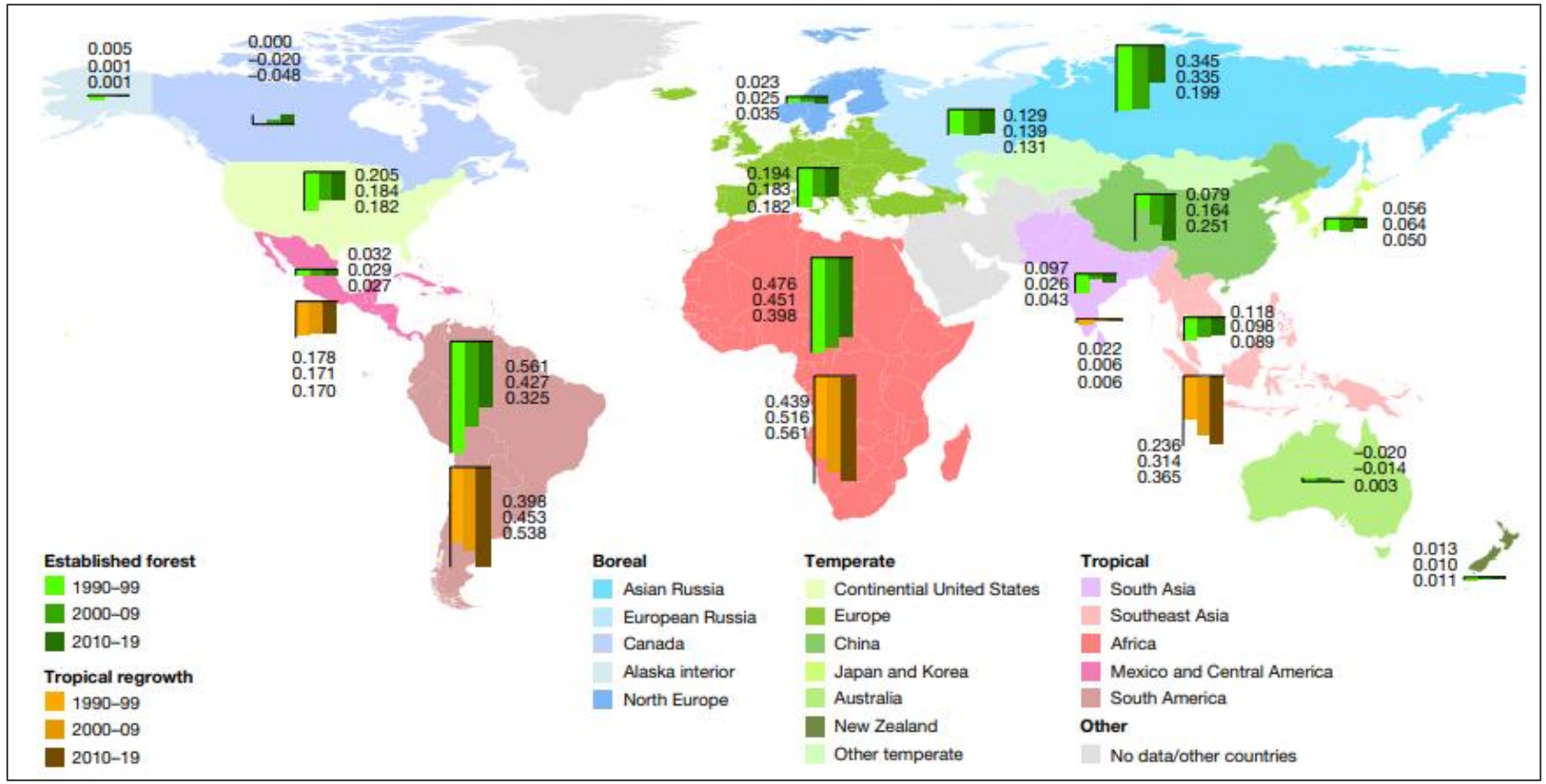
The Importance of Carbon Stability

The Guardian US

Mon 14 October 2024
By Patrick Greenfield

Trees and land absorbed almost no CO2 last year. Is nature's carbon sink failing?

Ke et al. 2024, using Global Carbon Budget 2023 data (www.icos-cp.eu/science-and-impact/global-carbon-budget/2023)



Pan et al. 2024. The enduring world forest carbon sink. *Nature,* 631:563-569

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

vulnerability rating

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

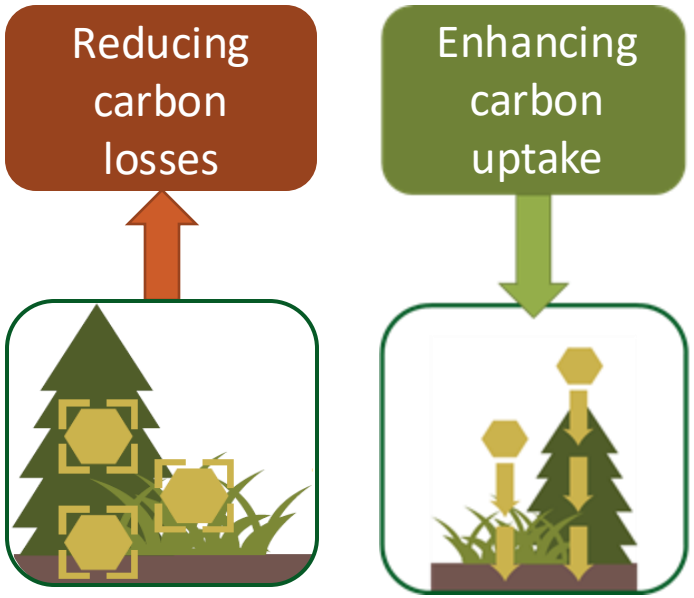
Adaptation is the adjustment of systems in response to climate change.

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

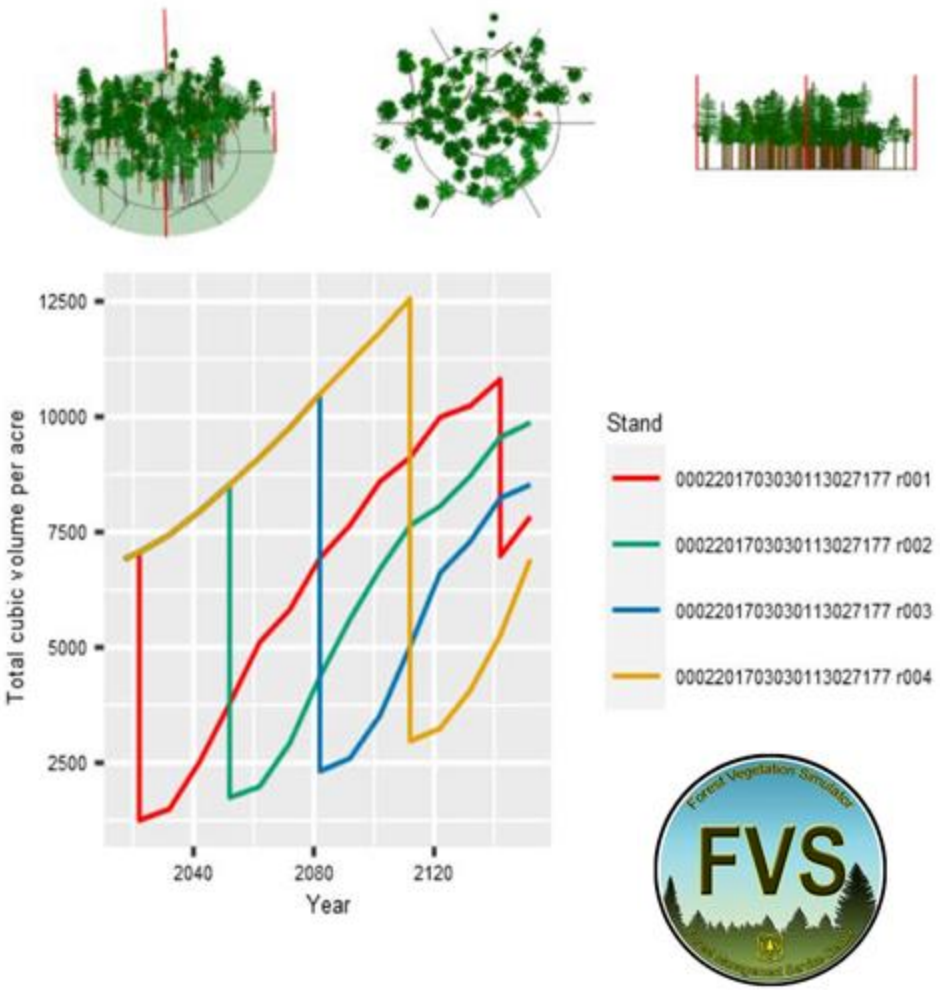
- Enhancing growth of existing mature trees
- Improving tree regeneration to increase future productivity

Principle #2: Fostering ecological integrity and climate resilience

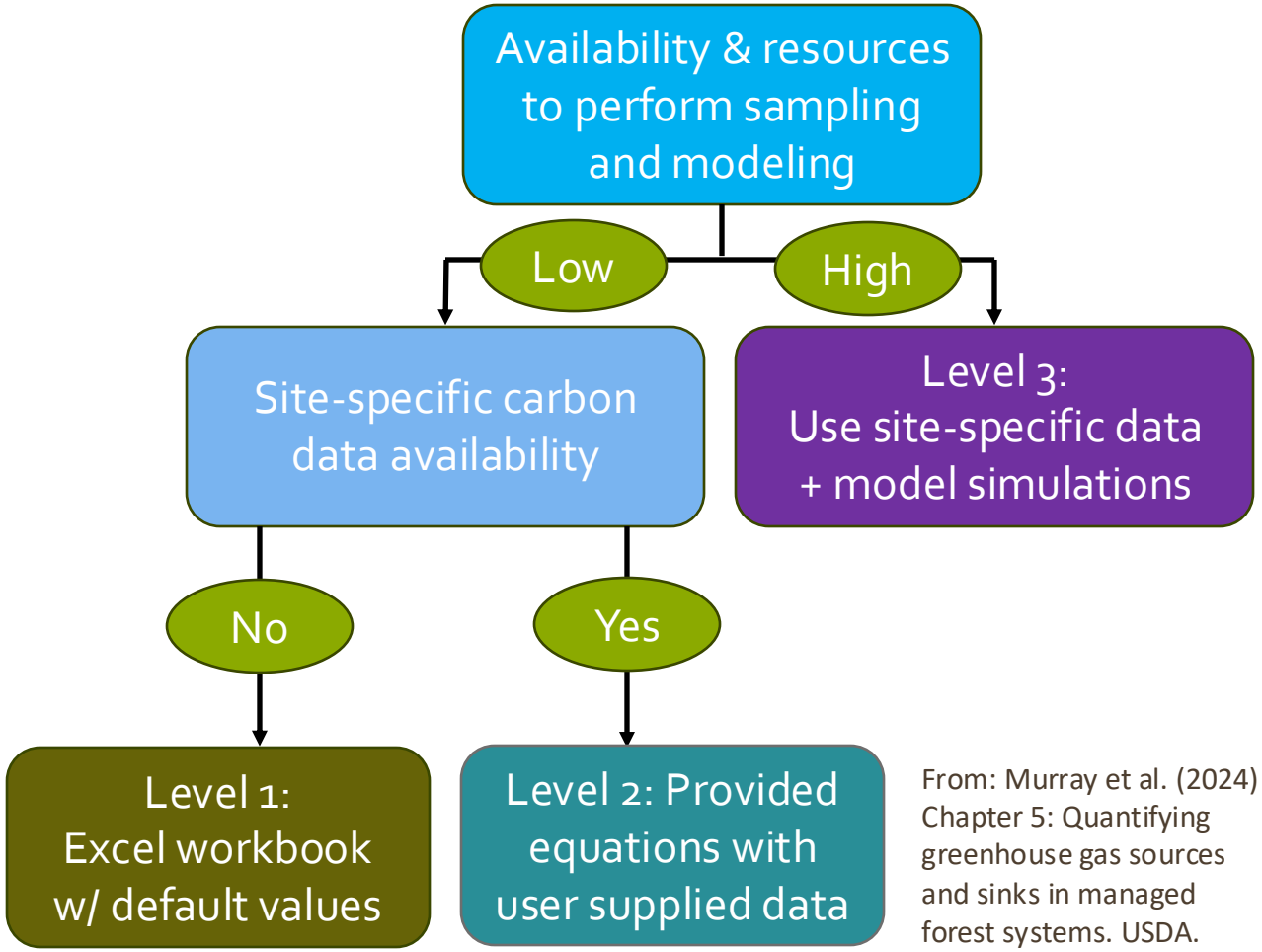
Principle #3: Integrated resource management that aligns with multiple uses

**Understanding tradeoffs can be critical!*

Principle #4: Based on carbon and climate science



Model-based quantification can vary in intensity:

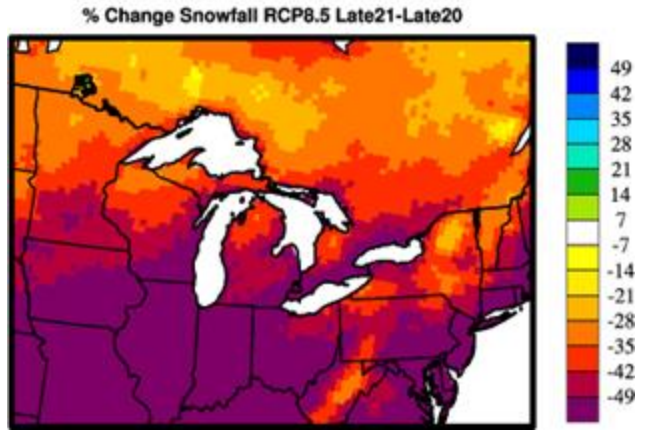


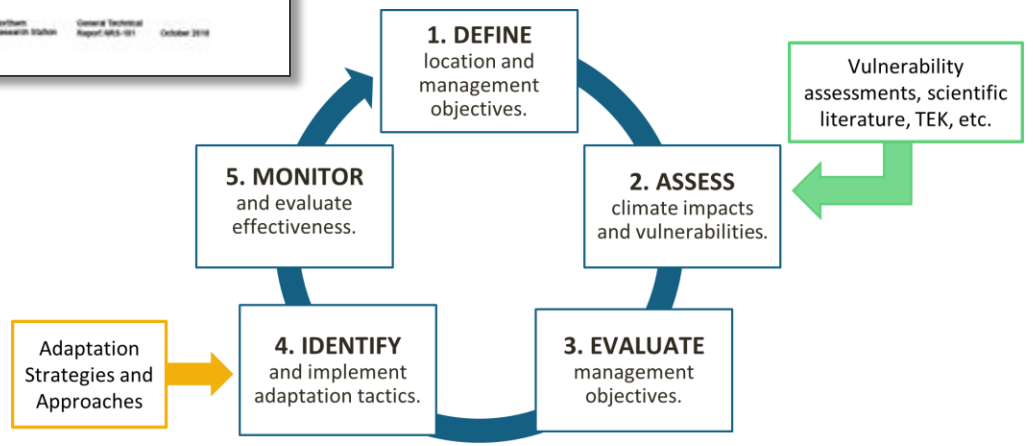
From: Murray et al. (2024) Chapter 5: Quantifying greenhouse gas sources and sinks in managed forest systems. USDA.

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>

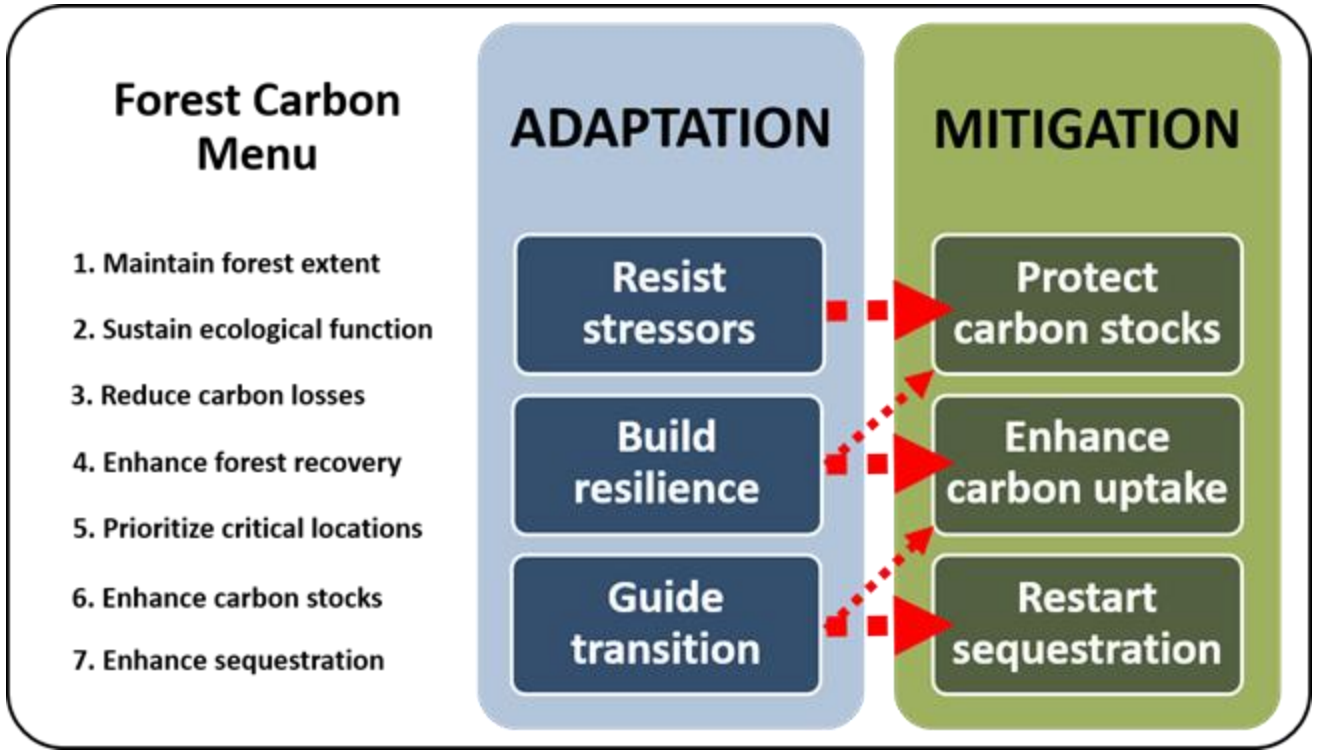




Principle #4: Based on carbon and climate science

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**

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