



Forest Carbon and Climate Program
Department of Forestry
MICHIGAN STATE UNIVERSITY

Carbon Stewardship of National Forests and Grasslands

This white paper is designed to provide a brief overview of USDA Forest Service authority to manage federal land, outline carbon stewardship principles in a changing climate, and provide resources for USDA Forest Service land managers to incorporate carbon into resource planning and management.

Evan Beresford, Michigan State University, Department of Forestry, Forest Carbon & Climate Program

Chad C. Papa, Michigan State University, Department of Forestry, Forest Carbon & Climate Program

Suggested Citation: Beresford, E., & Papa C. C. (2026). Carbon Stewardship of National Forests and Grasslands. [White Paper]. Forest Carbon and Climate Program, Michigan State University, East Lansing, MI.

Table of Contents

| | |
|--|---|
| <i>Introduction</i> | 2 |
| <i>A Brief History of Forest Service Authority</i> | 2 |
| <i>Carbon Stewardship</i> | 3 |
| <i>Strategies, Approaches, & Tactics for Carbon & Climate Management</i> | 5 |
| <i>Conclusion</i> | 6 |
| <i>References</i> | 7 |

Introduction

The USDA Forest Service has been managing forests and grasslands for over a century, and understanding the key acts of congress that give it the authority to purchase and manage lands is key to understanding forest management in a changing climate. Changing climate patterns paired with complex federal policies can create challenges for federal land managers. Recent attention has shifted towards carbon stewardship, or the idea of managing land in a way that considers how and where carbon is stored to ensure forest health and resilience. This paper will cover some of the defining legislation that guides the Forest Service, and lay out the need for carbon stewardship, providing examples of management activities.

This white paper draws on information developed in a [professional short course](#) by the Michigan State University, Department of Forestry, Forest Carbon and Climate Program and the Northern Institute of Applied Climate Science, a collaborative, multi-institutional partnership led by the USDA Forest Service.

A Brief History of Forest Service Authority

While there is a massive body of legislation that determines Forest Service authority, this section will only cover a few significant regulations that guide the ways that land managers can incorporate carbon management into their planning process.

The USDA Forest Service was formally established in 1905, though earlier legislation (the Forest Reserve Act of 1891; Organic Act of 1897) created the framework for a federal agency to designate and manage forests and grasslands in the United States¹. The Transfer Act of 1905 transferred the administration of federal forest reserves to the Department of Agriculture from the Department of the Interior, creating the USDA Forest Service as it is known today². The Weeks act of 1911 expanded Forest Service power to purchase private lands in the eastern United States, encouraging federal ownership, restoration, and conservation of marginal forestlands³.

The next major legislation regarding forest management was the Multiple-Use Sustained Yield Act (MUSY) of 1960. MUSY established that National Forest lands be "...administered for outdoor recreation, range, timber, watershed, and wildlife and fish purposes",⁴ creating lands that must be managed with a variety of needs in mind. This seminal legislation gives Forest Service the authority to conduct timber harvests, selective thinnings, and other management activities, so long as they meet the needs of the American people. MUSY also created multiple-use planning, creating a need for new specialists (such as silviculturists, geologists, wildlife experts, and more).

A decade later, the National Environmental Policy Act (NEPA) was passed, which requires environmental assessments to be conducted before any management activity can occur on public lands. This process can include conducting environmental impact statements (EIS), which investigate environmental impact of proposed activities, as well as the impacts of alternatives.

The National Forest Management Act (NFMA), first passed in 1976 as an amendment to the Forest and Rangeland Renewable Resources Planning Act of 1974, built off the MUSY doctrine, requiring National Forest System lands to develop management plans, set standards for timber sales based on sustained yield estimates, and incorporate ecosystem management planning into broader forest plans. Since its initial enactment, the NFMA has been amended multiple times, most recently in 2012.

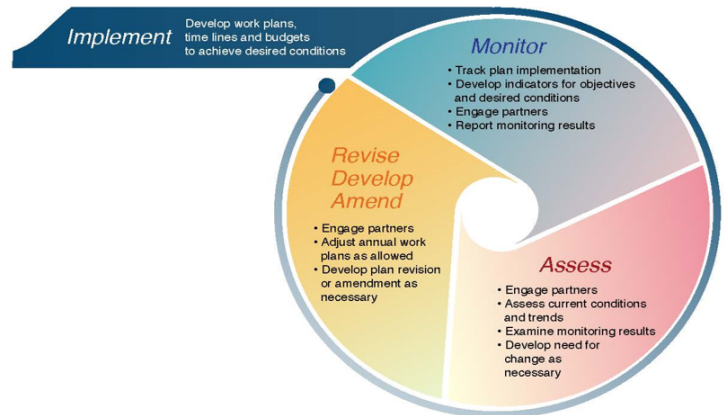
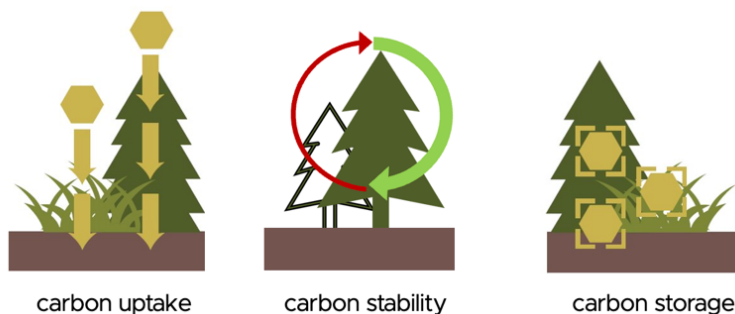


Figure 1: Land management plan design process under the 2012 Planning Rule

The 2012 Planning Rule updated the ways that management plans should be written, including updated language about adaptive management, public engagement, and ecological, social, and economic objectives and now includes restoration goals such as the recovery, maintenance, and enhancement of carbon stocks and the inclusion of a range of climate and other environmental change projections⁵. The new Planning Rule also allows for climate change adaptation, which is management activities that seek to adapt forest systems to projected climate changes. **Figure 1** shows the planning process outlined by the 2012 amendment. The three major phases in plan development, assessment, revision, and monitoring, feed into one another, encouraging community engagement and continual assessment of project outcomes. In the new Planning Rule, there are specific guidelines surrounding carbon, including assessment of baseline carbon stocks (36 CFR 219.6).

Carbon Stewardship

Forests play an important role in the global carbon cycle through sequestering and storing atmospheric carbon dioxide in both woody tissues and harvested wood products. Incorporating carbon and climate into land management planning is increasingly important as climate change increases threats to ecosystem health and resilience, increases the risk of catastrophic natural disturbance⁶, and is driving novel departures in forest health, structure and functioning⁷.



Carbon Stewardship:

Considering and optimizing biogenic carbon within the context of multiple-use sustained yield planning, ecosystem integrity, and climate adaptation

There are four major principles of carbon stewardship:

1. Integrate climate adaptation to minimize risks to carbon.

Adapting forest systems to both observed changes and forecasted changes will help reduce the risk of significant carbon loss across the landscape. By adapting forests to future conditions through topical management approaches, managers can improve the durability of stored carbon on a landscape.

2. Foster ecological integrity and climate resilience.

The goal of carbon stewardship is not to maximize the amount of carbon on the landscape but strengthen ecosystem resilience and function to ensure the carbon captured is stable in the face of a changing climate. Optimization of carbon stocks (that is, prioritizing certain species, phenotypes and geographies), can lead to more stable, durable pools despite changes to local conditions.

3. Integrate resource management that aligns with multiple-uses.

Carbon stewardship on federal lands should be observed through the lens of multiple-use, meaning that other needs and uses for the land must be considered in addition to carbon storage. Managing forests for carbon can provide many other co-benefits, and accounting for them in the plan development process can help managers implement plans focused on carbon stewardship. In some instances and locations, managing for other values may be a higher priority than increasing carbon storage.

4. Align management with best-available carbon and climate science.

Carbon stewardship should be based on the best-available climate and carbon science to have the most significant positive impact. Resources such as the [Forest Service Carbon Dashboard](#) can help federal land managers understand local carbon stocks, as well as recent trends in local and national pools.

Carbon stewardship is predicated on up-to-date carbon and climate science and models to adapt forests to future conditions and ensure long term resilience. Maximizing carbon storage cannot be the only goal for federal land managers, but MUSY gives managers the authority to manage forest and grasslands lands for specific goals with the caveat that other interests and uses are considered. Resources such as the [National Climate Assessments](#) and the [Ecosystem Vulnerability Assessments](#) can assist forest managers in understanding current and future threats in their area. [The Adaptation Menu of Strategies and Approaches](#)⁸ provide land managers with strategies, approaches, and tactics that land managers can implement to increase the resilience of ecosystems, and in turn, the carbon stored on the landscape.

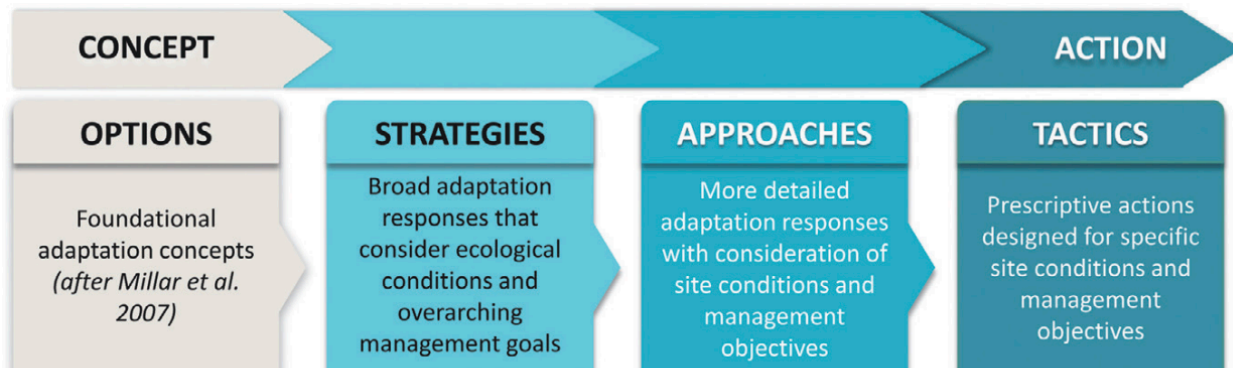
Strategies, Approaches, & Tactics for Carbon & Climate Management

The [Northern Institute of Applied Climate Science](#) (NIACS) has developed a framework for climate change adaptation, based on helping managers make decisions based on their goals and professional judgement. The Menu of Forest Adaptation Strategies and Approaches⁸ is designed to translate conceptual adaptation ideas into on-the-ground actions that target different aspects of climate adaptation. Land managers must consider their own forest stand conditions, local climate projections, and needs of their communities before making any management decisions. NIACS has also developed a related [Forest Carbon Management Adaptation Menu](#)⁹ that highlights the value of managing for carbon storage and sequestration capacity. These menus are not strict guidance documents but rather aim to help land managers consider a variety of adaptation-oriented or carbon specific actions.



Both the adaptation and carbon menus employ a tiered structure beginning with strategies and are general management options. Strategies from the forest carbon menu guide include ideas such as reduce carbon losses from decreased natural disturbance, including wildfire (strategy 3) or enhance forest recovery following disturbance (strategy 4). Strategies are not prescriptive actions but instead are a starting point for thinking about climate-smart management activities.

Moving toward more specific action, the 67 identified approaches across both menus help land managers hone their focus. Approaches are more detailed ideas that are nested within strategies, further clarifying actions that can help accomplish a given strategy. For example, within the above-mentioned strategy 3, approach 3.2 is to establish natural or artificial fuel breaks to slow the spread of catastrophic fire. This is still not a prescriptive action, as there are many ways to establish fuel breaks, and will ultimately look different in different forests and geographies.



Finally, tactics are on the ground activities that land managers can implement to meet their management goals. The Forest Adaptation and Carbon Menus list over 100 example tactics that could be implemented each connected to an overarching approach and strategy. For example, within approach 3.2, a tactics listed in the carbon menu is “using prescribed fire or mechanical thinning to lower the volume of dense vegetation

and reduce flammability within a buffer zone of appropriate size for the landscape”⁹. This specific action is only suitable under certain ecological, climate, and social conditions. The menus provide land managers with a wide breadth of options to consider when designing and writing management plans designed to be paired with local knowledge and expertise.

Conclusion

Federal lands already sequester and store substantial amounts of carbon. Proper carbon stewardship of national forests and grasslands can help federal land managers mitigate and adapt to climate change. Further incorporating carbon and climate adaptation into multiple-use planning gives land managers the flexibility but requires consideration of trade-offs between carbon and other goals.

References

- ¹Fedkiw, J., 1997. National Forests and the Performance of the Organic Act of 1897. Published in Forest History Today. Accessed at: https://foresthstory.org/wp-content/uploads/2016/11/Fedkiw_National-Forsets-and-the-Performance-of-the-Organic-Act-of-1897.pdf
- ²West, T., 1992. Forest Transfer Act of 1905. Published in the Journal of Forestry. <https://academic.oup.com/jof/article/90/6/44/4635580>
- ³Forest History Society, n.d. "The Lands Nobody Wanted" Accessed at: <https://foresthstory.org/research-explore/us-forest-service-history/policy-and-law/the-weeks-act/lands-nobody-wanted/>
- ⁴Multiple-Use Sustained-Yield Act of 1960 PL 86–517; Approved June 12, 1960. Accessed at: <https://www.fs.usda.gov/emc/nfma/includes/musya60.pdf>
- ⁵USDA Forest Service. (2020). The 2012 Planning Rule. Access at: <https://storymaps.arcgis.com/stories/dce6a7782db042689016f5bdd32c565a>
- ⁶Seidl, R., Thom, D., Kautz, M., Martin-Benito, D., Peltoniemi, M., Vacchiano, G., Wild, J., Ascoli, D., Petr, M., Honkaniemi, J., and Lexer, M.J. (2017). Forest disturbances under climate change. Nature climate change, 7(6), 395-402. <https://doi.org/10.1038/nclimate3303>
- ⁷McDowell, N.G., Allen, C.D., Anderson-Teixeira, K., Aukema, B.H., Bond-Lamberty, B., Chini, L., Clark, J.S., Dietze, M., Grossiord, C., Hanbury-Brown, A. and Hurtt, G.C. (2020). Pervasive shifts in forest dynamics in a changing world. Science, 368(6494). <https://doi.org/10.1126/science.aaz9463>
- ⁸Swanston, C. W.; Janowiak, M. K., Brandt, L. A., Butler, P. R., Handler, S. D., Shannon, P. D., Derby Lewis, A., Hall, K., Fahey, R. T., Scott, L., Kerber, A., Miesbauer, J. W., Darling, L., Parker, L., St. Pierre, M. (2016). Forest Adaptation Resources: climate change tools and approaches for land managers, 2nd ed. Gen. Tech. Rep. NRS-GTR-87-2. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 161 p. <https://doi.org/10.2737/NRS-GTR-87-2>
- ⁹Ontl, T.A., Janowiak, M.K., Swanston, C.W., Daley, J., Handler, S., Cornett, M., Hagenbuch, S., Handrick, C., Mccarthy, L. and Patch, N., 2020. Forest management for carbon sequestration and climate adaptation. Journal of Forestry, 118(1), 86-101. <https://doi.org/10.1093/jofore/fvz062>
- ¹⁰Millar, C. I., Stephenson, N. L., Stephens, S. L. (2007). Climate change and forests of the future: Managing in the face of uncertainty. Ecological Applications, 17(8), 2145-2151. <https://doi.org/10.1890/06-1715.1>