Natural & Working Landscapes Track Background Paper

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Track Overview

We are fortunate to have a diversity of native ecosystems in Wisconsin, and their distribution is a result of interactions of climate, geology, soils, hydrology, and land stewardship. Relative to other types of land uses, Wisconsin's natural and working lands store large amounts of carbon and can be protected and restored to maximize storage and sequestration. Society also depends on a diversity of *ecosystem services*, or benefits derived from these lands. The increased frequency of extreme weather events threatens the capacity of these lands to store and sequester carbon and to support natural and human communities. The consequences of inaction negatively affect both ecosystem and public health, as well as local economies. Examples include but are not limited to: changing pest and disease dynamics, loss of biodiversity and productive soils, excessive nutrients in our waters, increased flood damages, and more.

In this track we will explore strategies to maintain or increase landscape-scale carbon storage, protect biodiversity, and increase resilience. The discussions will be informed by the Wisconsin Initiative for Climate Change Impacts' (WICCI) climate change vulnerability assessments for the state's ecological communities, and other efforts by agricultural and water resource managers to understand and address vulnerabilities. Preliminary strategies identified for discussion, include:

1. Establish collaborations to better understand and quantify the value of climate related ecosystem services provided by natural and working landscapes.
2. Develop frameworks that help communities facilitate landscape-scale initiatives to address climate change.
3. Generate data needed to assess and restore degraded hydrology.

4. Prioritize implementation of agricultural practices that maximize mitigation and adaptation benefits.
5. Develop mechanisms to fund adoption of practices to implement climate mitigation and adaptation strategies in natural and agricultural landscapes.

Participants will be invited to reflect on these strategies and offer alternative approaches. Themes central to these discussions will include: the importance of assessing opportunities and implementing practices at meaningful scales; how to manage for resilience without putting existing natural landscapes at risk; identifying opportunities to maximize co-benefits; and how to ensure recommended strategies address the disproportionate impacts of climate change on vulnerable human populations.
Although we are addressing climate risks and mitigation opportunities in natural and working lands separately, in reality most Wisconsin landscapes include a mix of natural and agricultural land cover. Thus, the most effective strategies will be informed by regional context. Our vision is for natural and working landscapes that contribute to climate mitigation and are ecologically, economically, and socially resilient to climate.

Natural & Working Lands Strategies

Strategy 1: Establish collaborations to better understand and quantify carbon stocks and the value of climate related ecosystem services provided by natural and working landscapes.

Current status: While some efforts have been made to measure or model the amount and distribution of soil carbon across Wisconsin's natural and working landscapes[1,2], these efforts are not comprehensive. Carbon market development efforts and prioritization of mitigation strategies tend to focus on carbon sequestration potential, with forests and agricultural lands receiving the most attention. The extent of soil carbon and valuation of ecosystem services of other key resources such as prairies, grasslands, and wetlands appear to be under-studied. Current efforts also tend to ignore current and potential emissions from natural and working lands which can be extensive such as those that come from wetland drainage. It is difficult to optimally manage and build existing carbon pools if we cannot measure, track, *and compare* the extent and value of stored carbon and other economic benefits.

End status: Wisconsin's strategies and investments to protect and increase carbon storage and reduce emissions are prioritized based on reliable estimates of the relative positive climate impacts and the value of co-benefits. Such an approach would quantify and incentivize both sequestration and reduced emissions.

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[1] Kabindra Adhikari, Phillip R. Owens, Zamir Libohova, David M. Miller, Skye A. Wills, Jason Nemecek, Assessing soil organic carbon stock of Wisconsin, USA and its fate under future land use and climate change, Science of The Total Environment, Volume 667, 2019, Pages 833-845.

[2] Birdsey, Richard; Pan, Yude; Janowiak, Maria; Stewart, Susan; Hines, Sarah; Parker, Linda; Gower, Stith; Lichstein, Jeremy; McCullough, Kevin; Zhang, Fangmin; Chen, Jing; Mladenoff, David; Wayson, Craig; Swanston, Chris. 2014. Past and prospective carbon stocks in forests of northern Wisconsin: a report from the Chequamegon-Nicolet National Forest Climate Change Response Framework. Gen. Tech. Rep. NRS-127. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. 52 p.

Impact on climate change mitigation, adaptation, or resilience: As with all conservation, we need to understand the relative benefits of our actions in order to maximize the return on investments. If we cannot accurately quantify existing carbon stocks or assess their vulnerabilities, investments to increase stocks could be offset by ongoing losses. The ecosystem services valuation is equally important because public support for climate investments - mitigation or adaptation - will always be greater when there are quantifiable benefits to local residents or discrete communities.

Why this is a good approach for Wisconsin: We cannot expect to increase investments in the protection and restoration of natural landscapes or investments in/adoption of climate friendly management practices in working landscapes without understanding and communicating these values.

Focal constituencies: Policy-makers, farmers, foresters, public lands managers, private landowners.

Potential key actions:

- Seek funding for primary research to better assess the extent and vulnerability of existing carbon stock.
- Convene economists and resource experts to develop uniform methods for identifying and quantifying the value of ecosystem services provided by natural and working lands.
- Develop recommendations to prioritize protection and restoration of natural and working lands that considers mitigation and adaptation benefits and the value of ecosystem services provided.

Strategy 2: Develop frameworks that help communities facilitate landscape-scale initiatives to address climate change.

Wisconsin communities are vulnerable to changing precipitation patterns, warming trends, and the increasing frequency of extreme weather events. Advancing community resilience to these climate risks requires planning and implementation of landscape-scale natural climate solutions.

Current status: The Wisconsin Department of Public Health recently developed a Climate and Health Community Engagement Toolkit for public health professionals. However, we lack more generalized frameworks for facilitating community-led conversations around climate resilience and adaptation.

End status: By 2025, a Wisconsin climate-smart community frameworks resource is available for engaging communities in the development of place-based, landscape-scale climate solutions.

Impact on climate change mitigation, adaptation, or resilience: There have been a number of successful county-led climate adaptation and resilience initiatives in Wisconsin[3,4], and these models can be used to facilitate conversations around community concerns and potential solutions. Climate solutions which have broad community support are more likely to be implemented and maintained, and have the potential to connect Wisconsin communities in climate action across jurisdictional boundaries.

Why this is a good approach for Wisconsin: Effective community engagement strategies are critical for developing climate literacy and a language of opportunity around climate adaptation and resilience. Community climate resilience will require action at landscape scales, and investment in climate solutions that simultaneously address a number of natural resource concerns.

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[3]Natural Flood Management in the Marengo River Watershed
https://marengo-restoration-floodscience.hub.arcgis.com/pages/about

[4]Monroe County Climate Change Task Force
https://www.co.monroe.wi.us/government/county-board-of-supervisors/boards-committees/climate-change-task-force

Focal constituencies: This approach is relevant in all Wisconsin communities when frameworks are adaptive to landscape context and community needs.

Potential key actions:

- Identify a team of community leaders and social scientists with expertise relevant for developing adaptive Wisconsin climate-smart community frameworks.
- Review successful Wisconsin examples and best practices for communicating climate science and engaging community members in climate problem-solving.
- Pilot test the Wisconsin climate-smart community frameworks approach in communities throughout the state.
- Establish a network for sharing experiences and successful examples across Wisconsin communities.

Strategy 3: Generate data needed to restore hydrology to increase resilience.

Watershed-scale hydrologic restoration, particularly re-establishment of upper watershed wetland storage and reconnecting floodplains, can increase the health and resilience of aquatic ecosystems and reduce flood risks and damages. Enabling this work requires hydrology and hydraulics modeling and analyses to understand where water comes from and how it moves, and to identify degraded hydrology. While many things go into these analyses, both require high resolution elevation data that accounts for the presence of culverts and other features that modify flows (i.e., hydro-enforced digital elevation data).

Current status: The baseline data needed to enable watershed-scale hydrologic restoration work are not uniformly available across Wisconsin. Instead, we have a patchwork of locally or project-specific derived data generated using a variety of methods. The lack of uniformly available, standardized data makes it difficult and more expensive to engage in watershed-scale hydrologic restoration work.

End status: By 2027, all Wisconsin communities will have access to hydro-enforced digital elevation data that has been processed using a standardized methodology.

Impact on climate change mitigation, adaptation, or resilience: We cannot increase resilience to severe storms without restoring the capacity of our natural landscapes to manage water. Doing so can help protect vulnerable transportation infrastructure, safeguard the health and extent of natural systems, and maintain agricultural productivity. Hydrologic restoration has an additional climate mitigation benefit because it can slow or reverse the loss of carbon that occurs when highly organic wetland soils are drained and decompose. A 2019 inventory of soil organic carbon stock (SOC) by soil and land cover type found that wetlands contained the greatest SOC stock (~243 Mg C ha^{-1}) in the state.[5]

Why this is a good approach for Wisconsin: These factors make this strategy timely and achievable:

1. The data to be generated is useful to a broad array of constituencies.

[5] Assessing soil organic carbon stock of Wisconsin, USA and its fate under future land use and climate change: https://www.sciencedirect.com/science/article/pii/S0048969719309301

2. Rapidly evolving technologies have reduced the time and expense of generating the needed data.
3. Concerted public-private sector collaborations are underway to advance this strategy.[6]
4. Large-scale, hydrology focused natural flood management efforts are already underway and well supported in the Lake Superior Basin.[7]
5. Unprecedented federal dollars are currently available for resilience-focused work.
6. Wisconsin lags behind many states in the development and distribution of similar baseline data.

Focal constituencies: Local governments, state/local transportation managers, agricultural landowners, and natural resource managers.

Potential key actions:

- Engage the Wisconsin Land Information Office, Wisconsin Land Information Association, and related entities to help identify and address barriers to hydrologic data generation and delivery.
- Improve incentives for counties to generate hydro-enforced digital elevation data using standardized methodologies and to make that openly accessible.
- Encourage state budget policy and funding initiatives that enable counties to partner with state agencies or private sector consultants to generate these uniform hydrologic data sets.
- Encourage the Governor's office and state agencies to pursue new investments through federal funding.

[6] See Wisconsin Regional Orthoimagery Consortium https://www.ayresassociates.com/project/wisconsin-regional-ortho-consortium/

[7] See *Lake Superior Basin Natural Flood Management Initiatives: Exploring Impacts through Ripple Effects Mapping.* https://www.wisconsinwetlands.org/wp-content/uploads/2021/11/REM-NFM-Report-11-8-21.pdf

Strategy 4: Prioritize implementation of agricultural practices that maximize mitigation and adaptation benefits.

Current status: Agriculture was the source of 15% of Wisconsin's greenhouse gas emissions in 2017.[8] Although we lack a comprehensive assessment of carbon stocks in the state, maintaining baseline conditions requires protection of native and novel ecosystems with significant capacity for carbon storage, including wetlands, forests, and grasslands. Soil parent material and land use/land cover (LULC) are the primary drivers of soil organic carbon stocks,[9] while carbon stocks in vegetation are affected by a combination of plant composition, management, and biophysical context.

End status: Wisconsin agricultural producers have access to recommendations and resources for emissions reductions and carbon sequestration actions that are appropriate to their operation, and support for carbon accounting practices that can be used to access new markets for their products and the ecosystem services they generate from their land.

Impact on climate change mitigation, adaptation, or resilience: Emissions reductions and practices which increase landscape carbon storage will result in an array of environmental benefits for Wisconsin communities, including improvements in soil health, water quality, and flood control.

Why this is a good approach for Wisconsin: Wisconsin's diverse agricultural sector contributes $104.8 billion annually to our economy[10]. At the same time, market volatility and the increasing frequency of extreme weather events have placed significant stress on agricultural producers. Strategic investment in climate-smart agricultural practices will support a resilient Wisconsin agriculture that is diversified to include production of food and other ecosystem services, and can be marketed to a new generation of consumers interested in climate-friendly practices.

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[8] Improving climate change mitigation and resiliency across Wisconsin's agriculture industry. Wisconsin Initiative on Climate Change Impacts: Agriculture Working Group Report. June 18, 2021. https://wicci.wisc.edu/agriculture-working-group/

[9] Assessing soil organic carbon stock of Wisconsin, USA and its fate under future land use and climate change: https://www.sciencedirect.com/science/article/pii/S0048969719309301

[10] The Contribution of Agriculture to the Wisconsin Economy: An Update for 2017 https://economicdevelopment.extension.wisc.edu/files/2019/08/Contribution-of-Ag-to-WI-Econ-4-Update.pdf

Focal constituencies: Farmers/agricultural producers, rural communities, consumers, and Wisconsin residents

Potential key actions:

- Develop and fund a support network of extension professionals, agency representatives, and peer practitioners who can assist agricultural producers in accessing resources and support for adopting climate-smart agricultural practices and monitoring farm carbon storage
- Incentivize agricultural practices which increase continuous living cover (e.g., cover crops, intercropping, perennial cropping systems, and managed grazing), and improve soil health and reduce field emissions (e.g., no-till/reduced tillage and nutrient management aligned with crop need)
- Incentivize livestock management practices that reduce emissions from enteric fermentation and manure storage and application
- Remove disincentives in Wisconsin property tax law to keeping land in permanent perennial cover, and develop ecosystem services market opportunities for conservation of native ecosystems

Strategy 5: Develop mechanisms to fund adoption of practices to implement climate mitigation and adaptation strategies in natural and agricultural landscapes.

Current status: The social and economic mechanisms to enable and facilitate adoption of natural climate solutions (NCS) at scale - particularly on private lands - are currently underdeveloped. Often, the leasing and funding structures available to agricultural landowners challenge the implementation of long-term NCS that offer multiple co-benefits other than production. Similarly, Wisconsin also lacks the policy and program support on natural lands including restoration of wetlands and floodplains.[11]

End status: Stewardship of Wisconsin's agricultural and natural landscapes prioritizes natural climate solutions which also generate important co-benefits. Stewardship action is supported through a combination of private and public funding, and implemented by landowners with assistance from climate mitigation and adaptation professionals.

Impact on climate change mitigation, adaptation, or resilience: Natural climate solutions offer an opportunity to help mitigate climate change while also adapting management practices to new climate conditions and building resiliency on lands that are directly impacted by climate change.

Why this is a good approach for Wisconsin: More than 80% of lands in Wisconsin are privately owned, and innovative mechanisms are critically needed to catalyze knowledge sharing and adoption of NCS practices on natural and working lands at a pace and scale to have impact by 2030. Innovations beyond policy are needed to increase available funding and to increase human capacity and knowledge to help deploy NCS on a network of private lands at scale. Providing landowners options to deploy NCS in ways that help meet their goals and maintain their autonomy will have lasting impact. In addition, a few organizations in Wisconsin have already started implementing NCS in order to achieve their visions and can offer useful examples (e.g., The Nature Conservancy, the Savanna Institute).

Focal constituencies: Farmers; agricultural professionals; forest land managers; private and institutional land use decision makers; and policy-makers.

Potential key actions:

[11] "Examining the Status of Hydrologic Restoration in Wisconsin" https://www.wisconsinwetlands.org/wp-content/uploads/2021/11/Final-FG-report-11.22.21.pdf

- Research and document funding and land access structures (e.g., loans, grants, leases) that support the implementation of NCS
- Research and document new and underused NCS that store carbon while maintaining biodiversity;
- Develop mechanisms at local, state, and federal scales to fund adoption of NCS, with an emphasis on the recommendations developed in strategy 1

Glossary

Biodiversity - a measure of the number and arrangement of regionally appropriate (i.e., native) species and ecosystems that can be found within an area

Carbon sequestration - the capture and storage of atmospheric carbon dioxide (CO_2), often in soil and vegetation carbon stocks; the goal is to attain long-term storage that will significantly reduce atmospheric concentrations of CO_2

Climate adaptation - strategies which focus on preparing for and responding to the impacts of climate change

Climate mitigation - strategies which address the underlying cause of climate change, with a focus on reducing atmospheric greenhouse gas concentrations

Co-benefits - the additional positive outcomes that can result from well-planned strategies to reduce atmospheric greenhouse gas emissions and increase carbon stored in the landscape (e.g., biodiversity conservation, improved water quality, flood control)

Ecosystem - a community of plants, animals, and other living organisms that interact with their environment

Ecosystem services - the benefits of nature on which human society depends (e.g., food production, nutrient cycling, water infiltration and purification, flood control, pest control, pollination)

Native - refers to organisms or ecosystems that have evolved in a particular region, and are an important part of its regional ecology

Natural climate solutions - land stewardship practices that preserve or increase carbon stored in the landscape

Natural landscapes - landscapes characterized by permanent perennial cover, often including large tracts of native ecosystems including wetlands, forests, savannas and grasslands

Novel ecosystem - ecosystems that are the result of human design and/or management (e.g., pasture, forest production stand). May primarily include nonnative species, yet have potential to produce important ecosystem services in working landscapes

Resilience - the capacity of a system to maintain function or recover following disturbance; includes measures of ecological, economic, and social resilience

Working landscapes - landscapes managed for the production of saleable goods, with predominant land uses including farming, grazing, or forestry