Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-213

Proposal Title: Forests, Wildlife & Climate Change: Proactive Landscape Designs

Project Manager Information

Name: Michael Carson

Organization: U of MN - North Central Research and Outreach Center

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Project Basic Information

Project Summary: First-of-its-kind strategy for statewide contingency planning, proactively addressing uncertainties surrounding climate change, carbon sequestering and spatially-explicit wildlife needs. Project helps integrate multi-objective forest landscape-planning strategies for multiple agencies.

Funds Requested: $404,000

Proposed Project Completion: 2023-06-30

LCCMR Funding Category: Methods to Protect, Restore, and Enhance Land, Water, and Habitat (F)

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Narrative

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Climate change threatens to disrupt the ecosystem services that forests provide and we depend on. Uncertainty surrounds both the speed in which climate change will occur and how Minnesota tree species will respond. Adjusting landscape conditions takes decades, as only about 2% of the forest can be treated each year. The time to start planning for adjusting statewide is likely here. Improving landscape resilience requires attention to detail, as forest ecosystem structure and function is complex. Minnesota's forest is a mosaic of ownerships, with more state-managed forestland than any state other than Alaska. Traditionally, forest landscape planning struggles to account for uncertainties associated with climate change or spatial habitat needs of wildlife. New tools like LIDAR make more data available about current conditions, yet comprehensive strategies are lacking for utilizing that data to plan ahead. The 2014 Minnesota Forest Ecosystem and Vulnerability Assessment states, "Confronting the challenge of climate change presents opportunities for land managers to plan ahead, assess risk, and ensure that the benefits forests provide are sustained into the future." Minnesotans want to manage the present to help ensure the future of our natural resources and to reduce the likelihood of irreversible mistakes.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

Forest planning should be proactive, helping forests and forest-based communities be more resilient through deliberate harvest design and reforestation investments. To help better address climate change and spatially-explicit forest wildlife habitat needs in forest planning, this project leverages 30+ years of applied forest planning research and research of two soon-to-be PhDs who have developed promising forest planning tools. The project emphasizes spatial arrangement and temporal changes of forest conditions, focusing on designs of today's management actions that can perform well over a plausible range of climate change predictions. Differences in growth estimates of Minnesota tree species between plausible climate change scenarios will impact designs. In addition to data sharing, a major strength and common thread of the new tools is their ability to break extremely large and complex landscape problems into manageable-sized parts, while maintaining direct linkages to broad objectives involving ecological services and local economies. Taking a landscape perspective is key for addressing cumulative impacts of site-level management on broader objectives ranging from wildlife habitat to carbon sequestration to fire hazard to timber supply. Working closely with an advisory team throughout the project will be critical for success.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

The project will advance proactive statewide forest planning and associated interdisciplinary learning. It will:

- recognize uncertainties surrounding climate change and identify efficient site-level contingency plans for multiple climate change futures
- add insight on statewide strategies for multiple objective planning, including carbon sequestering and fire risk reductions
- add insight on how management of one major forest landownership fits within the statewide forest situation
- demonstrate how wildlife habitat needs can be integrated efficiently into forest planning, considering directly gains from collaborative planning by major forest landowners
- provide a tool for field staff to evaluate alternative site-level strategies within a forest-wide context

Activities and Milestones

Activity 1: Identify proactive forest management actions for today to help ensure future forests of Minnesota under uncertainties of climate change.

Activity Budget: $141,046

Activity Description:
A risk analysis will apply a recently developed Minnesota model to identify how forest management can be more proactive for climate change. The model considers a range of climate futures and how uncertainties could unfold. It identifies site-level harvest selections that, when aggregated to the landscape-level, perform well for multiple objectives over potential future climate change scenarios. Key inputs for the analysis will be results from the spatially-explicit State of Minnesota study (HF-1251) that projected plausible Minnesota climate futures. Each climate future will be assumed to impact growth rates and natural disturbances differently by forest cover type and landscape ecosystem. The study area will include all Minnesota forest ownerships north of the Twin Cities. An advisory team representing major forest landowner and stakeholder groups will help refine key facets for focus. Results will suggest high impact cost-effective management actions today. Statewide harvest levels will be tracked and timber demands addressed for major, site-specific Minnesota markets. Applications will include tracking of carbon sequestration to help identify efficient statewide sequestering strategies under the identified climate change futures. Results will be published, with presentations held throughout Minnesota.

Activity Milestones:

Description	Completion Date
Develop framework and climate change futures for analysis including key advisory team input	2021-10-31
Estimate responses of tree growth and natural disturbance to climate change futures	2022-04-30
Complete initial model applications for advisory team review	2022-07-31
Complete revised scenario applications and compare results emphasizing keys for proactive strategies and carbon sequestration	2023-03-31
Develop publications and conduct at least 3 workshops	2023-06-30

Activity 2: Improving understanding of the fit of DNR land management opportunities within the broader statewide forest resource situation.

Activity Budget: $121,140

Activity Description:
An analysis will help managers better understand the role that DNR lands play in achieving multiple statewide forest resource management objectives. This analysis will identify opportunities to integrate ecological and economic objectives, including carbon sequestering opportunities, older forest objectives, forest fire risk reductions, and potential watershed concerns.

The DNR maintains an extensive stand level forest inventory dataset that will provide insight into possible gains across multiple ecosystem services. This activity will integrate that dataset, US Forest Service's Forest Inventory and Analysis (FIA) information, and data from Activity 1 in a statewide forest planning model considering all forest ownerships. Using data from Activity 1 will help streamline the enormous data requirements. Activity 2 will also engage the multi-stakeholder/agency advisory team on the project.

Results will help identify specific issues and opportunities that collaborative planning across ownerships may provide. The study will also describe how detailed agency inventory data can improve statewide forest resource assessments and

how FIA data can reciprocally help local agency planning. Case study results will be reported in detail, emphasizing key lessons learned including effective approaches for multiple-objective forest resource opportunities for more proactive forest management.

Activity Milestones:

Description	Completion Date
Develop case study framework and integrate inventory data based on advisory team input	2022-02-28
Summarize draft results for at least 7 scenarios	2022-06-30
Develop revised scenarios based on advisory team input	2022-08-31
Complete model applications and compare results emphasizing fit of DNR lands in statewide situation	2022-12-31
Identify gains from integrating forest inventories for planning	2023-04-30
Develop final report, refereed publications and present at workshops	2023-06-30

Activity 3: Improve our understanding of how to better address spatially-dependent wildlife habitat objectives in multiple-objective forest management planning.

Activity Budget: $141,814

Activity Description:
This activity will focus on integrating spatially-explicit wildlife concerns into strategic forest management planning, emphasizing proactive opportunities for wildlife that go beyond "satisfactory" wildlife habitat conditions. A case study will address habitat quality using regularly measured forest stand attributes. Initial focus will be on clustering and spacing of older forest, as such conditions can easily be lost and then not easily restored. New modeling methods are in the developmental stages, with this activity helping to bring them to practical application.

The case study will focus on integrated planning for USDA Forest Service, Minnesota DNR, and other publicly managed forestlands near and within the boundary of the Chippewa National Forest. This area currently provides valuable older-forest wildlife habitats. Species like fisher and marten benefit from relatively large patches (several square miles) of old forest, and to varying degrees can tolerate or benefit from those patches being intermixed with younger forest that provides additional prey diversity.

This activity will explore ways to directly tie strategic results to field applications, where practitioners can develop their own local-level analyses to help develop and understand how strategic-level habitat values can be integrated into site-level management. Such applications may prove valuable in short-term operational planning.

Activity Milestones:

Description	Completion Date
Refine wildlife habitat assumptions and analysis framework based on team advisory input	2021-10-31
Complete draft analyses and draft report for multiple scenarios	2022-06-30
Consult with advisory team on scenario revisions and complete final analysis	2023-01-31
Develop and test field applications for practitioners	2023-03-31
Develop final report, publications and workshop presentations, emphasizing key recommendations for collaborative planning	2023-06-30

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Irene de Pellegrin Llorente	University of Minnesota Department of Forest Resources, Silviculture Lab	Highly skilled for climate change risk analyses. PhD candidate in forest management, degree expected 2020. PhD research focused on forest planning under climate change. Research experience in forest inventory and silviculture needed in analyses. PhD minor in Applied Economics, skills in multiple objective planning and trade-off analysis. Strong International background.	Yes
Howard Hoganson	University of Minnesota North Central Research and Outreach Center	Professor, 30+ years experience in forest management modeling/planning. Led analyses for current multiple objective, spatially-explicit forest plans for both National Forests in Minnesota. Led forest management modeling for the statewide Minnesota GEIS on timber harvesting and forest management. Experienced in analysis methods for collaborative planning and planning under uncertainty.	Yes
Lee Frelich	University of Minnesota Department of Forest Resources; Center for Forest Ecology	Main reference for the project's climate change models, forest succession, tree population dynamics, disturbance regimes, landscape ecology, and old growth forest expertise. Dr. Frelich's extensive research in forest succession modeling is vital to selecting climate change scenarios and tree responses to those scenarios.	No

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

All results will be provided to the public free of charge. We will maintain communication with the advisory group and stakeholders throughout the duration of the project to emphasize relevancy, transparency, accessibility, and adaptability.

Project Manager and Organization Qualifications

Project Manager Name: Michael Carson

Job Title: Research Forester; PhD Candidate

Provide description of the project manager's qualifications to manage the proposed project.

Project Management Experience

Four years of experience leading private industry projects, one year leading grant activities in academia, co-PI on two grant applications. Three years of supervisory experience with two years of accounting and financial planning experience. I will provide scientific leadership, offer subject matter expertise, supervise grant collaborators and staff, budget and track expenses, and oversee project completion within established timelines.

Area of Expertise

Concluding PhD research includes building core models and methodologies that activities 2 and 3 will apply. Educated in optimization-focused computer modeling, programming, and analysis. Trained and proficient in forest management, forest and conservation planning, operations research, risk analysis, machine learning, and linear programming. I have nine years of data analysis experience in research and industry.

Professional Roles
Research Forester, University of Minnesota North Central Research and Outreach Center, 2017-present
Financial Analyst, American First Finance, 2016-2017
Systems Analyst and Production Control Scheduler, HM Dunn, 2013-2016
Extension Technologist, University of Nebraska, 2012

Education
PhD in Natural Resource Management, UMN, expected Fall 2020
BS in Forest Conservation and Ecosystem Management, UMN, 2011
Progress toward MS: Outdoor and Environmental Education and BS: Mechanical Engineering

Collaborations
Minnesota Department of Natural Resources: Forestry, Fish and Wildlife, and Ecosystem and Water Resources Divisions
Minnesota Society of American Foresters
Itasca Community College Natural Resources Program
Minnesota Forest Habitat Collaborative
Institute for Operations Research and Management Sciences
Minnesota Tree Improvement Cooperative

Publications
Completed: One peer reviewed article, two UMN Staff papers, two trial reports
In Process: One peer review article, NCROC forest management plan
Grant Submissions: Forest Resources Association: An Assessment of the Safety and Efficiency of Interstate and State Highway Weight Limit Disparity for Log Trucks in Minnesota and Wisconsin, $30,000, in review; USDA Forest Service Wood Innovations Grant: Investing more in reforestation to increase timber harvesting today, $121,201, not funded.

Organization: U of MN - North Central Research and Outreach Center

Organization Description:
The North Central Research and Outreach Center (NCROC), established in 1896, is one of 10 research and outreach centers in the University of Minnesota's College of Food, Agricultural and Natural Resource Sciences. NCROC serves as a regional center for excellence in research and education programs in agriculture, forestry, environment and rural economic development. The center conducts broad-based, collaborative research and educational programs using the diverse cultural and environmental resources of North Central and Northeast Minnesota. We discover and disseminate knowledge, which contributes to sustainable and wise use of resources; promotes economic opportunity; supports improved policy making and increases public understanding of the mission of the University of Minnesota.

Scientists at this center collaborate on a wide range of research topics with colleagues from the U's St. Paul campus as well as from other centers and universities, public and private agencies and individuals, industry and commodity groups. University of Minnesota Extension's regional center is also located here. The center's unique soil, climate, social and economic environment in North Central Minnesota all provide opportunities to conduct research that contributes to sustainable economic systems and improved quality of life for Minnesotans.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Michael Carson		Principal Investigator/Researcher 6			31.8%	2		$190,071
Irene de Pellegrin Llorente		Researcher 6			31.8%	2		$190,071
Howard Hoganson		Co-Principal Investigator			36.5%	0.08		$17,981
							Sub Total	**$398,123**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
							Sub Total	**-**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Meetings with DNR to work and present findings	Work with DNR Employees to refine analysis and present case studies at the conclusion of the projects					$5,577
							Sub Total	**$5,577**

Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Printing	Printing of Case Studies	Disseminate results to various stakeholders					$300
							Sub Total	**$300**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$404,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	Unrecovered indirect costs @ 54% of direct covered costs for 2021, 55% of direct covered costs for 2022 & 2023	Costs incurred by organization for institutional activity including utilities, building maintenance, clerical salaries, and general supplies.	Secured	$219,214
			State Sub Total	**$219,214**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$219,214**

Attachments

Required Attachments

Visual Component

File: ee9f619e-ead.pdf

Alternate Text for Visual Component

Quote to denote the project importance. Title of project. Pictures in a hexagon formation depicting important processes, habitats, and products provided by Minnesota's forests and considered for the project: the carbon cycle, important bird species in habitat, blowdowns, timber products, forest fires, and mammal species. Text summarizing the need, solution, and outcome of the project.

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

Does your project include research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Manage the present to ensure the future…

“ because an ounce of prevention is worth a pound of cure. ”

Forests, Wildlife & Climate Change: Proactive Landscape Designs

Need
Uncertain risks from climate change require proactive forest management decisions today

Solution
Spatially-explicit planning tools responsive to multiple futures

Outcome
Multi-ownership, multiple objective statewide contingency plans that provide insight and recommendations for sustainable forest ecosystems