Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-059

Proposal Title: Maximizing Economic and Ecological Benefits of Forest Management

Project Manager Information

Name: Marcella Windmuller-Campione

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: This study will investigate ways to use forest management to maximize multiple ecosystem services in the face of rapidly changing conditions in hardwood and conifer forests in Minnesota.

Funds Requested: $650,000

Proposed Project Completion: 2027-01-31

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?

Region(s): NE, NW, Central,

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

Region(s): Central, NE, NW,

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.

Over one third (17.7 million acres) of Minnesota is forested. Minnesotans rely on forestlands to provide multiple ecosystem services including forest products, wildlife habitat, water quality, carbon sequestration, and many others. These ecosystem services contribute millions of dollars in direct and indirect revenue for Minnesota. Forest disturbance, invasive species, and a shifting climate are impacting forests ecosystems at unprecedented rates, and it is unknown if current forest management practices are maintaining, let alone maximizing, ecosystem services. In order to address these concerns and make sound forest management decisions, a foundation of quantitative data is needed. However, most research has focused on one ecosystem service at a time– e.g., timber harvest vs. wildlife habitat vs. carbon sequestration– not the interaction among them. This separation of research hinders the simultaneous optimization of all ecosystem services and reduces application for addressing complex statewide problems. For example, the lack of data on how harvest strategies affect tree growth, wildlife habitat, biodiversity and other ecological services limits the ability of land managers to determine sustainable harvest levels that meet multiple uses. This is also a priority for the MN Forest Resource Council. Without this data, managers are lacking information to make informed decisions.

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.

We will holistically assess the influence of four different forest management strategies on ecosystem services in conifer and hardwood forests using a replicated, long-term experiment. Data will be collected on water quality, carbon sequestration, soil health, wildlife, wood fiber production, and biodiversity; we are capturing a full suite of ecosystem services a forest can and does provide.

We will work with project partners (MN DNR, US Forest Service, County Lands, The Nature Conservancy, and UPM Blandin) to establish a network of long-term research sites in conifer and hardwood forests. Specifically, we will select sites in rich mesic broadleaf forests (hardwoods) and mixed pine (conifer) forests, representing a large portion of forest conditions in Minnesota. At each site, four different management strategies will be implemented, spanning a gradient of structural complexity from low to high. The four strategies are intensive (low structural complexity), guideline-informed (moderate structural complexity), natural disturbance regime-informed (high structural complexity), and structurally complex (maximum structural complexity). This experimental design will provide data that allow land managers to better assess trade-offs in ecosystem services, which is needed to inform management decisions.

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?

Our project will treat 800 – 1000 acres of hardwood and conifer forests. We will measure 1,000s of trees, identify 100s of understory species, monitor hydrology and soil health over three years, quantify carbon above and below ground, and monitor response to treatments for over 50 wildlife species in our sampling. These data will be shared across land management agencies to ensure the development of management strategies that will protect, conserve, and enhance Minnesota's forests. Finally, we will use these sites as locations for educational outreach opportunities through field tours for natural resource professionals, extension programs, and school groups.

Activities and Milestones

Activity 1: Establish a network of long-term experimental research sites to assess impacts of forest harvest strategies on ecosystem functions.

Activity Budget: $183,827

Activity Description:
We will work with our project partners (DNR, County Lands, USFS, UPM Blandin) to identify eight sites on which to establish a large scale, replicated experiment – four hardwood and four conifer sites. At each site, each of the four harvesting strategies will be implemented on 25-35 acre treatment blocks. Sites will be selected so they are representative of the two forest types and will be similar to each other in terms of soils, stand age, and productivity to allow comparison across the four different harvesting strategies and across the four sites. Prior to harvest, 128 permanent plots will be established and pre-treatment data on vegetation, wildlife, soils, hydrology, and above and below ground carbon will be collected. We will then work with the forest management agencies on the implementation of the four different harvesting strategies. The four harvest strategies are intensive (low structural complexity), guideline informed (moderate structural complexity), natural disturbance regime informed (high structural complexity), and structurally complex (maximum structural complexity). Harvesting will be completed by each forest management organization and follow their guidelines. No budget dollars are allocated for harvesting. We will work with all project partners to implement the harvesting strategies.

Activity Milestones:

Description	Completion Date
Locate and establish four hardwood and four conifer treatment sites	2022-04-30
Collect pre-harvest data on vegetation, wildlife, soils, hydrology, carbon sequestration, and biodiversity	2022-11-30
Install 128 permanent survey plots	2022-11-30
Work with forest agencies to complete harvested treatments on eight sites	2023-04-30

Activity 2: Acquire baseline data to quantify the effects of alternative forest harvest strategies on multiple ecosystem services

Activity Budget: $335,616

Activity Description:
After harvesting, we will quantify short-term (see long-term implementation and funding for future monitoring) changes in vegetation, hydrology, soils, above and below ground carbon, and wildlife at the permanent plots. To assess vegetation and growth, we will quantify all layers of vegetation and structural attributes (down dead wood, snags, etc.) to assess the effects of management on forest plant biodiversity, forest development, forest growth and yield, and carbon. Hydrology and water quality will be assessed by measuring water table fluctuations, soil water dynamics, and water chemistry on a subset of plots. Soil health will be assessed via comparison of pre-treatment and post-treatment soil properties including density, water holding capacity, and soil carbon and nutrient pools. Pooling data from the vegetation (above ground carbon) and soil carbon (below ground) we will estimate total carbon pools. We will establish long-term biodiversity monitoring plots to monitor wildlife in the experimental study areas using a variety of methodology (i.e. bioacoustic recorders, camera traps, mist netting, and point counts) to comprehensively assess wildlife communities. Plots will be monitored seasonally to provide a comprehensive assessment of management impacts on wildlife.

Activity Milestones:

Description	Completion Date
Two years of assessment of change in the carbon pools	2025-12-31
Post-harvest remeasurement of all vegetation layers to assess biodiversity, forest growth, and productivity	2025-12-31
Two years of assessment of change in hydrology, water quality, and soil nutrient loss	2025-12-31
Two years of remeasurement of wildlife diversity and use	2025-12-31

Activity 3: Use post-treatment data to develop predictive models to identify and assess short-term trade-offs in ecosystem services across harvest strategies.

Activity Budget: $130,557

Activity Description:

We will utilize findings from Activities 1 and 2 to evaluate trade-offs among the four different harvest strategies and the multiple ecosystem services (forest products, biodiversity, wildlife habitat) in both the hardwood and conifer forests to develop predictive forest models for optimization of economic and ecological benefits. We will holistically assess the data to provide quantitative information on how different variables are influenced by different harvest strategies to be able to assess forest management objectives. Tactics to maximize ecosystem benefits through forest management will be developed through a collaborative process with representation of multiple disciplines across forest management agencies to ensure that we account for the complex interactions between vegetation dynamics, hydrological function, and wildlife use within the context of working forested landscapes that provide multiple economic and ecological benefits.

Activity Milestones:

Description	Completion Date
Development of collaborative group of natural resource managers to assess trade-offs	2025-01-31
Post harvest treatments assessed and short-term tradeoffs quantified.	2026-09-30
Development of predictive optimization model to assess trade-offs among harvest treatments including ecological and economic	2026-11-30
Statewide forest management strategies for addressing multiple ecosystem services	2026-12-31

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Alexis Grinde	Natural Resources Research Institute	Co-PI responsible for the collection and analysis of data related to wildlife (Activity 2). Dr. Grinde will assist with site selection (Activity 1) and collaborative development of management recommendations (Activity 3).	Yes
Robert Slesak	MN Forest Resources Council	Co-PI responsible for collection and analysis of data related to soils and hydrology (Activity 2). Dr. Slesak will assist with site selection (Activity 1) and also the collaborative development of management recommendations (Activity 3)	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?

This project will result in an increased understanding of the near-term impacts and trade-offs of four harvest strategies. We will contribute important data to ensure working forests continue to be managed and support both economic and ecological services to provide important revenues and benefits within the county and state. Because we are working directly with the primary forest management organizations and plan to collaboratively develop management recommendations (Activity 3), the information gained will be directly applicable for practitioners and policy makers. We plan to continue long-term (6-12 years post-harvest) monitoring of the sites and will pursue additional funding to support.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Peatland Forest Management	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 03d	$600,000
MITPPC Sub-project # 4 Dwarf Mistletoe Detection and Management in Minnesota	M.L. 2016, Chp. 186, Sec. 2, Subd. 06a-04	$0

Project Manager and Organization Qualifications

Project Manager Name: Marcella Windmuller-Campione

Job Title: Assistant Professor

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

As a faculty member at the U of MN, I (Marcella Windmuller-Campione) have a background in using a holistic approach to researching, providing data, and supplying information on complex forest management issues. I was part of an interdisciplinary team in Utah, exploring how forest managers could increase resistance and resilience of western ecosystems to an uncertain future. My work in Minnesota uses these same approaches to explore adaptive and alternative management strategies for forest communities in Minnesota. In my 5 years at the U of MN, I have successfully managed multiple grants totaling over 4 million dollars. These grants include work in peatland systems, floodplain forests, pine forests, and hardwoods. I am currently the PI for grants funded by LCCMR and MITPPC. I am the Co-Director of the first module for the National Advanced Silviculture Program (NASP), a two week, graduate-level course for federal employees to become certified silviculturists. For the proposed project, I will provide scientific leadership and serve as lead contact for this collaborative research. I will oversee and participate in all parts of this project to ensure the successful development of the expected outputs.

Organization: U of MN - College of Food, Agriculture and Natural Resource Sciences

Organization Description:
For over 100 years, the Department of Forest Resource at the University of Minnesota has been the leader in producing high quality research regarding natural resource management issues across the state of Minnesota. The Department of Forest Resources and the College of Food, Agricultural and Natural Resource Sciences strive to provide key data on the management of natural resources in Minnesota. Our mission is to serve our communities through teaching, outreach, and research on natural resources to ensure the health and resilience of these systems now and into the future.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Faculty: Windmuller-Campione		PI - Lead on Vegetation			36.5%	0.24		$32,186
Forest Reseacher 5		Collection and analysis of forest vegetation and carbon data			36.5%	2.25		$152,206
Researcher 5 Soils & Hydrology		Collection and analysis of soils and hydrology data			36.5%	2.25		$151,807
Wildlife Researcher		Collection and analysis of wildlife data			25.4%	2.25		$127,752
3 Undergraduate Field Assistants		Assist with collection of data across the project			0%	0.78		$79,642
Faculty: Grinde		Co-PI Lead on Wildlife Design and Management			36.5%	0.36		$43,707
							Sub Total	**$587,300**
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Equipment	Trail Cameras (24 units)	The detection of wildlife species					$4,500
	Equipment	Well dataloggers (17 units)	Gather data on hydrology of sites					$5,160
	Equipment	Transmitters and telemetry equipment (60 units)	The detection and tracking of wildlife species					$15,000
	Tools and Supplies	Sampling Supplies	Flagging, tags, and pins to establish and mark plots					$500
	Equipment	Forest Inventory Equipment (6 units)	Equipment to measure diameters (d-tapes, loggers tapes) and heights (clinometers)					$2,500
	Equipment	Rain gauges (12 units)	Measure hydrological and rain across harvests					$5,040

	Equipment	Soil moisture sensors (50 units)	Monitor changes in hydrology and soil moisture					$6,000
							Sub Total	**$38,700**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel, per diem, and lodging	Extensive travel will be required to cover a wide portion of the state for sampling across multiple years					$24,000
							Sub Total	**$24,000**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$650,000**

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	unrecoverable indirect cost	general operating expenses related to the University	Secured	$351,000
In-Kind	MN DNR	80 hours, Silviculture and Timber program for site selection, coordination, and involvement on the project 20 hours, ECS staff for assistance with vegetation community 160 hours, field forester, timber sale appraisal and admin this would all be part of normal harvesting activities 200 hours of staff time for site visits and consultation from FAW	Secured	$46,000
			State Sub Total	**$397,000**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$397,000**

Attachments

Required Attachments

Visual Component

File: 925438f0-53a.pdf

Alternate Text for Visual Component

The visual component includes images for each of the three activities. Activity 1 - describes visually the four harvest strategies and are arranged from least structurally complex to most structurally complex. Activity 2 - describes visually a subset of ecosystem services we will be measuring. Activity 3 - describe visually a model for our holistic modeling of ecosystem services

Optional Attachments

Support Letter or Other

Title	File
MN DNR Letter of Support	44fad34b-478.pdf
UPM Blandin Letter of Support	fb1549f2-6bb.pdf
TNC Letter of Support	edee197c-331.pdf
UMN Approval to Submit	e6109f7a-51e.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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

No

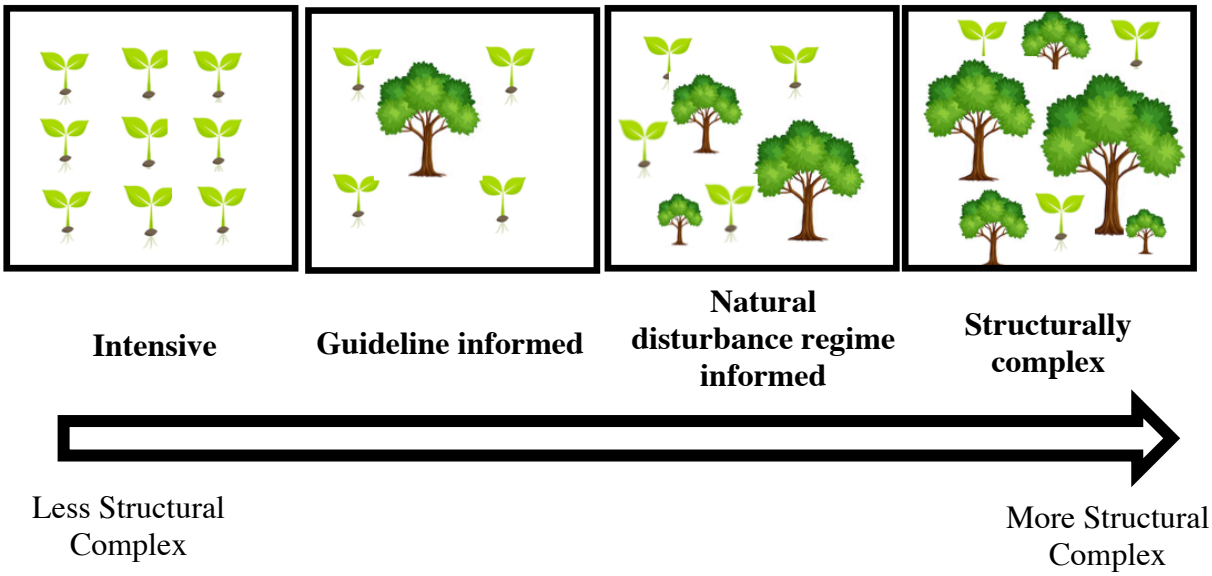
Does your project include research?

Yes

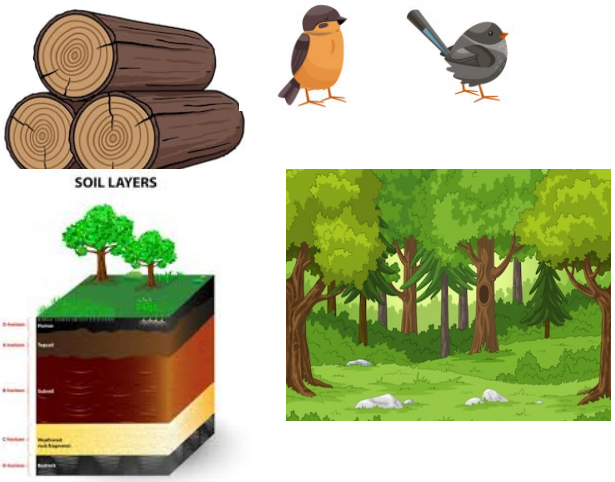
Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

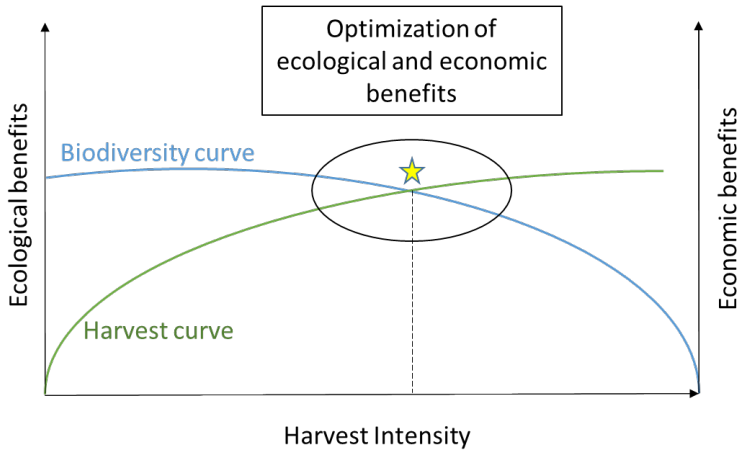
Maximizing Economic and Ecological Benefits of Forest Management



Activity 1: Establish a network of long-term experimental research sites to assess impacts of forest harvest strategies



Activity 2: Holistically quantify how different harvesting strategies influence ecosystem services like forest products, wildlife, soils, carbon sequestration, and forest biodiversity



Activity 3: Develop predictive models to identify and assess short-term trade-offs in ecosystem services across harvest strategies