Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-045

Proposal Title: Can Increased Tree Diversity Increase Community Diversity?

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: While aspen is one of the most dominant forest types, predicted future conditions will negatively impact aspen growth. Increasing tree diversity can provide increase ecological and economic resilience.

Funds Requested: $415,000

Proposed Project Completion: June 30, 2027

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.

Aspen is the dominant cover type in much of Minnesota's forested regions. The species was able to take advantage of open conditions created by the large extractive logging and subsequent fires between 1890 -1910. In the decades since, aspen forests have provided critical forest products and valuable wildlife habitat for many species including Golden-winged Warbler and Ruffed Grouse. However, these relatively simple monotypic stands are expected to be highly vulnerable to future climate change and other stressors due to the lack of tree species diversity. Managers are interested in increasing the ecological and economic resilience of these ecosystems by restoring and enhancing tree species diversity. The mixedwood approach encourages managers to grow long-lived conifers and aspen as diverse multi-species stands. This method attempts to restore historical forest conditions and is predicted to increase the resilience of stands to future change. There has been an initial investment by UPM Blandin, MN DNR Forestry, and MN Forest Resource Council to quantify the growth and yield of mixed-wood stands, however there are many unknowns regarding impacts to other ecosystem services including providing quality wildlife habitat, conservation of plant and fungal community diversity, and long term economic resilience through diversified wood products.

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

A growing body of evidence suggests that increasing tree species diversity will lead to increased resilience in the face of climate change. As managers work to actively increase tree species diversity within forested stands, there remain large knowledge gaps related to the impacts to other ecosystem features, including plant, animal, and fungal communities.

We will explore these unknown by sampling an already established network of permanent plots in mixedwood and aspen stands in northern Minnesota. With initial funding provided by UPM Blandin, MN DNR Division of Forestry, MN Forest Resource Council, 100 plots across 30 stands will be established during the summer of 2023 for growth and survival of overstory and understory tree species. We are requesting funding for additional sampling of wildlife, understory plant communities, carbon storage and sequestration, and fungal community diversity during this 3 year project. We will then integrate knowledge gained from our work and the management community to consider best management practices which can provide ecological and economic resilience to critical ecosystems in Minnesota, thus providing tangible benefits to natural resource managers, individuals who rely on the forest economy (e.g. mills and recreational outfitters), and the general public through natural climate solutions like carbon sequestration.

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?

Aspen forests provide critical resources across Minnesota – economic, ecological, and cultural. The Minnesota Forest Resource Council's North Central Landscape Plan advocates for foresters and natural resource managers to increase the diversity of aspen forests by using the mixed wood system, providing forest resilience for climate and market adaptation to ensure the continuation of the goods and services. However, foresters need additional information on how other parts of the ecosystems are impacted by increased tree resilience – overall positive, neutral, or negative and for which species and ecological groups? This provides valuable data for the sustainable management of forest ecosystems.

Activities and Milestones

Activity 1: Quantify differences in aspen and mixed wood systems on bird and small mammal diversity.

Activity Budget: $200,000

Activity Description:
We will establish long-term wildlife monitoring plots in the existing research sites to assess differences between aspen and mixed wood systems in wildlife diversity. We will deploy autonomous recording units (ARUs) in the spring to document differences in American Woodcock and Ruffed Grouse abundance. We will conduct point count surveys to quantify differences in breeding bird abundance and diversity between systems. Finally, we will use a combination of camera trap arrays and live traps to document differences in mammal diversity between forest types. Experimental sites will be monitored seasonally for two years to provide a comprehensive assessment of management impacts on wildlife diversity.

Activity Milestones:

Description	Approximate Completion Date
1. Establish long-term monitoring plots and develop protocol for measuring wildlife diversity in aspen	March 31, 2025
2. Quantify bird and small mammal abundance and diversity in paired research sites and	October 31, 2026
Integrate wildlife data with vegetation data to create habitat models	January 31, 2027

Activity 2: Quantifying understory plant diversity and carbon dynamics in aspen and mixed wood systems

Activity Budget: $200,000

Activity Description:
Using the already established 100 permanent plots across 30 mixedwood and aspen stands, we will revisit these stands to quantify understory plant diversity, fungal diversity, and down dead wood. Understory plant diversity will be surveyed over two years and occur in spring and summer; the goal of the multiple sampling is to capture species diversity including spring empherals which occur before full canopy leaf out and capture later season shrubs and flowering plants. Additionally, by sampling over 2 growing seasons we can capture seasonal variability (wet versus dry year) which can influence understory plant presence, diversity, and abundance. We will use a hemispherical camera to capture light levels during understory sampling. We will take soil samples to quantify below ground carbon and fungal diversity. Finally, during the summer sampling we will sample down dead wood to understand current carbon pool. We will link this data with already collected overstory and regeneration data to fully capture plant diversity and carbon storage within mixedwood and aspen stands.

Activity Milestones:

Description	Approximate Completion Date
1. Refine methods for sampling understory plant diversity, down dead wood, and fungal diversity on	March 31, 2024
2. Sampling of plant diversity, down dead wood, and fungal diversity over two growing season	October 31, 2025
3. Statistical analysis of diversity metrics and abundance across sites and successional stages	October 31, 2026
4. Integration with overstory and regeneration data to model broader plant community diversity and carbon	January 31, 2027

Activity 3: Incorporation of diversity measures into best management practices

Activity Budget: $15,000

Activity Description:

As forest managers face the dual threats of climate change, and global biodiversity loss it is essential that they have a comprehensive understanding of the tradeoffs associated with their management decisions and the services they provide like quality wildlife habitat, conservation of plant and fungal community diversity, and long-term economic resilience through diversified wood products. We will use information collected previously, within this proposal (Activity 1 and 2), and through managers feedback to build models which predict how different metrics (wildlife, fungal community, carbon) respond to diversifying forest stands over time. We will use these models to develop best management practices. The best management practices will work through different scenarios and consider potential trade-offs regarding management in aspen and mixedwood systems. Tangible products including management guidelines and examples of management scenarios can be shared and hosted through University of Minnesota websites like the Silviculture Library (https://silvlib.cfans.umn.edu/) which includes case study examples which managers can and do use when developing forest management plants.

Activity Milestones:

Description	Approximate Completion Date
Continuation of integrated approach to research with natural resource management community	August 31, 2024
Development of initial management scenario with project partners	November 30, 2025
Modeling how diversity metrics vary under different scenario and different timelines	November 30, 2026
Creation of best management practices for mixedwood systems	June 30, 2027

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 work be funded?

Our work has been developed in collaboration with the natural resource management community and implementation and result distribution will be an integrated part of our project (see Activity 3). We will work to host field tours, webinars through organizations like the Sustainable Forest Education Cooperative, and produce peer-reviewed literature that will be open-access to allow availability and access.

Given the long-term nature of forest ecosystems, we've established permanent plots. This allows continued monitoring in the future. Our goal is to provide critical knowledge for natural resource managers and will work with the natural resource management community on future funding.

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

Project Manager and Organization Qualifications

Project Manager Name: Marcella Windmuller-Campione

Job Title: Associate Professor in Silviculture

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

As a silviculturist, Dr. Marcella Windmuller-Campione's overarching research goals are to explore the underlying dynamics of forests – how forests develop or are impacted by current and future disturbances – and to use that basic science to develop management strategies (silvicultural practices) which allow the sustainable management of forest ecosystems in the face of changing conditions. Since 2015 when she started at UMN, Dr. Marcella Windmuller-Campione has successfully mentored 15 graduate students and researchers and has been the PI or CO-PI on more than 3.5 million dollars in grant funding.

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

Organization Description:

The mission of the Department of Forest Resources housed within the College of Food, Agricultural and Natural Resource Science is to advance the science and management of forests and related natural resources by developing solutions to important problems affecting these resources; training the next generation of forest and natural resource scholars and practitioners; and informing the broad public on the economic and ecological importance of forests and natural resources and how they enrich our quality of life.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Dr. Alexis Grinde/Researcher		Activity 1 Project Lead			36.8%	12		$16,598
Dr. Marcella Windmuller-Campione		Project Lead			36.8%	12		$19,223
Dr. John Zobel		Project Co-lead on Activity 2			36.8%	12		$16,382
Researcher 5		Reseacher and Project Coordinator			36.8%	45		$42,005
PhD Student		Collection of Data for Activity 1			24.1%	150		$154,177
Graduate Student Bird Diversity		Collecting Data for Activity1			24.1%	15		$2,260
Undergraduate Research Tech		Collecting data throughout field season and processing data after			0%	93		$25,272
Civil Service Researcher		Collection and Analysis of Bird and Small Mammal Data			32%	120		$85,270
Bird Bander		Bird Bander and recorder			8.2%	30		$7,384
							Sub Total	**$368,571**
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Tools and Supplies	Camera traps	Documenting and sampling bird and small mammal populations					$3,050
	Tools and Supplies	Small mammal traps	Trapping small mammals for sampling					$1,000
	Tools and Supplies	Forestry supplies	Flagging, write-in-the-rain paper, and other displosable supplies					$1,500
	Tools and Supplies	ARUS	sampling bird and mammal diversity					$3,800
							Sub Total	**$9,350**
Capital Expenditures								

							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel to sites, lodging, and per diem for an estimated 100 trips	Field crews will need to travel for sampling across 100 plots over 2 years					$25,000
							Sub Total	**$25,000**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	Open access fees for journal article	open access fees so not behind a paywall to allow accessibility of data and results					$2,500
							Sub Total	**$2,500**
Other Expenses								
		Soil fungi genetics and carbon sampling	To gather fungal diversity and below ground carbon					$9,579
							Sub Total	**$9,579**
							Grand Total	**$415,000**

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				
			State Sub Total	**-**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**-**

Attachments

Required Attachments

Visual Component

File: 32a4ab9d-804.docx

Alternate Text for Visual Component

A graphical description questioning if increased tree diversity increases wildlife, plant, and fungal species diversity. We have all three of our activities and clip art representations for each of the activities including trees, plants, birds, and small mammals....

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
Approval by Board of Regents of the University of Minnesota	b0350dd7-22e.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Does your project include the design, construction, or renovation of a building, trail, campground, or other capital asset costing $10,000 or more?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services, as defined in Minnesota Statutes section 299C.61 Subd.7?

No