



Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-289

Proposal Title: A Biodiversity Checkup for Minnesota's Big Woods

Project Manager Information

Name: Lee Frelich

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

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Project Basic Information

Project Summary: Compare the historic and contemporary flora of Minnesota's Big Woods to see whether all species are able to survive on a small fraction of the original area

Funds Requested: \$109,000

Proposed Project Completion: 2023-06-30

LCCMR Funding Category: Small Projects (H)

Secondary Category: Foundational Natural Resource Data and Information (A)

Project Location

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

Region(s): SE, Metro, Central,

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

Region(s): SE, Metro, Central,

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.

Much time and money has been invested in preserving remnants of Big Woods (maple, basswood and oak forests), a landscape in southern Minnesota where most forests present at the time of European settlement were converted to other land uses. It is time for a checkup to see how biodiversity is faring in these small islands of native habitat, and to ask the question: can all species survive on a tiny fraction of the original landscape? Ecologists predict that loss of area will lead to loss of species, but that has not been tested with field data in Minnesota. It has been a century since the Big Woods were fragmented, so that the resulting impacts should be apparent by now. Although many scientific studies on the status of the Big Woods were published from the 1930s to the 1990s, there is surprisingly little information available on recent status. The question of whether forest biodiversity can coexist with agriculture over the long term is important because we need to know how well existing Big Woods remnants are serving as refuges for native biodiversity. Other projects have examined this coexistence question for highly fragmented prairies, however, we also need answers for forests.

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.

The project will compare the historic and current number of plant species in the Big Woods, in total for the entire ecosystem, and for individual Big Woods remnants and per unit area. We examine plant species because they comprise a large proportion of all species, are the ecosystem base that supports soil health, pollinators, and all wildlife species. Historical records of plant occurrences in the Big Woods will be assembled from several sources. University herbarium records of plant collections done over the last ca 150 years are now digitized and available via electronic searches. Also available are publications in peer-reviewed journals, university students theses, MNDNR biological survey data, and many other species lists that were created over the last several decades when a given park or natural area was established. Current species lists will be assembled in the field by a graduate student assisted by a pool of skilled citizen scientists associated with the Minnesota Native Plant Society. We will assess the extent to which premier Big Woods remnants (designated natural areas), remnants that had been logged, cleared, farmed and returned to forest, remnants invaded by buckthorn, and city parks, each function to preserve native plant

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 assess the status of biodiversity for the entire Big Woods ecosystem, and show whether the current system of reserves is adequate to protect all species. It is possible that scientist predictions of species loss in severely fragmented ecosystems are not valid and that our forest ecosystems are more resilient to change than many people think. The findings will provide guidance for managing natural areas in places like southern MN where remnants are sparse, and whether broad-brush strategies like having a certain number or a certain acreage of forest remnants works, versus having to track every species individually.

Activities and Milestones

Activity 1: Gather all available historic records of plant species occurrences in the Big Woods

Activity Budget: \$37,000

Activity Description:

These records will be assembled from university herbaria in the Midwest region, which contain millions of pressed plant specimens which can now be electronically searched, and are visible via high definition scans. Because these records go back 150 years, this will give us a picture of Big Woods plant diversity as it existed prior to European settlement. However, herbarium records also continue up to the present, so we can get a picture of continuing change. Other sources of data include species lists assembled by examinations of tracts of land by the MN Biological Survey over the last several decades, and species lists assembled when natural areas or state parks were established, as well as university student thesis projects that examined floras of individual tracts of land over the years. Records of all types will be assembled into a database by location, date, and species of every record of plant occurrence relevant to the project.

Activity Milestones:

Description	Completion Date
Establish historic plant data base	2022-03-31
Gather all other records from various government agencies	2022-03-31
Search peer-reviewed literature and university theses for historic plant occurrences	2022-03-31
Search herbarium records from major universities for historic plant occurrences	2022-03-31

Activity 2: Gather current data on plant species with a graduate student and citizen scientists in the field

Activity Budget: \$42,000

Activity Description:

This would be accomplished by visiting existing Big Woods remnants with several different types of management history that we hypothesize will lead to different levels of persistence of the original plant diversity: old-growth remnants (never logged, areas which we think still have the same number of species per unit area that they had in the past), and several types of second growth (areas that had tree cover removed by human activity at some point in their history) which we hypothesize will have progressively lower levels of plant diversity: second growth forests that were logged and recovered, second growth that was logged, farmed and then recovered to forest, second growth invaded by buckthorn, and wooded areas in city parks. We expect that species present per unit area will follow this gradient high to low. We will also assess the overall flora of the entire Big Woods region as one large geographical unit. This is a non-destructive project, no specimens will be taken. The needed information can be obtained by simple field observations, hugely aided by the very skilled botanical observations of Minnesota Native Plant Society members, allowing more geographic coverage than we could do with a graduate student.

Activity Milestones:

Description	Completion Date
Establish Native Plant Society collaboration group	2021-07-31
Choose sites with varied human disturbance history to include in plant survey	2021-08-31
Carry out surveys field surveys of plants with graduate student and Native Plant Society members	2022-10-31

Activity 3: Analyze the status of Big Woods native plant diversity and disseminate the results

Activity Budget: \$30,000

Activity Description:

Here we will use the data on plant occurrences to test the hypotheses that the current flora is as species rich today as it was historically. Comparisons will be made at the scales of the entire Big Woods region, and individual sites, comparing today with 50 years ago and 100 years ago. We will also identify species that were historically present that cannot be found today, also at the site and regional scales. It is possible that some species are no longer present but that new species (including native and invasive species) have moved in, so it is important to look for differences in the flora as well as the total number of species. Another important analysis is to identify species that are declining or increasing in number of occurrences across the landscape. These may fall into groups, for example studies in northern MN, WI and MI have shown that grasses and other grass-like plants have been increasing while other groups like native orchids and Trillium species are declining. Finally, we will examine whether the flora is becoming more homogeneous, with a small group of species adapted to fragmented conditions and other changes in the contemporary environment becoming more common.

Activity Milestones:

Description	Completion Date
Graduate student thesis	2023-03-31
Analyze historic and current plant data	2023-03-31
Dissemination via public lectures, media appearances and peer-reviewed publications	2023-06-30

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Scott Milburn (representing the organization as board president)	Minnesota Native Plant Society	Organize the involvement of 10-12 society members who will help survey plant diversity in Minnesota's Big Woods (maple-basswood-oak forests) as described in the proposal.	Yes

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 is a logical progression adding onto 26 years of previous research in Big Woods forests by the project manager. Other proposals for supplemental funding from within and outside of the University of Minnesota and donations from private individuals will be pursued to continue this line of research. This future funding would be used for the next step after the project proposed here, namely to learn how to restore Big Woods remnants to their full level of biodiversity on small tracts of land so the plant-pollinator complex essential to human wellbeing can be restored in southern Minnesota.

Project Manager and Organization Qualifications

Project Manager Name: Lee Frelich

Job Title: Director, University of Minnesota Center for Forest Ecology

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

Lee E. Frelich is Director of the University of Minnesota Center for Forest Ecology. He received a Ph.D. in Forest Ecology from the University of Wisconsin-Madison in 1986. Frelich has authored more than 183 publications with 240 coauthors from 23 countries, including major works for Cambridge University Press and Oxford University Press. He is listed among the top 1% of all scientists in the world in the Ecology and Environment category by the Web of Science. His research has been featured in the news media 500 times, including such venues as The New York Times, Newsweek and National Geographic. Frelich has provided consulting services on forest management for the U.S. Army, Air Force, National Forest Service, and National Park Service. Current research interests include large-scale fire and wind, earthworm invasion, and climate change in temperate and boreal forests.

Qualifications for this particular project stem from research conducted in Minnesota Big Woods forests since 1994, including six graduate students and at least 15 peer-reviewed publications. These previous projects have covered varied aspects of Big Woods ecology including invasive species like buckthorn and European earthworms, deer browsing on native plants, and effects of severe windstorms.

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

Organization Description:

The University of Minnesota is one of the premiere research universities in the U.S. and the world, with one of the largest graduate schools in the U.S. The St. Paul Campus where The College of Food Agriculture and Natural Resource Science (CFANS) and the Center for Forest Ecology are housed has all laboratory, office, and computer facilities necessary to carry out the research proposed in this LCCMR proposal.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Lee Frelich		Project manager			27%	0.48		\$40,000
Graduate student		Lead field work, andalyze data, write papers			52%	0.64		\$50,000
							Sub Total	\$90,000
Contracts and Services								
Minnesota Native Plant Society	Professional or Technical Service Contract	We anticipate that 12 members of the MN Native Plant Society who are professional scientists will carry out field work and report their data to the project manager. There will be about 15 hours of work per person for a professional fee of \$750.00 (\$50.00 per hour).				0.12		\$9,000
							Sub Total	\$9,000
Equipment, Tools, and Supplies								
	Tools and Supplies	Field equipment including 2 GPS units, 2 lasers for distance measurements, 2 notebooks	Recording locations where plants are identified, recording and measuring surrounding habitat characteristics					\$1,000
							Sub Total	\$1,000
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								

	Miles/ Meals/ Lodging	Travel by project manager and graduate student to field sites in southeast and central MN from St.Paul Campus	Visit Big Woods remnants to evaluate current number of plant species					\$3,000
	Miles/ Meals/ Lodging	Travel to Big Woods remnants by MN Native Plant Society collaborators	Evaluate plant species present in Big Woods remnants					\$3,000
							Sub Total	\$6,000
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
	Publication	Publish two peer reviewed papers based on this project	Dissemination of results of the project					\$3,000
							Sub Total	\$3,000
Other Expenses								
							Sub Total	-
							Grand Total	\$109,000

Classified Staff or Generally Ineligible Expenses

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

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
In-Kind	Unrecovered indirect costs @52.6% of direct costs.	Costs incurred by organization for institutional activity including utilities, building maintenance, clerical salaries, and general supplies	Secured	\$57,336
			Non State Sub Total	\$57,336
			Funds Total	\$57,336

Attachments

Required Attachments

Visual Component

File: [7e340c32-cb9.pdf](#)

Alternate Text for Visual Component

Map of Minnesota showing the project area, and major questions to be answered if the project is funded. Can all species survive on a small fraction of the original area? How many Big Woods remnants still retain their original lushness of species composition, retain a small component of species including only those adapted to fragmented habitats or have major species loss and 'biological desert' conditions?

Optional Attachments

Support Letter or Other

Title	File
Letter of support from MN Native Plant Society	779e690b-ce9.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

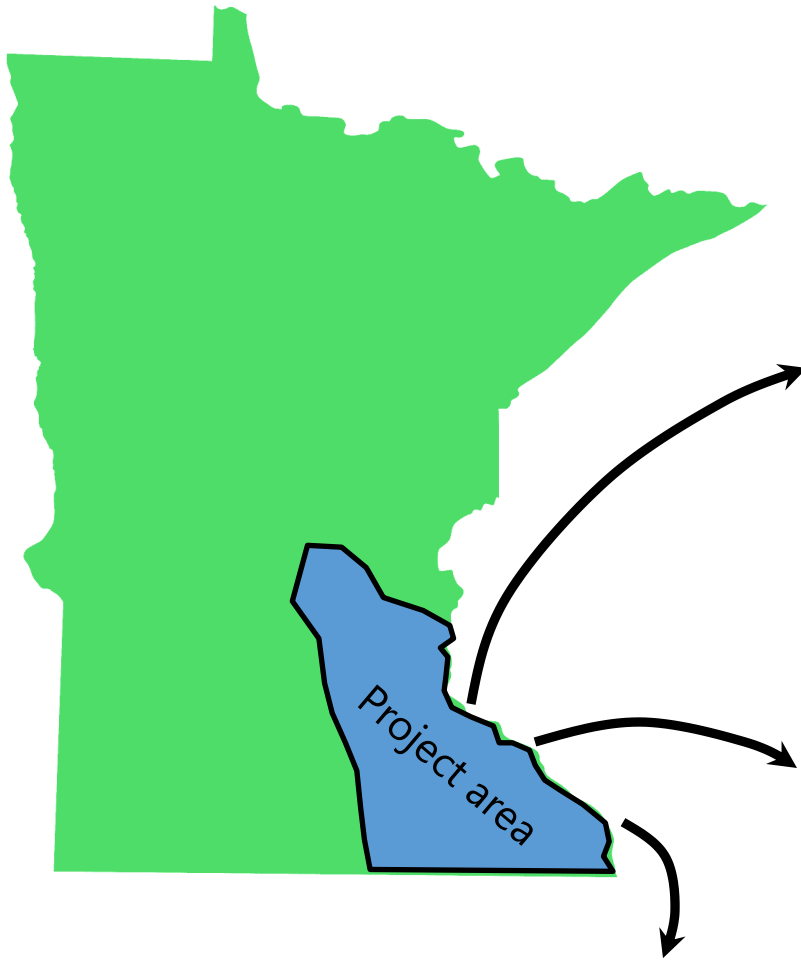
Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

A biodiversity checkup for Minnesota's Big Woods

Lee E, Frelich, Project Manager

Can all species survive in a small fraction of their original area?



How many Big Woods remnants retain their original lushness?



How many remnants retain a small group of species adapted to fragmentation?



How many remnants are becoming biological deserts?

