Environment and Natural Resources Trust Fund

M.L. 2020 Approved Work Plan

General Information

ID Number: 2020-030

Staff Lead: Corrie Layfield

Date this document submitted to LCCMR: August 13, 2021

Project Title: Healthy Prairies III: Restoring Minnesota's Prairie Plant Diversity

Project Budget: $500,000

Project Manager Information

Name: Ruth Shaw

Organization: U of MN - College of Biological Sciences

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Project Reporting

Date Work Plan Approved by LCCMR: August 13, 2021

Reporting Schedule: April 1 / October 1 of each year.

Project Completion: December 31, 2023

Final Report Due Date: February 14, 2024

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 03j

Appropriation Language: $500,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to improve Minnesota prairie resiliency by increasing locally sourced seed availability and diversity, evaluating use of beneficial microbes in prairie restorations, and assessing adaptation and adaptive capacity of prairie plant populations.

Appropriation End Date: June 30, 2024

Narrative

Project Summary: We will collect native seed throughout Minnesota's prairie region, study microbial effects on plant survival, estimate the geographic scale and rate of adaptation, and communicate results aiding restoration and propagation.

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

The widely supported goal of preserving and restoring the extraordinarily diverse plant and microbial life harbored in MN prairies presents serious, pressing challenges. This work is critically important in the face of habitat loss and rapid environmental change, which threaten the persistence of the once vast prairie and its stunning biotic diversity, which nurtures wildlife, purifies water and retains topsoil. Loss of prairie and prairie plant diversity touches Minnesotans across the state, because it impairs hunting and fishing, water quality of rural areas, and the ability to cultivate beautiful and sustainable landscapes on private and public lands. Our proposed and ongoing work will address critical problems that hinder cost-effective and sustainable restoration of the iconic Minnesota prairie biome for diverse uses. Land managers working to restore and preserve prairie need greater availability of seed and improvements in methods for propagating diverse plants appropriate to any one region, and well as the knowledge base to understand how diverse plants and beneficial microbes adapt to the varied landscape of MN prairies.

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 request a third funding allocation to the Healthy Prairies Project to further realize the tremendous investment in preservation of MN prairie plant diversity, and to provide essential resources and information for prairie restoration. By evaluating the geographic scale and rate of adaptation by diverse prairie plants, and the beneficial roles of microbes, our project will guide seed deployment and improve the success of new plantings across the greatly varied environments of MN prairies. Motivated by these goals, we will build on the extensive accomplishments of two previous phases of funding and further the acquisition and propagation of materials and knowledge necessary for prairie restoration that is resilient to environmental challenges. Our team at UM-TC and UM-Morris and more than 50 volunteers have devoted over 2500 arduous hours at 66 prairie remnants across the state, collecting seeds of 90 native prairie species, retaining extensive genetic variation while tracking locality. We have shared early findings with land managers and provided seeds to producers who bring source-identified seeds to market. Because most prairie species are long-lived, our work has just now reached the crucial point of realizing the full benefits of the LCCMR's considerable investment.

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?

- Preserve diverse seed from 10 of the rarer prairie species, and develop methods for propagating them.
- Develop protocols for the use of beneficial microbes to improve plants' survival in conversion of marginal agricultural land to resilient prairie.
- Evaluate the distance over which prairie plants or seeds can be translocated into restorations without severely compromising survival and reproduction.

Project Location

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

Region(s): NW, SW, Metro, Central,

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

Region(s): NW, Central, SW,

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Preserving prairie plant diversity for conservation and restoration

Activity Budget: $57,483

Activity Description:
Working with our partners across MN, we will increase the availability of source-identified seed for use in MN prairie restorations. New collections will target 10 rarer yet important prairie species. Efforts will be evaluated via the amount and diversity of seed collected, by the number of species for which propagation methods are developed, and by the degree of partner involvement. Having consulted with land managers and seed producers over the past three years, we have learned which species groups are most needed. Through these consultations, we have also developed a careful approach to transferring seeds to producers, several of whom have now received numerous collections of seeds that we are authorized to distribute. We will extend our collecting efforts to gather additional seeds, focusing on groups of species that are most desired, but least available, for restorations.

Activity Milestones:

Description	Completion Date
Expand availability of source-identified seed by collecting 10 additional species from geographically widespread locations.	October 31, 2022
Continue to establish material transfer agreements with producers and to transfer seeds to them.	October 31, 2022
Develop propagation methods for species that are currently difficult to propagate.	June 30, 2023

Activity 2: Characterizing beneficial microbes: the hidden partners in prairie restoration.

Activity Budget: $200,010

Activity Description:
We will use experimental plantings in the field and greenhouse to determine the beneficial impact of naturally occurring microbes for two types of plants essential to healthy prairies - legumes and grasses. Results will inform land managers about the role of beneficial microbes for successfully establishing new prairie restorations, and provide these mangagers with locally-sourced microbes.
*We request an addition semester of support for the graduate student who will be carrying out this work, above our previously approved request. The additional support will allow the student to test a broader range of conditions for microbial enhancement of little bluestem's tolerance of drought and inundation , and thus generate results that have broader application across MN.

Activity Milestones:

Description	Completion Date
Compare early seedling survivorship and establishment in Dalea spp. with and without beneficial microbe inoculation.	October 31, 2022
Compare drought and inundation tolerance of little bluestem grass with and without beneficial fungal inoculation.	June 30, 2023

Activity 3: Evaluating adaptive genetic diversity of prairie plants

Activity Budget: $242,507

Activity Description:
Continue field experiments to characterize the spatial scale of local adaptation for six prairie perennials. This work

focuses on four field sites. In all sites, each of the six species is represented by twelve populations originally sampled from throughout the prairie region late in 2014. We assess survival and reproduction of all individuals planted. In a second major study, we are focusing on little bluestem grass evaluating, for two populations, genetic variation for survival and reproduction, and assessing effects of interbreeding between them. We have shared interim results with land managers in response to their requests for advice about restoration practices. Our further results will better inform methods of prairie conservation and restoration that maintain genetic diversity and optimize use of genetic resources.

Activity Milestones:

Description	Completion Date
Monitor survival, growth, and reproduction in established experiments with 6 species and over 6000 plants.	June 30, 2023
Evaluate pedigreed little bluestem populations in field experiments to assess their genetic capacity to adapt.	June 30, 2023

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Georgiana May	Department of Ecology, Evolution and Behavior, CBS, University of Minnesota-TC	Dr. May leads research investigating the diversity of microbial symbionts of prairie plants, as well as their effects on the plants.	Yes
Dr. Margaret Kuchenreuther	Division of Science and Mathematics, University of Minnesota-Morris	Dr. Kuchenreuther leads efforts to gather seeds of prairie species. Through her classroom teaching, she trains the undergraduates who carry out this work. She supervises them through the collection process.	Yes

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
We will communicate to Minnesota seed producers the availability of new seed collections, as we have in the past, and transfer to them seeds they request. We will publish results of our research in the scholarly literature. As in the past, we will consult with government agencies (MN DNR, MN DOT) and non-governmental organizations, such as The Nature Conservancy to offer insights that emerge from this research. We will present findings from the research informally as opportunities arise, for example, at Market Science events. Acknowledgement of ENRTF support will be included in all promulgation of our work

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?
Given the long lifespans of prairie plants and complexity of microbial plant communities, continuing the established project through further field seasons (2021 – 2023) is required to accomplish all its goals.
After the project is no longer funded by the ENRTF, findings, results, and products will be disseminated by Shaw and May, who will be supported by their salaries at the University of Minnesota-TC, along with their collaborators, as their capacities allow.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Prairie Sustainability through Seed Storage, Beneficial Microbes, and Adaptation	M.L. 2014, Chp. 226, Sec. 2, Subd. 06c	$600,000
Preserving Minnesota Prairie Plant Diversity – Phase II	M.L. 2017, Chp. 96, Sec. 2, Subd. 03c	$900,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Dr. Ruth Shaw		PI			26.7%	0.08		$19,337
Dr. Georgiana May		Co-PI			26.7%	0.08		$17,633
Dr. Margaret Kuchenreuther		Collaborator			26.7%	0.12		$19,795
Postdoc Associate		Postdoc will work on Activity 3 for 2 years.			20.25%	2		$133,398
2 Graduate Students		50% FTE graduate students - Support is requested for the summer in year 1 plus one semester in year 2 under Activity 2. Also, support is requested for one semester in year 1 plus one semester plus summer in year 2 under Activity 3. Tuition included in academic year support.			46.88%	1.06		$89,749
5 Undergraduate Students		Undergraduate students to work on activities 1-3.			0%	0.46		$54,415
Lab Tech		100% FTE Lab Tech			24%	2		$98,657
							Sub Total	**$432,984**
Contracts and Services								
Consultant	Professional or Technical Service Contract	Northern MN seed collections				-		$6,000
UM Genomics Center	Internal services or fees (uncommon)	Lab Services - Analysis. Sequencing, 4 analyses (of 200 samples) @ $2,000 each				0		$8,000
UMN Greenhouses	Internal services or fees (uncommon)	For planned experiments: 800 sq. ft for 12 months over 2 years, at $0.8 per sq. ft. per month, per current UMN greenhouse rental rates				0		$3,616
							Sub Total	**$17,616**

Equipment, Tools, and Supplies								
	Tools and Supplies	field and lab supplies	seed collection, censuses, microbial culturing					$11,200
							Sub Total	**$11,200**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel to field sites for seed collection (Activity 1) and microbial sampling (Activity 2), establishing and monitoring experimental plots (Activities 2, 3), and seed increase plots in Rosemount. Total travel estimated: 30K mi in MN, w/ 180-hotel person overnights, over 2 yrs. All travel to be conducted per UMN Policy as required in Guidelines On Allowable Expenses.	Travel to field sites for seed collection and microbial sampling and establishing and monitoring experimental plots.					$32,000
							Sub Total	**$32,000**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Publication	$3,000 per year requested for publication of research results (page charges).	Dissemination of research results.					$6,000
							Sub Total	**$6,000**
Other Expenses								

		Mailing or Courier Fees	Send seeds collected by collaborators at outstate sites to UMN.	X				$200
							Sub Total	**$200**
							Grand Total	**$500,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Other Expenses		Mailing or Courier Fees	Mailing or courier fees to cover shipping of seeds collected by collaborators at sites outside MN to UMN.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	Indirect costs associated with this project.	Indirect costs	Potential	$256,931
			State Sub Total	**$256,931**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$256,931**

Attachments

Required Attachments

Visual Component

File: f4e72bc7-a33.pdf

Alternate Text for Visual Component

Shaw_2020_Graphic. Counter-clockwise from the top left, we show Activity 1: Ordway prairie a seed collection site with an inset showing propagation methods; Activity 2: using beneficial microbial collections to enhance seedling establishment and growth; Activity 3; Assessing adaptive genetic diversity of prairie plants with three outstate evaluation sites (green rectangles) and collection sites for prairie species across MN (blue and red dots)....

Optional Attachments

Support Letter or Other

Title	File
Background check certification form	578033ba-9cd.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

The support for graduate student on Activity 2 was reduced somewhat. This does not compromise the work, because the student has been awarded a fellowship for the coming academic year.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I agree to the UMN Policy.

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

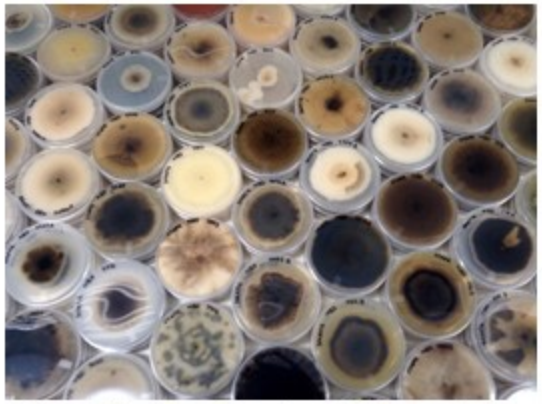
Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

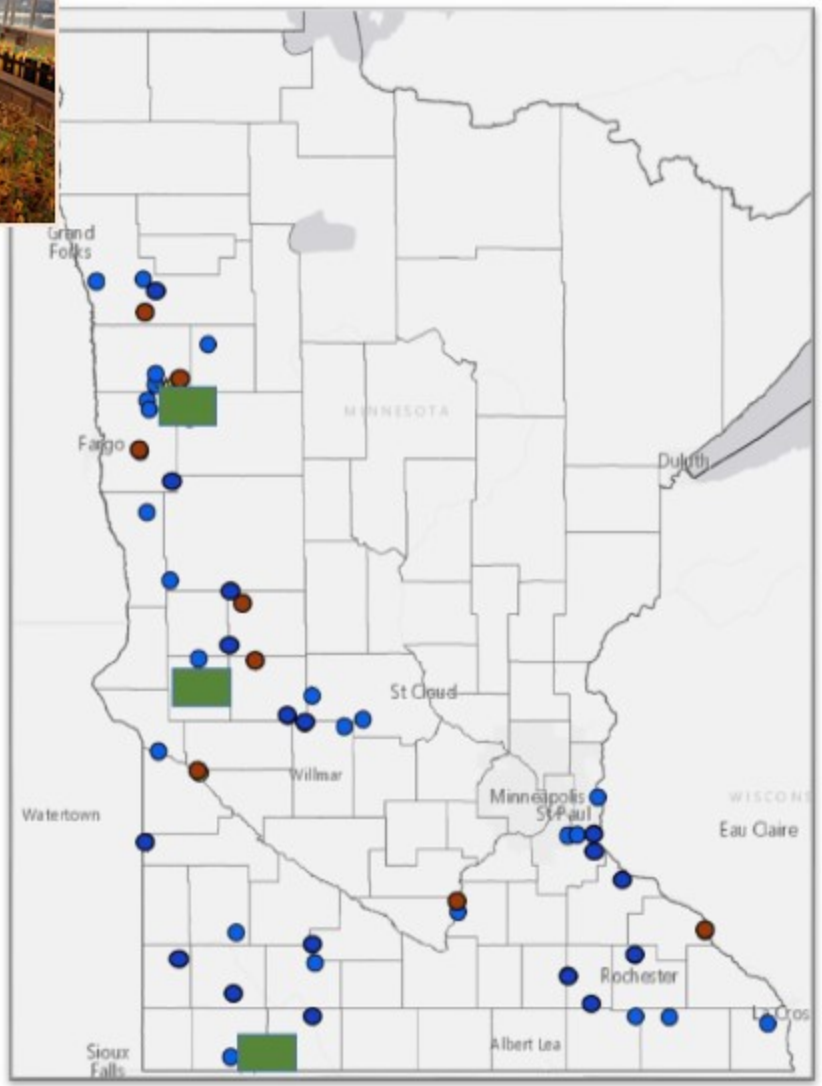
Yes, Sponsored Projects Administration

Activity 1: Preserving prairie plant diversity. With our partners across the state, collect 20 additional rare species from varied environments, develop propagation methods, and transfer to producers.



Microbial diversity cultured from plants

Activity 2: Beneficial microbes: hidden partners in prairie restoration. Characterize beneficial impacts of microbes for little bluestem (grass) and prairie clover (legume). Evaluate changes in beneficial microbes with conversion of marginal ag. land to prairie.



Activity 3: Adaptive genetic diversity of prairie plants. Map of remnant prairie collection sites (blue = SNA, red = TNC) and 3 evaluation sites (green). Seeds of 6 different species from 16 sites are grown in the three evaluation sites to assess capacity for adaptation to differing environmental conditions.