



Environment and Natural Resources Trust Fund

M.L. 2023 Approved Work Plan

General Information

ID Number: 2023-061

Staff Lead: Corrie Layfield

Date this document submitted to LCCMR: May 20, 2023

Project Title: Minnesota Million: Seedlings for Reforestation and CO2 Sequestration

Project Budget: \$906,000

Project Manager Information

Name: Julie Etterson

Organization: U of MN - Duluth

Office Telephone: (218) 726-8110

Email: jetterso@d.umn.edu

Web Address: <https://www.d.umn.edu/>

Project Reporting

Date Work Plan Approved by LCCMR: June 22, 2023

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

Project Completion: June 30, 2025

Final Report Due Date: August 14, 2025

Legal Information

Legal Citation: M.L. 2023, Chp. 60, Art. 2, Sec. 2, Subd. 08e

Appropriation Language: \$906,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota, Duluth, to collaborate with The Nature Conservancy and Minnesota Extension to expand networks of seed collectors and tree growers and to research tree planting strategies to accelerate reforestation for carbon sequestration, wildlife habitat, and watershed resilience.

Appropriation End Date: June 30, 2026

Narrative

Project Summary: A grower network will raise tree seedlings so that we have enough to conduct widespread reforestation in Minnesota to improve carbon sequestration, wildlife habitat, watershed resilience, and create economic opportunity.

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

Reforestation is a natural climate solution. Trees uptake CO₂ from the atmosphere and store carbon. By reforesting one million acres in Minnesota, we could draw down 1.6 million tons of CO₂ annually—the emissions equivalent to 348,000 average passenger vehicles. Reforestation also benefits water resources, habitat, and resilience to extreme events such as intense rainfall and heatwaves. So, why don't we do it? A major obstacle is that we do not grow enough conservation-grade tree seedlings to meet reforestation demand. Consequently, even if we had the will to plant enough trees to reabsorb carbon emissions, we would not have the way. This project aims to remedy this problem by increasing the capacity of farmers and tree nurseries to produce tree seedlings and, in turn, scale up forest restoration potential across the state. In order to ramp up tree seedling production so that we can meet our ambitious goal of reforesting one million acres by 2045, we would need to grow seven times more seedlings than we do right now, from 6.1 million to ~42 million tree seedlings per year. This level of seedling production would allow reforestation on 1/3 of the land available for restoration in Minnesota (figure).

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.

We will mobilize people across Minnesota to engage in all aspects of climate-resilient forest restoration through a new initiative called the Minnesota Million: from seed collection, to seedling production, purchasing, and planting. Through a successful pilot project, we have field-tested each of these steps (figure). In 2020-2021, we collected wild seeds (six species, 36 sites) that were grown by 14 farmers yielding 10,000 trees that were large enough to sell. These seedlings are currently being planted into 14 reforestation sites. In 2022, we added three new members to our farmer coalition, and are currently planning a broader fall 2022 seed collection. Here we identify key LCCMR investments that will solidify and grow the project with the ultimate goal of becoming self-sufficient. Specifically, we are requesting funding for:

- training, salary, and travel for wild seed collectors
- outreach to engage more farmers and growers, especially Indigenous nurseries and foresters
- training, equipment, and technical support for growers
- funds to track survival and establishment of seedlings from specific species/population seed sources, and
- educational programming for diverse Minnesotan populations including urban and Tribal youth.

This two-year investment will fuel the momentum of this promising program and heighten public awareness about natural climate solutions.

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?

Train community members in best practices for seed collection in collaboration with the state nursery, Tribal Nation, academic, and extension partners. Seed collectors will learn how to select locations, species, populations, and conduct seed collection and cleaning to retain valuable genetic diversity.

Establish a larger network of tree growers across the state by engaging farmers and tribal, commercial and state

nurseries to increase the supply of climate-adapted seed and seedlings.

Equip and train growers to successfully germinate seeds, raise and overwinter seedlings to meet industry standards, and sell them.

Direct benefits to Minnesotans who are most impacted by forest losses

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?

In the Future

Activities and Milestones

Activity 1: MN Million - TREE GROWERS - recruitment, training, consultation, funding, and outreach

Activity Budget: \$499,963

Activity Description:

We will use our networks and media to recruit growers (e.g., 2022 event with RSDP, 50 people, public seminars, MN Million kick off meeting). TNC will be especially focused on recruiting tribal nurseries and urban partners, including tribal and inner-city youth organizations who will be invited to be growers. Farmer and nursery sites will be visited at least once by David Abasz, the primary liaison with the growers, to determine eligibility and growing supply needs. Together, they will develop a MOU that specifies the supplies provided the level of production agreed upon. The MOU will also summarize rules associated with expenditure of ENRTF funds and will include the LCMR Guidance on Allowable Expenses as an appendix to the agreement. Each farmer will be eligible to draw growth supplies (cone-tainers, labels, etc.) from an equipment pool housed at UMD. Farmer and nursery training and support will occur through site visits and monthly zoom meetings for problem solving. The onus for compliance to all LCCMR and MN Million policies will be borne by the Project Manager. The ultimate measure of grower success will be the delivery of tree seedlings that are of sufficient size to be donated to restoration organizations for planting.

Activity Milestones:

Description	Approximate Completion Date
One-day meeting in Duluth to introduce MN Million to tribal leaders, nursery personnel, and foresters	November 30, 2023
In-person grower visits to consult on infrastructure, set-up, supplies, and procedures in winter 2023	February 28, 2024
Virtual and in-person workshops with potential farmers/commercial growers winter 2023 and 2024	November 30, 2024
In-person grower visits to consult on infrastructure, set-up, supplies, and over-winter seedling storage in 2023	June 30, 2025
Outreach to tribal and urban youth organizations that may want to participate as growers	June 30, 2025

Activity 2: MN Million - SEED COLLECTORS - recruitment, training, funding, and outreach

Activity Budget: \$302,004

Activity Description:

Biological diversity is the cornerstone of ecological stability. This fundamental concept holds at the macro level of species diversity and at the micro level of genetic diversity. Biodiversity at both scales contributes to ecosystem function and long-term community resilience. Our seed collection strategy is designed to enhance diversity at both levels by selecting species that will thrive into the future and by collecting seeds in a way that maximizes genetic diversity. Importantly, we will also track the success of restoration plantings that are based on specific species/populations to assure that we are meeting our goals. To select species, we will use tools now available from the Forest Service and others that predict the species that will thrive into the future in different forest types in Minnesota. For these species, we will collect seeds from numerous populations and from 20-50 mother trees per population to assure that we are capturing genetic diversity. Seed collections will be maintained separately through seed processing and delivery to seed growers so that we can track the success of our specific collections as measured by percentage germination, the number of seedlings successfully raised/sold by the grower and, ultimately, tree establishment at the restoration site.

Activity Milestones:

Description	Approximate Completion Date
Virtual training and three in-person workshops for seed collectors in 2023-2024	November 30, 2024
Planning and coordination of seed collection in 2023-2024	December 31, 2024

Tracking seedling survival and growth per species/population collection at the production sites	March 31, 2025
Outreach to community seed collectors for recruitment into MN Million	June 30, 2025
Tracking tree survival and growth per species/population collection at the reforestation sites	June 30, 2025

Activity 3: Research to optimize seed germination, seedling growth, and tree survival at the restoration site, especially with respect to mycorrhizal amendments

Activity Budget: \$104,033

Activity Description:

Recent popular books such as the Pulitzer Prize winner “The Overstory: A Novel” (Powers, 2018) and the New York Times bestseller “Finding the Mother Tree: Discovering the Wisdom of the Forest” (Simard 2021) have captured the public imagination and helped people realize that trees require community partners to thrive. One of the most important partners is the mycorrhizal fungi. These organisms grow a fine web of threads that extend widely into the soil and deliver water and dissolved nutrients to the tree roots, as much as 80% of the required nitrogen and phosphorus for plant growth. In exchange, the fungi obtain sugars from the tree. These below-ground partners have been shown to play a key role in seed germination, plant growth, and survival. Despite their importance, they have not been studied extensively in the context of reforestation. Here, we will test whether the addition of natural or commercially obtained mycorrhizal inoculants promote seedling germination and growth better than fertilizers. Few studies have examined this, and none have followed the trees through the phases of seedling production and into the restoration site. With this information, we will provide valuable recommendations to growers that will increase seedling yield and promote reforestation success.

Activity Milestones:

Description	Approximate Completion Date
Greenhouse experiments testing the value of mycorrhizal and other soil amendments on germination, survival, and growth.	October 31, 2024
Germination tests in the lab and at grower sites in 2023-2025 to optimize seedling yield	June 30, 2025
Experiments testing the value of mycorrhizal/soil amendments on tree establishment at restoration sites	June 30, 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Meredith Cornett	The Nature Conservancy in MN/ND/SD	co Principal Investigator	No
David Abazs	U of MN Northeast Sustainable Development Partnership	co Principal Investigator	Yes
Mary Hammes	The Nature Conservancy in MN/ND/SD	Serve as primary contact for TNC's involvement in the overall project, including coordination with diverse partners engaged in the Minnesota Million, Minnesota's statewide initiative to reforest 1-million acres by 2045.	No

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.

MN Million is a public movement that considers dissemination of information about the project to be a core goal. We will accomplish this goal through professional presentations given by the Principal Investigators and MS graduate students in public forums, including to tribal entities, and as a component of undergraduate and graduate courses and K-12 outreach. Diverse Minnesota citizens will be directly engaged in the project as seed collectors, seed quality testers, seedling growers, and undergraduate researchers. These people will become aware of the project through public outreach conducted by all project participants and media attention. Results from the two MS thesis projects that are embedded in the work will be published in scientific journals and the data will be made publicly available on DRUM (<https://conservancy.umn.edu/drum>). Likewise, information on experimental design of all long-term experiments will be made publicly available so that these experiments can be monitored for decades to come. We are very pleased to acknowledge the valuable resources provided by the Environment and Natural Resources Trust Fund that are making this project possible.

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?

We piloted the grower's network with \$50,000 from the Institute on the Environment and successfully: 1) collected wild seed, 2) recruited/trained farmers who grew the seed, and 3) sold seedlings to conservation organizations for spring 2022 planting. We request a ~one-million-dollar LCCMR investment to improve and expand our operations to include Tribes, urban populations, and commercial nurseries. We will continue to raise funds for MN Million to support seed collection and seedling production, for example, through a USDA Partnerships for Climate -Smart Commodities proposal that is supporting "innovative, scalable approaches to carbon sequestration that also benefit the economy."

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Conserving and Monitoring of Minnesota's Rare Arctic Plants	M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 08d	\$135,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Julie Etterson		PI: Supervise and manage all aspects of the project with collaborators Cornett and Abazs			26.9%	0.16		\$30,063
Graduate Student 1		MS Graduate Student: Planning BIPOC youth programming, testing value of mycohrizal additions to seedling growth medium			47%	1.12		\$49,384
Graduate Student 2		MS Graduate Student: Planning BIPOC youth programming, testing value of mycohrizal additions to seedling growth medium			47%	1.12		\$49,384
Researcher 2		Coordination of seed collection - finding populations, organizing collection, seed cleaning, preparation of packages for farmers			24.2%	2		\$155,631
Greenhouse manager to coordinate undergraduate seed cleaners		25% appointment for the UMD Greenhouse Manager to supervise undergraduate seed cleaners and organizers			24.2%	0.5		\$38,906
Undergraduate Research Assistants		Undergraduates: Process and package seeds for farmers, test percent germination, conduct independent research on optimal conditions for germination and early growth in conjunction with UMD undergraduate research programs; March - May, 10 people, 10 hours per week, 5 weeks			0%	0.48		\$15,901
Seed Collectors Temp/Casual		Work with Seed Collection Manager to learn how to find sources populations, identify species, and make genetically diverse seed collections, monitor seed maturation, collect seeds according MN Million protocols, record basic site information, enter data. Citizen scientists - 10 people, 20 hours per week, 8 weeks			7.76%	1.4		\$63,070
David Abazs		Co-I: Project oversight			26.9%	0.56		\$59,996
Researcher2		Coordination of seedling growers - recruitment, training, site visits, supporting research			24%	2		\$155,631
							Sub Total	\$617,966
Contracts and Services								

UM Extension NE Regional Sustainable Development Partnership	Sub award	Americorps Interns: Work with the David Abazs and the Farmer/Nursery Project Manager to facilitate communication with seedling growers, conduct sites visits for trouble shooting. \$12,974 for the interns, plus \$6,000 for mileage/per diem numerous trips to centralized locations for trainings/site visits to farmers and nurseries.				0.38		\$18,974
							Sub Total	\$18,974
Equipment, Tools, and Supplies								
	Tools and Supplies	Seed cleaning non-capital equipment	<p>Here is detailed information on the non-capital equipment for seed cleaning:</p> <ul style="list-style-type: none"> • Wincrowing Machine 2 - The Winnow Wizard for the smallest of seeds, like the birches. \$4,800 • Primary Screens for 20 collectors - initial seed cleaning in the field prior to seed delivery to UMD (\$200 a set) total \$4,000 • Acorn separator - primary seed segregation from forest floor debris. Five units to be dispersed regionally \$1,200 • Dust and Safe Masks. Disposable Filter Masks with Elastic Strap. 4 packs of \$1000 @ 150 each - \$600 • Large paper bags - 15 packs of 50 @ \$32 each = \$640 • Stackable clear storage bins with lids and locking handles in multiple sizes. Ten sets @ \$45 per set = \$450 • Protective work gloves w/ breathable rubber coating. Four packs of each of L, M and S @ \$25 each - \$300 • Five packs of 20 Brown Paper Bags with Handles Mixed Size @ \$40 each = \$200 • Coin envelopes - 9 boxes #1 Coin Envelope with Gummed Flap Brown Kraft, 2-1/4 x 3-1/2 @ \$20 per box = \$180 • Hardware Cloth 48 					\$12,647

			inch x 50 Foot 23 Gauge, 2 rolls @ \$86 each = \$172 • Safety Glasses Protective EyeWear - Over-The-Glass (OTG). Pack of 40 pairs - \$135 • Four sets of various sized scoops @ \$25 each = \$100. • One gallon Zip lock bags - 3 boxes of 60 @ \$10 each = \$30					
							Sub Total	\$12,647
Capital Expenditures								
		Seedling Storage and overwintering	Two solar powered tree seedling storage refrigeration units, of adequate size, to allow for optimal temperature storage and assure both the grower and the planting organizations, good winter survival rates and high quality stock for planting.	X				\$145,750
		Seed cleaning equipment - Cone drying racks	Cone Drying SS Screen Racks - essential airflow units to store and dry cones for the pine cone dehuller. Mostly hand built using stainless steel tight screens and wood framing. \$5,000	X				\$5,000
		Seed cleaning equipment - Pine Cone Dehuller	Pine Cone Dehuller - The Wet Dewinger and Seed Extractor is a large capacity and multi-purpose unit that can be used for pre-cleaning, seed extraction (all cones) and wet dewinging (i.e. maple seed) of seed. \$10,000	X				\$10,000
							Sub Total	\$160,750
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								

	Miles/ Meals/ Lodging	Seed Collection travel for "citizen scientists" (hired as UMN Temp/Casual staff) - 10 people, 2000 miles each, \$0.585 per mile	Mileage to collect seeds						\$23,400
	Miles/ Meals/ Lodging	Farmer/Nursery Manager and Production Coordinator training travel - 3 trips to grower sites, 300 miles per grower on average, \$0.585 per mile	Mileage to three sites for on-site regional trainings						\$1,052
	Miles/ Meals/ Lodging	MS Graduate Student outreach travel - 10 trips, 300 miles per trip, \$0.585	Mileage for 10 educational sessions						\$3,510
	Miles/ Meals/ Lodging	Farmer/Nursery Manager and Production Coordinator travel for site visits- 30 trips to grower sites, 300 miles per grower on average, \$0.585 per mile	Mileage to travel to growers for on-site consultation						\$10,530
	Miles/ Meals/ Lodging	MS Graduate Student research travel - 6 trips to 5 sites, 300 miles per trip on average, \$0.585 per mile	Mileage to restoration to assess tree seedling survival and growth depending upon soil amendment treatments						\$5,265
								Sub Total	\$43,757
Travel Outside Minnesota									
								Sub Total	-
Printing and Publication									
								Sub Total	-
Other Expenses									
		ST Lease - Building	Conference Room rental for Tribal meeting						\$500
		Professional services	MDA Nursery License for seedling quality control inspection						\$400
		Equipment lending pool	We will purchase basic growing supplies (e.g., cone-tainers and cone-tainer racks) that will be lent from UMD to ~45 growers (non-UMN staff, generally local farmers, \$1000 value or less depending upon their need) to establish and/or expand tree nursery production. Personal site visits and training will identify the amount of materials the grower requires. These						\$43,506

			materials will be returned to UMD after the project is completed					
		One-day project training session for Tribal leaders, nursery personnel, and foresters (non-UMD staff/students)	We will provide a \$300 stipend for 25 MN Million participants to attend a training session where they will learn how to aquire seeds and become a grower for the project.					\$7,500
							Sub Total	\$51,906
							Grand Total	\$906,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Expenditures		Seedling Storage and overwintering	See explanation of purpose Additional Explanation : They will be strategically placed within the region to store the tree seedlings grown by the Farm and Forest Growers for the entirety of the project.
Capital Expenditures		Seed cleaning equipment - Cone drying racks	This is a key piece of equipment necessary for drying large quantities of seed. Additional Explanation : Acquire seed cleaning equipment that will be temporarily housed at UMD but will ultimately be moved to a permanent seed cleaning facility. This piece of capital equipment will be used for seed cleaning as long as it is functional. We anticipate this will be a long-term project that extends beyond the time scope of this LCCMR grant.
Capital Expenditures		Seed cleaning equipment - Pine Cone Dehuller	This is a key piece of equipment necessary for cleaning large quantities of seed. Additional Explanation : Acquire seed cleaning equipment that will be temporarily housed at UMD but will ultimately be moved to a permanent seed cleaning facility. This piece of capital equipment will be used for seed cleaning as long as it is functional. We anticipate this will be a long-term project that extends beyond the time scope of this LCCMR grant.

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: [906a1e6b-690.pdf](#)

Alternate Text for Visual Component

PROJECT FLOW CHART: Collect seeds->Grow seedlings on farms/nurseries->Sell trees and reinvest->Plant trees for reforestation and carbon sequestration. BOTTOM: Map of reforestation opportunities and 2021-2022 pilot project accomplishments. Seed collected from 11 species->60,000 trees grown by 14 farmers->10,000 trees produced->14 restoration plantings....

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
Letter of Support from the Rutabaga Project, a shared initiative between the Arrowhead Economic Opportunity Agency and the Iron Range Partnership for Sustainability	1f3a4225-6c3.pdf
Letter of Support from the Iron Range Partnership for Sustainability	304d9f3e-5d7.pdf
Letter of Support from Lake Superior Sustainable Farming Association	8b934312-568.pdf
Etterson et al. 2020. Using assisted migration to detect adaptation lags in two major North American tree species in response to global climate change	4958a54a-6f9.pdf
Etterson et al. 2018. Embedding research into restoration: A case study illustrating the value of applied-academic partnerships.	bcc9cbb9-3af.pdf
Minnesota Million - Media Attention	433b5631-539.pdf
Transmittal Letter	ce86d4eb-674.docx
Etterson - background check form	3da8fe3d-14c.pdf
Abazs - background check form	c07ff861-9b5.pdf
Response to LCCMR comments 11.8.22	aa395af5-0d2.docx
Etterson 2023-061 Revised Addendum 2/23/23	819174ee-bb4.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

NEW COMMENT - 1/23/23

I am resubmitting a revised proposal in response to the most recent set of suggested changes. Most of the changes concern Activity 1. Here are the two major aspects of the proposal that have been eliminated: 1) Any equipment purchased to fulfill the objectives of this proposal will become part of a "equipment lending pool" that will be owned and housed by the University of Minnesota Duluth and distributed to farmers as necessary, and 2) any seedlings that are produced based on LCCMR funds, including resources from the "equipment lending pool" will be used in research and/or donated to restoration organizations, rather than being sold for profit. Here are aspects of the budget that have been revised: 3) This grant will be used to purchase growth supplies such as seedling trays and plugs that will be "owned" by the University and lent out to farmers for the duration of their involvement in this project. Because this budget line no longer includes money for facility upgrades, this line item has been reduced from \$198,835 to \$43,204. 4) We have added a new "Research 2" who will be in charge of aspects of the project related to seed collection, as was in our original

proposal. This money, \$155,631, has been moved from the farmer equipment budget equipment line (i.e., point 3 above).

OLD COMMENT ON PREVIOUS DRAFT. The LCCMR Committee requested that we cut our budget from \$1,012,000 to \$906,000 (-\$106,000). One way we accommodated this budgetary change was by shifting personnel responsibilities. Specifically, we eliminated one of the full-time project manager staff position in each year (- \$156,293, Researcher 2) and reallocated the work to David Abazs who now has 30% of his salary on the grant (+\$60,000) and to Julie Etterson who now has one month of summer salary on the grant (+\$15,000). In addition, the duration of one of the graduate student position was reduced and one increased. Now there are two students, each with 50% positions for one semester and the summer per year. Funds for some staff travel was reduced as well as the budget for seed cleaning equipment and winter seedling storage. Finally, we decided to hold the Tribal meeting on a single day which reduced hotel costs. In general, we tried to retain the goals of all of the activities but modify and redistribute the work so that we could achieve our core objectives on a slightly smaller budget.

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?

Yes

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 (UMD)