Environment and Natural Resources Trust Fund

M.L. 2022 Approved Work Plan

General Information

ID Number: 2022-193

Staff Lead: Corrie Layfield

Date this document submitted to LCCMR: June 17, 2022

Project Title: Restoration of Eastern Hemlock, Minnesota's Endangered Tree Species

Project Budget: $199,000

Project Manager Information

Name: Andrew David

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

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Project Reporting

Date Work Plan Approved by LCCMR: June 27, 2022

Reporting Schedule: March 1 / September 1 of each year.

Project Completion: June 30, 2025

Final Report Due Date: August 14, 2025

Legal Information

Legal Citation: M.L. 2022, Chp. 94, Art. , Sec. 2, Subd. 03j

Appropriation Language: $199,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to develop guidelines for restoring eastern hemlock, Minnesota's only endangered tree species, by testing methods and seed sources at different sites across northern Minnesota.

Appropriation End Date: June 30, 2025

Narrative

Project Summary: This project will develop planting guidelines for eastern hemlock, Minnesota's only endangered tree species from four different seed sources planted on four different sites across northeast and north central Minnesota.

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

Eastern hemlock is Minnesota's rarest tree species, numbering about 50 mature wild trees in the state. In the early 1900's it was more prevalent but overharvesting, wildfire and severe weather events have dropped the number of trees precipitously. Two populations, near Paupores, MN and Mile Lacs Lake have disappeared entirely while the Hemlock Ravine in Jay Cooke State Park has suffered losses due to rain induced landslides. As a result of these losses hemlock was listed as a species of great concern in 1984 and state endangered in 2013.
Eastern hemlock is a long-lived, shade tolerant conifer with high wildlife value. It provides excellent winter cover and food for birds, deer and moose and is suitable for fisher habitat. In Wisconsin, it is a valuable commercial species, utilized for pulp, saw timber and veneer. In northern Wisconsin and western Michigan hemlock exists in larger numbers and regenerates readily as seedlings, often benefiting from cooler, moister conditions near downed logs.
In Minnesota there is growing interest in restoration of hemlock through planting but there is little information on forest restoration techniques. Data are needed to make recommendations on how site quality, weather conditions, and planting techniques influence restoration success.

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.

Our proposal will provide natural resource professionals with recommendations about site selection and planting methods to maximize the survival and growth of eastern hemlock seedings. We will assess current and historical eastern hemlock sites in the state for soil type and weather conditions (precipitation, temperature, etc.) to understand the range of conditions hemlock seedlings prefer.
We will then establish an eastern hemlock restoration experiment on four sites across northeast and north central Minnesota. Sites will be located collaboratively with Fond du Lac Natural Resources, Carlton County Land Department and University of Minnesota Research and Outreach Centers and cover a range of environmental and site conditions. The goal is to test restoration efforts on sites similar to previous eastern hemlock populations and are likely to support the species in the future. Within each site we will plant seedlings with with and without 'nurse blocks', small blocks of wood designed to mimic the cooler, moister conditions provided by downed logs.
While eastern hemlock provides excellent habitat for many wildlife species as mature individuals, as seedlings, it can be heavily browsed. To protect seedlings from browse and to assess the potential site for restoration, all eastern hemlock seedlings will be fenced.

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?

This project will provide some of the first information on restoration strategies and treatments for eastern hemlock, a species considered endangered in Minnesota. Our information is vital to forest management agencies and private landowners as they seek to provide multiple ecosystem services including wildlife habitat, species diversity, and forest productivity.

Project Location

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

Region(s): NE, Central,

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

Region(s): NE, Central,

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Identify site conditions that promote survival and growth of eastern hemlock seedlings in Minnesota.

Activity Budget: $38,000

Activity Description:
Through an email survey of natural resource organizations and city foresters in the state and a search of published records such as journal articles, dissertations, popular press, websites, herbarium samples from the Minnesota Biodiversity Atlas and forest inventory analysis records, identify the latitude and longitude of current and historic eastern hemlock sites. Use these geo-referenced locations to find online soils information and weather records for each site and create a description of the type of site favored by eastern hemlock. This information will be specific to Minnesota and more informative than a range map and a standard textbook description of eastern hemlock site preferences.

Activity Milestones:

Description	Approximate Completion Date
Create and send email survey regarding location of any existing hemlock in Minnesota	August 31, 2022
Search published accounts for historic or current existence of eastern hemlock in Minnesota	August 31, 2022
Analyze results of email survey and published accounts and create description of preferred hemlock sites	December 31, 2022

Activity 2: Establish four eastern hemlock seedling trials across northeastern and north central Minnesota

Activity Budget: $44,000

Activity Description:
This activity identifies the four sites, plants the seedlings, and establishes the experiment. Identify four planting sites on collaborator lands that meet the Minnesota specific eastern hemlock site preferences found in Activity 1. Prepare the sites for planting seedlings by herbicide or mechanical removal of grass, weeds, brush and/or trees if necessary. Purchase seedlings, fencing, fence posts, wooden 'nurse blocks', and planting supplies. Seedlings will come from four different sources, three from near local Wisconsin sources and one from a distant source to test the value of locally sourced hemlock seed. Plant a total of 480 seedlings across four sites (30 seedlings from each of four different seed sources planted at four different locations or 30 seedlings x 4 sources x 4 sites = 480 seedlings). Install 'nurse blocks' on half of the seedlings and fence each site.

Activity Milestones:

Description	Approximate Completion Date
Identify four locations on collaborator lands to plant seedlings that fit favored sites description	March 31, 2023
Acquire fencing supplies, nurse blocks, seedlings	May 31, 2023
Prepare sites for planting by removing competing vegetation	June 30, 2023
Plant seedlings, install nurse blocks, establish trials, fence trials on four sites	June 30, 2023

Activity 3: Collect seedling survival and growth data, analyze data, create planting recommendations and disseminate results

Activity Budget: $117,000

Activity Description:

During this phase of the project sites are visited three times during each of two growing seasons (2023 and 2024) to collect seedling data, manage competing vegetation, and fix any fencing issues. At the beginning, middle and end of each growing season the following data is collected: survival, height growth, needle coloration, bud set, bud break, frost damage and winter injury. Collectively this tells us how well the seedlings are growing on the sites we chose, the impact of 'nurse blocks' and whether local seed sources are better for early seedling survival and growth. After the first growing season data can be analyzed and preliminary results presented at conferences. Early spring second year data will have important information about winter injury and survival with a new analysis each time data is collected. Data collected at the end of the second growing season will be the most informative and after analysis will be used to write restoration method articles for land management agencies and make formal presentations.

Activity Milestones:

Description	Approximate Completion Date
Visit each site three times during first growing season; collect data, check vegetation, fix fencing.	October 31, 2023
Preliminary analysis and presentations of preliminary results	February 28, 2024
Visit each site three times during second growing season; collect data, check vegetation, fix fencing.	October 31, 2024
Analysis of second year data, write restoration methods articles, make formal presentations, summary of findings.	June 30, 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Marcella Windmuller-Campione	University of Minnesota Twin Cities	Assist with site determination, experimental design, co-mentor graduate student	Yes
Christian Nelson	Fond du Lac Natural Resources	Identify host site based on site criteria, direct site preparation if any, assist with planting,	No
Mark Westphal	Carlton County Land Department	Identify host site based on site criteria, direct site preparation if any, assist with planting.	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.
This project will generate data on conditions favorable for growth of eastern hemlock in Minnesota and two solid years of data on survival and growth of planted seedlings. All in-person meetings, presentations and publications would be based on data collected during the course of the project. Presentation of results will be made at conferences in state such as the Society of American Foresters annual meeting (statewide gathering of forestry professionals) and the Sustainable Forests Education Cooperative's annual Research Review. In person presentation allows for direct contact with practicing professionals and the ability to answer questions efficiently and effectively. First year data is better suited for non-peer reviewed journals and magazines such as Conservation Volunteer, Tree Planters Notes, the Great Lakes Silviculture Library (online only) or an Extension publication like My Minnesota Woods. Even though second year survival and growth data would be considered 'preliminary' for a long-lived species it will be sufficient for peer reviewed publication. Target journals would be Forest Ecology and Management, Forests, Ecological Restoration or Journal of Sustainable Forestry. These choices of conferences, in person meetings and publication choices are designed to reach those natural resource managers that are most likely interested in planting eastern hemlock and either read or attend professional or semi-professional meetings. For all communications (print, presentation, media, etc) the Environment and Natural Resources Trust Fund will be acknowledged through use of the trust fund logo or attribution language per the ENTRF Acknowledgment Guidelines. Specifically for print publications recognition of Environment and Natural Resources Trust Fund funding will be provided as an acknowledgement (typically in an acknowledgement section). For in person or electronic presentations acknowledgement will be made verbally and with the assistance of the ENTRF logo, while media interviews would receive a verbal recognition.

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?
Ultimately the results of this project will be implemented by other land managers and researchers who will use this information to successfully plant eastern hemlock. To get this information into the hands of practitioners we will make presentations at annual meetings of professional organizations in the state (Society of American Foresters, Wildlife Society), offerings through the Sustainable Forests Education Cooperative, on site tours and written summaries in scientific journals and Extension publications and non-scientific outlets such as MyMinnesotaWoods.com. Monitoring and reporting beyond this period can be handled through undergraduate internships and research opportunities provided through the University of Minnesota.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Graduate Student - TBD		Involved in all aspects of Activites 1, 2 and 3			11%	1.25		$114,469
Andrew David		Project manager, co-advise graduate student, assistance with surveys, experimental design, plantation establishment, knowledge of seed sources			36.5%	0.07		$12,464
Undergraduate student - TBD		Assist with data collection, data entry, vegetation management, fix fencing as needed			0%	0.5		$15,600
Marcella Windmuller-Campione		Co-advise graduate student, assistance with site selection, experimental design, knowledge of silvicultural methods			36%	0.1		$25,638
							Sub Total	**$168,171**
Contracts and Services								
Forestry contractor for site preparation - TBD	Professional or Technical Service Contract	Company(ies) to provide site preparation (removal of grass, brush, trees) as required by site conditions to make site plantable. Contractor at each site to be determined independently. Total cost of site preparation at all four sites not to exceed $4000				0.2		$4,000
							Sub Total	**$4,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	56 rolls of 60 inch x 5 ft fencing	Main fencing to deter deer					$3,080
	Tools and Supplies	112 rolls of 36 inch x 25 foot poultry fencing	Secondary fence to keep small mammals out of trial					$1,680
	Tools and Supplies	20 treated wooden posts 10 foot long	Create corners of fence and 1 extra for gate					$326
	Tools and Supplies	168 metal fence posts 7 foot long	Primary support for fencing, spaced approximately every 15 feet					$1,008
	Tools and Supplies	2 spools of high tensile wire 14 gauge 1/4 mile long	Provides rigidity to top of fence					$60

	Tools and Supplies	20 bags of poultry fencing clips	Attaches fencing and poultry fencing to metal fence posts					$100
	Tools and Supplies	2 clip bender tools	Specialized tool that attaches poultry fencing clips faster than pliers					$40
	Tools and Supplies	4 different sources of 500 eastern hemlock seedlings (minimum size order)	Required as seedlings for the experiment					$1,200
	Tools and Supplies	60 timbers 8 foot x 6 inches x 6 inches aspen or pine	Will be cut into 2 foot sections to make 'nurse blocks'					$1,440
	Tools and Supplies	48 rods of 10 foot long #3 rebar	Need two pieces of rebar one foot long each to hold 'nurse blocks' in place					$240
	Tools and Supplies	Blades for cutting wood and rebar	Will require replacement blades for table saw and sawzall					$50
	Tools and Supplies	Misc supplies, pin flags, markers, tape measure, spray paint	Supplies for laying out seedling planting spots and corners of fencing					$500
							Sub Total	**$9,724**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	6 people, 4 sites, 8 days, 2 vehicles, 540 miles round trip travel St Paul to Carlton County to Cloquet area to Ely to Grand Rapids and back to St Paul.	Planting seedlings, installing 'nurse blocks', install fencing at 4 sites.					$7,853
	Miles/ Meals/ Lodging	2 people, 4 sites, 4 days, 1 vehicle, 540 miles round trip St Paul, Carlton, Cloquet, Ely, Grand Rapids and back to St Paul. 5 trips over 2 summers..	Measure survival and growth and condition of seedlings, manage vegetation and fix fencing as needed.					$7,552
	Conference Registration Miles/ Meals/ Lodging	1 person to present at two conferences, 2 days per conference, registration and mileage estimated	Present project and findings at two professional conferences of natural resource professionals	X				$1,700
							Sub Total	**$17,105**
Travel Outside Minnesota								

							Sub Total	**-**
Printing and Publication								
							Sub Total	**-**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$199,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Travel In Minnesota	Conference Registration Miles/Meals/Lodging	1 person to present at two conferences, 2 days per conference, registration and mileage estimated	I am requesting an explicit approval for in state conference attendance including: travel, lodging, per diem and conference registration for 1 person AND ONLY if it relates to a formal presentation of project findings, i.e. the person and the title of the presentation are part of an official agenda. I am making this request based on the wording above under "Generally ineligible expenses unless explicitly approved:" specifically the description, "... except if to participate in formal presentation of project findings."

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount
State				
In-Kind	University of Minnesota North Central Research and Outreach Center University of Minnesota Hubachek Wilderness Research Center	Long-term usage of land for eastern hemlock project - one site replication at each location.	Secured	$5,000
			State Sub Total	**$5,000**
Non-State				
In-Kind	Carlton County Land Department	In kind contribution of land for experimental site in Carlton County, time spent identifying parcel from land base, field checking and assistance with planting seedlings. Reimbursement waived via email.	Secured	$5,000
In-Kind	Fond du Lac Forestry	In kind contribution of land for experimental site in Carlton County, time spent identifying parcel from land base, field checking and assistance with planting seedlings. Reimbursement waived via email.	Secured	$5,000
In-Kind	University of Minnesota	Indirect costs waived by University of Minnesota;	Secured	$109,450
			Non State Sub Total	**$119,450**
			Funds Total	**$124,450**

Attachments

Required Attachments

Visual Component

File: 3d055076-813.docx

Alternate Text for Visual Component

Title: Restoration of eastern hemlock; Minnesota's endangered tree species. LCCMR 2022-193. Silhouette of Minnesota with the three major terrestrial biomes, tallgrass aspen parkland / prairie grasslands (west), eastern deciduous forest (central and southeast) and eastern coniferous forest (northeast and north central), four planting locations, seedling and nurseblock to protect from sun....

Optional Attachments

Support Letter or Other

Title	File
UMN approval to submit	01495f39-ad2.pdf
David_2022-193_Restoration of eastern hemlock Minnesotas endangered species	583a7cad-791.pdf
Background check certification form	b7540d50-198.pdf
University of Minnesota waived indirect costs / overhead (see Line #19)	43425ca6-01d.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

After peer review the proposal required no changes. After legislative consideration the proposal was fully funded (whew!)

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

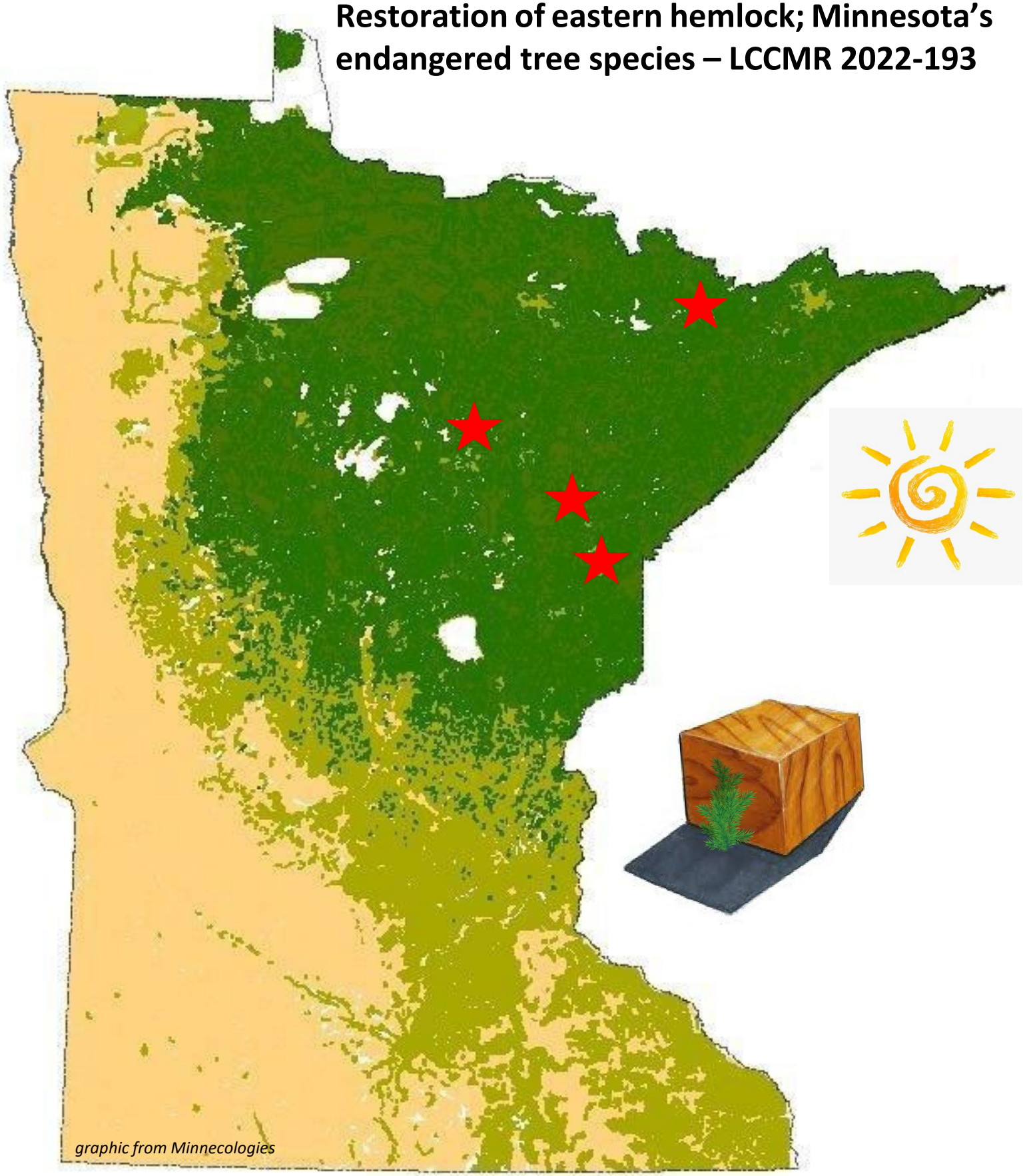
Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Restoration of eastern hemlock; Minnesota's endangered tree species – LCCMR 2022-193



graphic from Minnecologies

This project will provide planting recommendations for eastern hemlock (*Tsuga canadensis*) in Minnesota. Data for these recommendations will come from 4 seedlings trials near Carlton, Cloquet, Grand Rapids and Ely and test a 'nurse block' method that provides young, vulnerable seedlings a cooler, moister setting.