Environment and Natural Resources Trust Fund

M.L. 2025 Approved Work Plan

General Information

ID Number: 2025-283

Staff Lead: Tom Dietrich

Date this document submitted to LCCMR: June 9, 2025

Project Title: Tree Protection for Minnesota's Tamarack Against Larch Beetle

Project Budget: $321,000

Project Manager Information

Name: Brian Aukema

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

Office Telephone: (612) 624-1847

Email: brianaukema@umn.edu

Web Address: https://cfans.umn.edu/

Project Reporting

Date Work Plan Approved by LCCMR: June 24, 2025

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

Project Completion: June 30, 2028

Final Report Due Date: August 14, 2028

Legal Information

Legal Citation: M.L. 2025, First Special Session, Chp. 1, Art. 2, Sec. 2, Subd. 08q

Appropriation Language: $321,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to evaluate new insect management techniques and key factors for predicting future infestations to protect and preserve trees from native eastern larch beetle infestations.

Appropriation End Date: June 30, 2028

Narrative

Project Summary: Eastern larch beetle, native to Minnesota, has decimated one million acres of Minnesota's tamarack forests since 2001. This proposal evaluates new insect management techniques to protect and preserve trees.

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

Tamarack (Larix laricina) is the fifth most abundant tree in Minnesota. Tamarack forests serve as habitat to several birds and mammals, including several on the DNR's list of Greatest Conservation Need, and provide critical ecosystem services such as water filtration. A key component of Minnesota's northern wetland ecosystems, tamarack's importance is increasing with the impending loss of black ash to emerald ash borer.

Eastern larch beetle is a native insect that has devastated over 75% of Minnesota's 1.26 million acres of tamarack forests since 2001. This insect is closely related to mountain pine beetle. Historically, outbreaks across North America have always subsided within three or four years. Minnesota's ongoing 20 year outbreak is related to longer growing seasons that now permit multiple generations of beetles each summer.

When larch beetles colonize and kill trees, they chew through the bark and turn the tree's defensive resin into volatiles that attract more beetles. LCCMR Project 2020-047, in concert with state and federal specialists, facilitated the identification of the exact volatiles that the beetles are producing. These discoveries now allow us to move to tree protection strategies now used against similar tree pests: focusing on manipulating their communication, rather than insecticides.

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 have discovered in Project 2020-047 that the beetles produce several compounds that vary depending on stage of tree colonization. Some compounds appear to have dual roles: low concentrations might bring beetles into an area, but high concentrations are likely repellant. This makes sense; after all, once a tree is colonized, beetles want to repel additional attackers so there will be more food for their offspring. For other species of bark beetles, such repellant compounds have been deployed operationally for tree protection. These methods are advantageous because they are not toxic to animals or the environment.

We are seeking funding to:

Activity 1: Conduct field testing of some of the beetle-produced compounds identified in project 2020-047 for tree protection. One in particular, known as MCH, has been tried against bark beetles in other regions but never here in Minnesota.

Activity 2: Determine the growing season lengths and temperatures that predict future problems from eastern larch beetle. This Activity builds on success from project 2020-047 where we determined how fast these beetles develop at different temperatures and how they survive our winters.

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 US Forest Service publishes FIDL (Forest Insect and Disease Leaflet) guides for various insect challenges nationally. Currently, in the eastern larch beetle guide, there is no section on management. This project stives to offer a preservation option for small groups of trees such as those belonging to our northern property owners, seed orchards, those left after harvest, and more. Moreover, determining the overall trajectory of the outbreak moving forward will help foresters, resource managers, and agencies better understand management, mitigation, and restoration options for tamarack on Minnesota's landscape.

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): NE, NW, Central,

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Test compounds for repellency against eastern larch beetle

Activity Budget: $216,400

Activity Description:
In project 2020-047, we successfully identified several compounds that beetles produce when tunneling into trees and are able to detect with their antennae. This identification and detection work was made possible by the ability to work with global specialist Dr. Brian Sullivan of the US Forest Service in Louisiana. Some compounds we previously suspected based on knowledge of related species' behaviors, while others were quite surprising.

We found compounds that change in concentration after mating and may have differing attractive or repellent properties based on how many beetles are in an area. Larch beetles must attract a sufficient number of beetles to overwhelm and colonize trees, for example, but not too many that trees overfill so there is less food for their offspring. We propose to continue working with Dr. Sullivan to determine relevant concentrations and field test such compounds. One compound of interest that could be used for tree protection in particular is known from other species of bark beetles but has never been tested here in Minnesota.

Activity Milestones:

Description	Approximate Completion Date
Determination of proper concentrations to test based on individual beetle productions	June 30, 2027
Field tests of repellency for tree protection	June 30, 2028

Activity 2: Determine growing season lengths and temperatures that predict tamarack mortality from eastern larch beetle

Activity Budget: $104,600

Activity Description:
In project 2020-047, we have been working on determining how fast eastern larch beetles develop at different temperatures in the lab. We are finding that not all insects require a cold period (i.e., winter) to become physiologically mature before reproducing in the spring. Leveraged investments have facilitated field data collection on weekly patterns of attack in the northern part of the state, where we unexpectedly found this past summer evidence of three waves of attack of eastern larch beetle. The third wave of attacks occurred well into the warm fall. We were quite surprised as the beetles should have been preparing to overwinter, not reproduce. Only one spring emergence and attack period has been the historic norm.

In this activity, we will integrate existing lab data on insect development and physiology with tree mortality and climate data to determine seasonal conditions under which tamarack will be under the greatest threat from this insect in the future. As 2020-047 finishes in June 2025, we will be able to make predictions about population dynamics and tamarack's fate (i.e., will insects survive when they make surprise attacks as above? How many periods of attack might there be in the future?)

Activity Milestones:

Description	Approximate Completion Date
Determination of seasonal conditions that permit more than one generation per year	June 30, 2027
Predict outcomes in seasons where additional partial generations may occur	June 30, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. Brian Sullivan	US Forest Service	Specialist who will help select appropriate beetle-produced compounds for testing in tree protection. Dr. Sullivan is a global leader in this area and we are fortunate to have him involved; see letter of support.	No
MN Forest Health Team	Minnesota Department of Natural Resources	Our DNR colleagues are important partners who curate data on the state of the outbreak in their annual Forest Health Reports and help select field sites for our work. Please see attached letter of support.	No
Dr. Marcella Windmuller-Campione	University of Minnesota	Marcella played an important role in mentoring graduate students on project 2020-047, including co-advising Masters student Grace Graham. Lending silvicultural expertise, Marcella coauthored a book chapter with Brian reviewing eastern larch beetle and Minnesota's tamarack. Marcella is serving on the advisory committee of Masters student Ian Grossenbacher-McGlamery on this project.	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.
We will share results at workshops, field days, and conferences as opportunities arise. Based on past research in our lab, example venues might be the annual Northern Silviculture Workshop in Grand Rapids, the North Central Forest Pest Workshop, the winter Cloquet Forestry Research Review, the Western Forest Insect Work Conference, university seminars, Entomological Society of America, IUFRO, or others. This work will form the basis of a graduate thesis at the University of Minnesota, and we anticipate peer-reviewed publications for the scientific literature as well by or shortly after project completion. We will gratefully acknowledge the support of the ENRTF in all dissemination efforts.

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?
Work started in 2012 with a University early career grant to Dr. Aukema ($142K; 2011-2013) and a US Forest Service EM grant ($176K; 2011-2016) that determined there was more than one generation of larch beetle each summer. LCCMR project 2020-047 (finishing summer 2025) and a $50K USDA MacIntire-Stennis grant (2018-2023) allowed us to examine insect development at different temperatures, identify pheromones, and natural enemies that respond to them. Three leveraged graduate fellowships ($40K each) facilitated extra work on tree defenses. This project – and the potential to leverage additional US Forest Service funds – now integrates these components to tree protection strategies.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Native Eastern Larch Beetle Decimating Minnesota's Tamarack Forests	M.L. 2021, First Special Session, Chp. 6, Art. 5, Sec. 2, Subd. 08f	$398,000
Protecting Minnesota's Spruce-Fir Forests from Tree-Killing Budworm	M.L. 2022, , Chp. 94, Art. , Sec. 2, Subd. 03i	$189,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Graduate student		Work on tree protection and forecasting activities as part of their full-time training (3 yrs)			25.1%	1.5		$175,752
Summer students		Two summer students full time each of two summers, one in remaining summer to help deploy traps, sort and identify insects, measure tree colonizations			8%	0.9		$47,284
Faculty lead		Partial summer support to work with the students on tree protection schemes, forecasting, and overall project direction			37.1%	0.3		$64,052
							Sub Total	**$287,088**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
	Tools and Supplies	Supplies for field work: scintillation vials ($300/case), paracord, no-pest strips, compounds for field testing. Most supplies will not be more than $1,000/year, but the compounds to test for beetle repellency vary in price depending on source, quantity, and purity (e.g, if they need to be synthesized). Budgeting $2250/year for years one and two and $155 in final year.	Vials are for sample storage, no-pest strips allow sample preservation, paracord is used to hang and/or repair Lindgren funnel traps (traps are $100 each; have sufficient supply and can often repair rather than purchase new); compounds to test will be those identified from beetle aerations in project 2020-047 completing June 2025.					$6,655
	Equipment	Computer	Data recording and analysis	X				$1,400
							Sub Total	**$8,055**
Capital Expenditures								
							Sub Total	**-**

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	First two years: 12 work trips of 600 miles $4860 total, 10 nights hotel two people $1500 anticipating some cost savings staying at UMN Research/Outreach Centers); final year mileage, hotels reduced to $1620, and $500 respectively. Estimates assume use of lab truck but we may need to rent UMN Fleet vehicle from time to time. All distances will depend on where we do the work (insects move...) but are best estimates depending on work in northern MN over the past decade on this insect.	Field work for tree protection experiments					$14,840
	Conference Registration Miles/ Meals/ Lodging	Two workshops for PI and graduate student in Minnesota each of three years (e.g., Northern Silviculture Workshop, Cloquet Research Review, North Central Forest Pest Workshop, etc.). Estimated $500/yr; various locations around state, usually requires rental car and sometimes overnight stay.	Share results with resource managers and landowners; stay current on forest conditions					$1,500
							Sub Total	**$16,340**
Travel Outside Minnesota								
	Other	One trip to Pineville, LA to work with specialist Dr. Brian Sullivan as in LCCMR project 2020-047 to finalize compounds for field testing. Student will stay one month, project lead 5 days. Student costs est. $2250 vehicle plus 2500 miles mileage, $3k lodging (working with USFS on less expensive option at nearby VA), $1K food (reduced if lodging option has kitchenette available). Project lead costs $600 flights, $350 hotel, $267 per diems for 5 day trip.	Finalize compounds for field testing and identify best rates to deploy operationally.	X				$7,467
	Conference Registration Miles/ Meals/ Lodging	One conference out of state during project, estimated $1750 as $500 travel, $800 hotel, $250 per diem, $200 registration. Costs for sending students to workshops are sometimes offset by travel awards.	Share results with local managers and/or get advice from national colleagues in tree protection using anti-aggregation pheromones	X				$1,750

							Sub Total	**$9,217**
Printing and Publication								
	Printing	Poster printing ($100/year x 3 years)	Printing charges for posters for workshops or conferences where we do not present work orally					$300
							Sub Total	**$300**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$321,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Equipment, Tools, and Supplies		Computer	Replace aging machine used for previous LCCMR work.
Travel Outside Minnesota	Other	One trip to Pineville, LA to work with specialist Dr. Brian Sullivan as in LCCMR project 2020-047 to finalize compounds for field testing. Student will stay one month, project lead 5 days. Student costs est. $2250 vehicle plus 2500 miles mileage, $3k lodging (working with USFS on less expensive option at nearby VA), $1K food (reduced if lodging option has kitchenette available). Project lead costs $600 flights, $350 hotel, $267 per diems for 5 day trip.	Dr. Sullivan is the global expert in this area and we are very fortunate for his offer to help with this work, even though he is outside of Minnesota. Please see letter of support.
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	One conference out of state during project, estimated $1750 as $500 travel, $800 hotel, $250 per diem, $200 registration. Costs for sending students to workshops are sometimes offset by travel awards.	Eastern larch beetle is distributed in tamarack forests from Maine to Alaska, so we appreciate learning from experts wrestling with similar challenges and in related species. Hence we are asking for permission for an out of state conference (e.g., Western Forest Insect Work Conference, Ent Soc America, Bark Beetle Tech Working Group). Permission was similarly approved for previous ELB project and improved the science that we can advance to management.

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount
State				
			State Sub Total	**-**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**-**

Total Project Cost: $321,000

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: f12652f2-ee2.pdf

Alternate Text for Visual Component

Aerial photo of vast expanse of dead tamarack in northern Minnesota, along with inset photos of close up eastern larch beetle and tree damages....

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
Authorization letter from University of Minnesota	29d57155-3fb.pdf
Letter of support from Minnesota DNR	7f24ac67-ed9.pdf
Letter of support from Dr. Brian Sullivan (collaborator)	7a958172-f18.pdf
2025-283 Research Addendum revised_Final	58be4231-ade.docx

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

1. Revised budget (trimmed $13K) to align with recommended appropriation.
2. In response to feedback from Tom Dietrich, adjusted conference travel to reflect one out-of-state conference or workshop.
3. Formally added collaborator Dr. Marcella Windmuller-Campione, as we continue to work closely together on eastern larch beetle and tamarack.

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 understand that travel expenses are only approved if they 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 understand the UMN Policy on travel applies.

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

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?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing $10,000 or more or large-scale stream or wetland restoration?

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 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No

Provide the name(s) and organization(s) of additional individuals assisting in the completion of this project:

Sponsored Project Administration, University of Minnesota

Do you understand that a named service contract does not constitute a funder-designated subrecipient or approval of a sole-source contract? In other words, a service contract entity is only approved if it has been selected according to the contracting rules identified in state law and policy for organizations that receive ENRTF funds through direct appropriations, or in the DNR's reimbursement manual for non-state organizations. These rules may include competitive bidding and prevailing wage requirements

N/A