



Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-283

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

Project Manager Information

Name: Brian Aukema

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

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Project Basic Information

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.

ENRTF Funds Requested: \$334,000

Proposed Project Completion: June 30, 2028

LCCMR Funding Category: Methods to Protect or Restore Land, Water, and Habitat (F)

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

Narrative

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 repellent. 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 repellent 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 strives 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.

Activities and Milestones

Activity 1: Test compounds for repellency against eastern larch beetle

Activity Budget: \$229,400

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

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

Project Manager and Organization Qualifications

Project Manager Name: Brian Aukema

Job Title: Professor of Forest Insect Ecology

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

Dr. Brian Aukema directs the Forest Insect Laboratory in the Department of Entomology at the University of Minnesota. Prof. Aukema and his students work on both native and invasive species threatening the state of Minnesota and region (e.g., mountain pine beetle on pines, emerald ash borer on ash, spongy moth on oak and aspen, eastern larch beetle on tamarack, and more). Students he has taught can be found in a wide variety of resource professional positions, from city arborists to industry, NGOs, and state and federal government positions.

Prof. Aukema joined the Department of Entomology as their Forest Insect specialist in the fall of 2010. Prior to this, he was a research scientist for five years with the government of Canada and was responsible for a program managing large-area insect outbreaks. Prof. Aukema has successfully administered more than \$3 million in research project funding from a wide variety of state, federal and industrial sources in his career. He has received early career awards for Creativity and Innovation (Government of Canada) and a McKnight Land-Grant award from the University of Minnesota.

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

Organization Description:

The University of Minnesota-Twin Cities, founded in 1851, is the largest campus within the University of Minnesota system with an enrolment of just over 50,000 students. As a historic land-grant university, the University of Minnesota's mission is to engage students and faculty to address Minnesota's most pressing issues.

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 and quantity (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.					\$4,655
	Equipment	Computer	Data recording and analysis	X				\$1,400
							Sub Total	\$6,055
Capital Expenditures								
							Sub Total	-

Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	First two years: UMN Fleet truck rental (\$5K/summer, 12 work trips of 600 miles \$4860 total, 10 nights hotel two people \$2500); final year rental, mileage, hotels reduced to \$1250, \$1620, and \$250 respectively. The 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					\$27,840
							Sub Total	\$27,840
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	Placing this "outside MN," but will share results *within state* as well (e.g. Northern Silviculture Workshop, Cloquet Forestry and Wildlife Review, North Central Forest Pest Workshop, etc.). Venues to be determined on a case by case basis for reach and impact. The budget figure estimates three conferences at \$1750/year as \$500 travel, \$800 hotel, \$250 per diem, \$200 registration. Costs for sending students to workshops are sometimes offset by travel awards, and local in-state workshops are much less.	Share results with local managers and/or get advice from national colleagues in tree protection using anti-aggregation pheromones	X				\$5,250
							Sub Total	\$12,717

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	\$334,000

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 again 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	Placing this "outside MN," but will share results *within state* as well (e.g. Northern Silviculture Workshop, Cloquet Forestry and Wildlife Review, North Central Forest Pest Workshop, etc.). Venues to be determined on a case by case basis for reach and impact. The budget figure estimates three conferences at \$1750/year as \$500 travel, \$800 hotel, \$250 per diem, \$200 registration. Costs for sending students to workshops are sometimes offset by travel awards, and local in-state workshops are much less.	Eastern larch beetle is distributed in tamarack forests from Maine to Alaska, so we appreciate learning from other colleagues wrestling with similar challenges

Non ENRTF Funds

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

Total Project Cost: \$334,000

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

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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 proposal:

Sponsored Project Administration, University of Minnesota