



## Environment and Natural Resources Trust Fund

### 2021 Request for Proposal

#### General Information

**Proposal ID:** 2021-461

**Proposal Title:** Eastern Larch Beetle is Devastating Minnesota Tamarack Forests

#### 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

#### Project Basic Information

**Project Summary:** Eastern larch beetle, native to Minnesota, is suddenly decimating Minnesota's tamarack forests. This proposal develops insect management techniques and determines how bad this problem may remain in the future.

**Funds Requested:** \$398,000

**Proposed Project Completion:** 2025-06-30

**LCCMR Funding Category:** Methods to Protect, Restore, and Enhance 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): Central, NW, NE,

**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.**

PLEASE NOTE: This 2020 proposal was recommended for funding at \$398K. Per staff advice, this project is resubmitted at same amount pending outcome of the summer 2020 legislative session.

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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 has killed trees over 40% of Minnesota's 1.26 million acres of tamarack forests since 2001. This insect is closely related to mountain pine beetle, and has been studied for more than 100 years. Outbreaks occasionally flare after other insects weaken the trees by eating their needles. In tamarack forests across North America over the past century, outbreaks have always subsided within three or four years. Hence, Minnesota's ongoing outbreak of 18 years and counting – spreading across almost half of the state's remaining tamarack – is highly unusual behavior for this insect.

**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.**

From 2012-2016, collaborative non-LCCMR research (UMN, DNR, US Forest Service) determined that extended growing seasons are responsible for this unprecedented outbreak. Previous research elsewhere in North America had shown that larch beetles can only reproduce once per year, because they putatively required a cold period (i.e., winter) before they become physiologically mature and reproduce in the spring. We discovered and published evidence that a proportion of insects in Minnesota can reproduce without a required cold phase (!). As such, we believe that the outbreak in Minnesota is occurring because a proportion of insects can develop a second generation each summer/fall as a consequence of slowly expanding growing seasons.

Because the insect has rarely been a problem historically, there is a paucity of management information for eastern larch beetle. In Minnesota, it remains critical to develop a better understanding of the insect for management plans (sampling, natural enemies, etc).

Activity 1: Characterize natural enemy complex, including what lures work best to attract them (e.g., foundational knowledge for biological control)

Activity 2: Determine what proportion of the insects can reproduce without overwintering and what cues affect those levels.

**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?**

Delineating the scope of the challenge will help understand management options and prioritize restoration efforts for tamarack on the landscape. For example, the US Forest Service publishes FIDL (Forest Insect and Disease Leaflet) guides for various insect challenges nationally. Currently, in the eastern larch beetle FIDL handbook, there is no section on management other than a note that management has not been required historically. This project will give us options to present to foresters and other natural resource managers throughout the upper Midwest.

## Activities and Milestones

### Activity 1: Characterize the natural enemies and lures to attract them

**Activity Budget:** \$195,300

**Activity Description:**

Bark beetles release airborne chemicals known as pheromones when they attack a tree in order to attract mates. The pheromone for eastern larch beetle has been discovered and is commercially available, but it is based on populations in western North America (think: different accent). The lure works well, but we hypothesize that further refinements will boost attraction (helpful for trapping pests) and/or selectively attract insects that feed on eastern larch beetle, such as checkered beetles and hisster beetles. Preliminary surveys have shown that a variety of natural enemies are attracted to eastern larch beetle pheromones and could be useful in biological control, but a full survey has never been conducted.

**Activity Milestones:**

Description	Completion Date
Determination of optimal lure choice for trapping pest or augmenting natural enemies	2025-06-30
List of predators and competitors associated with eastern larch beetle	2025-06-30

### Activity 2: Find the temperature threshold that governs generational development

**Activity Budget:** \$202,700

**Activity Description:**

We now know that warm and/or elongated summers can result in two generations of eastern larch beetle in Minnesota instead of one. This activity will test development of the insect in the laboratory at a range of different temperatures to determine what life stage is receiving the developmental “stop sign” before winter, and elucidate whether the proportion of insects responsible for two generations each year instead of one changes through time. Once determined, we will be able to forecast the seasonal conditions under which tamarack will be under the greatest threat from this insect in the future.

**Activity Milestones:**

Description	Completion Date
Determination of diapause conditions and life stage	2024-06-30
Determination of seasonal conditions that may trigger or maintain outbreaks	2025-06-30

## Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Forest Health Team	MN Department of Natural Resources	Field and logistical 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 be funded?**

Past non-LCCMR research on eastern larch beetle was supported by a UMN McKnight Professorship award to Dr. Aukema (\$142K; 2011-2013) and a US Forest Service Evaluation Monitoring grant (\$176K; 2011-2016). Dr. Aukema is currently conducting complementary, ongoing work on tamarack in Minnesota on the failure of biological control in the resurgence of an invasive needle-feeding moth, larch casebearer (US Forest Service \$101K; 2016-2020), and has secured an additional \$50K from USDA McIntire Stennis (2018-2023) to complement these two projects.

## Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Mountain Pine Beetle Invasive Threat to Minnesota's Pines	M.L. 2014, Chp. 226, Sec. 2, Subd. 04e1	\$175,000
MITPPC #2: Mountain Pine Beetle, Phase II: Protecting Minnesota	M.L. 2015, Chp. 76, Sec. 2, Subd. 06a	-
MITPPC #5: Optimizing Tree Injections Against Emerald Ash Borer	M.L. 2015, Chp. 76, Sec. 2, Subd. 06a	-
MITPPC #9: Dispersal Characteristics of Gypsy Moth Larvae to Improve the Effectiveness of Quarantines	M.L. 2015, Chp. 76, Sec. 2, Subd. 06a	-
Biosurveillance and Biocontrol of Emerald Ash Borer - Phase 2	M.L. 2014, Chp. 226, Sec. 2, Subd. 04d	\$447,000
Emerald Ash Borer Biocontrol - Phase III	M.L. 2017, Chp. 96, Sec. 2, Subd. 06b	\$729,000

## Project Manager and Organization Qualifications

**Project Manager Name:** Brian Aukema

**Job Title:** Professor

**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, gypsy moth on oak and aspen, eastern larch beetle and larch casebearer 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 \$2 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
<b>Personnel</b>								
Graduate student		Conduct research work in Activities 1 and 2			17%	2		\$181,680
Faculty summer support		Advise and mentor research conducted by graduate student			33.7%	0.6		\$51,615
Undergraduate		Undergraduate student worker during summers			0%	1		\$37,485
Temporary student worker (recent university grad)		Summer research help			8%	0.75		\$29,910
							<b>Sub Total</b>	<b>\$300,690</b>
<b>Contracts and Services</b>								
							<b>Sub Total</b>	<b>-</b>
<b>Equipment, Tools, and Supplies</b>								
	Tools and Supplies	\$1,905 each of four years for research supplies such as funnel trap repair, pheromone lures for baiting traps, twine, and miscellaneous gear, plus one \$1300 desktop computer.	Lindgren funnel traps specialized to catch larch beetles, pheromones attract them to traps, twine is used for period repairs (vs. buying new trap at \$80 each) and hanging traps	X				\$8,920
							<b>Sub Total</b>	<b>\$8,920</b>
<b>Capital Expenditures</b>								
		Insect rearing chambers	Hold insects at constant temperatures for proposed research work	X				\$25,000
							<b>Sub Total</b>	<b>\$25,000</b>

<b>Acquisitions and Stewardship</b>								
							<b>Sub Total</b>	-
<b>Travel In Minnesota</b>								
	Miles/ Meals/ Lodging	6 months x fleet truck rental \$850, 1000 miles at 40c/mile x 20 trips, 4 hotel nights x 2 ppl @100 each x 6 months = \$17900 each of 3 years and \$4490 in final	Trips for sampling eastern larch beetle and natural enemy complex, testing pheromone responses. Travel estimates derived from previous projects on larch beetle in northern Minnesota.					\$58,190
							<b>Sub Total</b>	\$58,190
<b>Travel Outside Minnesota</b>								
	Conference Registration Miles/ Meals/ Lodging	Estimate for four day conference (1/yr): \$400 travel, \$500 hotel, \$200 food, \$100 registration (student rate)	Annual conference or workshop(s) to disseminate project results	X				\$4,800
							<b>Sub Total</b>	\$4,800
<b>Printing and Publication</b>								
	Printing	Printing of research posters (4), fact sheets (200). Approx. \$100/year	Research posters for conferences, fact sheets or informational handouts for extension gatherings					\$400
							<b>Sub Total</b>	\$400
<b>Other Expenses</b>								
							<b>Sub Total</b>	-
							<b>Grand Total</b>	\$398,000

## Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
<b>Equipment, Tools, and Supplies</b>		\$1,905 each of four years for research supplies such as funnel trap repair, pheromone lures for baiting traps, twine, and miscellaneous gear, plus one \$1300 desktop computer.	Requesting permission for a desktop computer \$1300 for graduate student to store data, conduct analyses, and write results over life of project
<b>Capital Expenditures</b>		Insect rearing chambers	<p>Requesting permission for two rearing chambers for lab assays in Activity 2. We currently have 5 old chambers; one wore out on previous LCCMR work (rearing biological control agents for EAB) and has been repaired without success and the other similarly needs replacement soon. Replacement chambers will last beyond life of project, but will continue to be used for forest insect work of benefit to the state (such as EAB).</p> <p><b>Additional Explanation :</b> Requesting permission for two rearing chambers for lab assays in Activity 2. We currently have 5 old chambers; one wore out on previous LCCMR work (rearing biological control agents for EAB) and has been repaired without success and the other similarly needs replacement soon. Replacement chambers will last beyond life of project, but will continue to be used for forest insect work of benefit to the state (such as EAB).</p>
<b>Travel Outside Minnesota</b>	Conference Registration Miles/Meals/Lodging	Estimate for four day conference (1/yr): \$400 travel, \$500 hotel, \$200 food, \$100 registration (student rate)	Special request of \$1200/year to share results/ receive advice at forest insect conference, which may be out of state (most experts are in other places with tamarack such as western North America and Canada).



## Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
<b>State</b>				
			<b>State Sub Total</b>	-
<b>Non-State</b>				
In-Kind	US Forest Service MacIntire Stennis MN17-095 "Challenges to tamarack from native and invasive insects in Minnesota"	Augmenting travel funding, publication costs, vehicle repairs	Secured	\$50,000
			<b>Non State Sub Total</b>	<b>\$50,000</b>
			<b>Funds Total</b>	<b>\$50,000</b>

## Attachments

### Required Attachments

#### *Visual Component*

File: [26bb7af9-f44.pdf](#)

#### *Alternate Text for Visual Component*

Picture of tamarack forest and eastern larch beetle

### Optional Attachments

#### *Support Letter or Other*

Title	File
LCCMR 2019 Letters of support re-loaded (DNR, SFEC)	<a href="#">6e15188b-788.pdf</a>

## Administrative Use

**Does your project include restoration or acquisition of land rights?**

No

**Does your project have patent, royalties, or revenue potential?**

No

**Does your project include research?**

Yes

**Does the organization have a fiscal agent for this project?**

Yes, Sponsored Projects Administration



# Project 219-F

# Eastern Larch

## A NATIVE BARK BEETLE

Please note: This 2020 project was recommended for funding at \$398K and is simply resubmitted pending outcome of current legislative session.



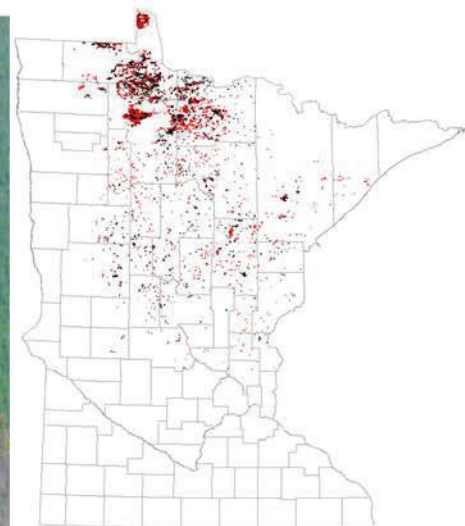
## Tamaracks in Trouble

Tamarack is the 5th most abundant tree in Minnesota (8% of forest land, or 1.4M acres). Eastern larch beetle has affected 535K acres (40% of resource) since an outbreak began in 2001

**Project Lead: Dr. Brian Aukema**  
(Forest Insect Lab, University of Minnesota)

**Activity 1: Characterize natural enemy complex**

**Activity 2: Determine what proportion of insects can reproduce without overwintering (i.e., future population trajectory)**



**Four years, \$398 K**

