

**Environment and Natural Resources Trust Fund
2016 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 126-D

Tamarack in Decline: The Resurgence of Larch Casebearer

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: \$ 344,900

Proposed Project Time Period for the Funding Requested: 3 years, July 2016 to June 2019

Summary:

Larch casebearer weakens tamarack and makes it susceptible to eastern larch beetle. This proposal examines the recent failure of biological control of larch casebearer.

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Sponsoring Organization: U of MN

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Location

Region: Central, NW, NE

County Name: Aitkin, Beltrami, Carlton, Cass, Clearwater, Cook, Crow Wing, Hubbard, Isanti, Itasca, Kanabec, Koochiching, Lake, Lake of the Woods, Mille Lacs, Morrison, Pine, Roseau, St. Louis, Wadena

City / Township:

Alternate Text for Visual:

Graphic of eastern larch beetle and larch casebearer

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity Readiness	_____ Leverage	_____ TOTAL	_____ %



I. PROJECT STATEMENT

SUMMARY: Tamarack is an abundant deciduous conifer important to lowland hydrology. Its importance is increasing with the impending loss of black ash to emerald ash borer. Unfortunately, **eastern larch beetle has killed 21% of the state’s mature tamarack since 2000**, and continues unabated. Moreover, **the remaining tamarack is being challenged by a small invasive moth, larch casebearer**, whose biology makes it hard to detect using standard aerial survey methods. Needle-feeding weakens the tree, making it susceptible to eastern larch beetle. Larch casebearer had been kept in check nationally by biological control since the 1960s, but **biocontrol is now failing for reasons unexplained.**

Background

Tamarack (*Larix laricina*) has long been an important component of Minnesota’s northwoods. At the time of European settlement, Public Land Surveys recorded 6M acres of tamarack forests, making it the most abundant forest cover type in the state. 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.

Since 2000, an outbreak of eastern larch beetle (a kissing cousin of mountain pine beetle) has been decimating Minnesota’s remaining mature tamarack. More than 1 in 5 trees has currently been killed. Eastern larch beetle is typically only active for 2-3 years at a time, so this activity is *well* outside of normal behavior for this insect. Collaborative non-LCCMR research (UMN, DNR, USFS) is discovering reasons behind its unusually sustained tree-killing behavior. One emerging problem is needle-feeding by larch casebearer that weakens these trees.

Larch casebearer was introduced from Europe to North America in 1886 on planting stock and spread across North America. Biological control agents were introduced in the 1960s and achieved immediate control. In fact, one parasite worked so well that no follow-up surveys were performed, because larch casebearer essentially disappeared... until now. In the past 10-15 years, casebearer has resurged on western larch in western North America. Now, it is outbreaking in Wisconsin and Minnesota. We seek LCCMR’s partnership to determine **why biological control of larch casebearer has suddenly failed.**

We have two goals:

1. Survey the extent of
 - a. increasing casebearer damage, as standard aerial survey techniques are underestimating damage
 - b. prevalence of associated natural enemies
2. Examine whether casebearer-natural enemy “decoupling” due to changing spring phenology (i.e., timing of needle flush) is behind the unexpected resurgence of this pest

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Evaluate the extent of increasing impacts of larch casebearer and survey for its natural enemies **Budget: \$154,400**

Each year the DNR publishes a report on state forest health conditions based on aerial survey data. Tamarack reflushes a set of needles after feeding by casebearer, albeit in a weakened state. Aerial surveys, often timed for other pests, underestimate damage when conducted after a reflush of needles. The US Forest Service has provided initial funding to study the aerial survey data, but ground work is needed.



In this activity, one graduate student with part-time summer undergraduate help will survey areas of putative casebearer activity, return the collected insects to the laboratory, and determine parasitism rates by rearing out biological control agents. No surveys for natural enemies of larch casebearer have ever been performed in Minnesota.

Outcome	Completion Date
<i>1. Identification of survey sites</i>	<i>12/31/2016</i>
<i>2. Field surveys of larch casebearer and associated natural enemies</i>	<i>06/30/2019</i>
<i>3. Better understanding of when to conduct aerial surveys for this insect in a given year</i>	<i>06/30/2019</i>

Activity 2: *Characterize how casebearers interact with natural enemies at different temperatures* **Budget: \$190,500**

One reason why biological control might be failing is increasing variation among seasonal events in the spring (e.g., early spring of 2012). Needles need to be flushed when casebearers emerge, and casebearers need to be at the correct life stage when natural enemies become active. Development of larch casebearer at various temperatures is not well-described beyond “adults occur in June to July.” One graduate student with part-time undergraduate help will examine how differing thermal regimes mimicking springtime temperatures impact growth and development using growth chambers mirroring various Minnesota spring weather scenarios.

Outcome	Completion Date
<i>1. Determine developmental rate of larch casebearer on tamarack needles at different temperatures</i>	<i>06/30/2018</i>
<i>2. Determine performance of natural enemies on casebearers under various thermal regimes (i.e., early spring, rapid spring, late spring, etc.)</i>	<i>06/30/2019</i>

III. PROJECT STRATEGY

A. Project Team/Partners

This project will be led by the University of Minnesota, with important collaborative help from the DNRs of Minnesota and Wisconsin (Forest Health Teams) and the USDA Forest Service.

Receiving funds: The University of Minnesota (Aukema lab) will receive funds. Federal funding to begin this work has been secured from the US Forest Service (\$29K for 2015) as we begin surveys for natural enemies for the first time since the 1960s.

Not receiving funds: The US Forest Service and state DNR’s will not receive funds. All institutions will provide in-kind equipment, facilities, intellectual input, and GIS/technical support.

B. Timeline Requirements

The project will run for three years from 7/1/2016 to 6/30/2018.

C. Long-Term Strategy and Future Funding Needs

This is a three-year project (July 2016-June 2019). LCCMR has not allocated any prior funds to larch casebearer because a) it has not been a problem in decades and b) it does not kill trees outright. The resurgence of its activity coupled with the continued onslaught by eastern larch prompts the urgency of examining this behavior. Western states have begun to fund studies to determine what happened to the biological control agents there (e.g., USFS Western Wildland Environmental Threat Assessment Center project FY10TS74). We anticipate with the funding already secured from the Forest Service for 2015, and LCCMR’s investment that would fund FY2016-2019, we can delineate the problem and determine a proper course of action within four years.

2016 Detailed Project Budget

Project Title: Tamarack in decline: the resurgence of larch casebearer

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel:	
Brian Aukema, project lead (1 month summer salary x 3 years, 34% benefits)	30,000
2 Graduate research assistants (one for Activity 1 survey, one for Activity 2 impacts; 83% salary, 17% benefits), 50% FTE for 2.2 years (July 2016 - August 2018) (86,000 each)	172,000
6 Undergraduate summer helpers (one for each graduate student x 3 summers to help with field	48,000
Professional/Technical/Service Contracts:	
Consulting: Mike and Jana Albers, responsible for much of the aerial survey data collection. Pending retirement from 41 yrs with DNR but still willing to advise on site selection given above expertise.	5,000
Equipment/Tools/Supplies:	
Growth chambers (4) for Activity 2, includes high-tech "Weathereze" control that directs chamber to follow real-time weather for any Minnesota location. Purchase partially necessitated by repeated breakdowns of old chambers used in rearing of biocontrol agents for emerald ash borer (LCCMR project 2011-2014).	80,000
Miscellaneous field supplies for collecting casebearers and rearing biological control agents (glass vials, netting, funnels, etc.)	1,700
Travel:	
Mileage (northern extent: Lake of the Woods), lodging, meals for travel between UMN and field	8,000
Additional Budget Items:	
Printing of posters to share student results at workshops/conferences	200
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 344,900

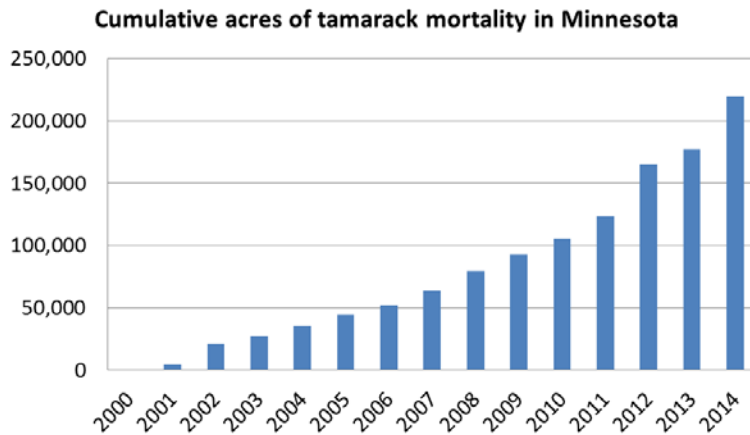
V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ To Be Applied To Project During Project Period: US Forest Service Evaluation Monitoring Program FY2015: to get start on Act. 1 before 2016	\$ 29,000	<i>secured</i>
US Forest Service Evaluation Monitoring Program FY2016-2017: Will apply for continued funds to inform Activity 1 site selection	\$ 58,000	<i>pending</i>
Other State \$ To Be Applied To Project During Project Period: UMN Rapid Agricultural Response Fund, FY 2015-2016: to study links between eastern larch beetle and larch casebearer	\$ 120,000	<i>pending</i>
In-kind Services To Be Applied To Project During Project Period: DNR is helping with transportation and site selection	\$ 20,000	<i>secured</i>
Funding History: US Forest Service, 2011-2014, "Factors affecting the continuing outbreak of eastern larch beetle on Minnesota's tamarack".	\$ 176,000	<i>spent</i>
Remaining \$ From Current ENRTF Appropriation: \$175,000 - ENRTF for ML 2014-07e "Mountain pine beetle: invasive threat to Minnesota's pines"	\$ 75,000	<i>obligated</i>
Remaining \$ From Current ENRTF Appropriation: \$360,000 - ENRTF for ML 2013-06c Part II "Improving emerald ash borer detection efficacy for control"	\$ 160,000	<i>obligated</i>

Tamarack in decline: The resurgence of larch casebearer



Since 2000, Minnesota has been suffering from a huge outbreak of eastern larch beetle. It has now killed 21% of the mature tamarack, and is not stopping.



This is very unusual, because eastern larch beetle is typically only active for 2-3 years at a time. One emerging problem is needle-feeding by larch casebearer that weakens the tree.

Larch casebearer is a small invasive moth. (Can you find all 32 in this photo?) Biological control agents introduced in the 1960s worked *great* until recently. We need to determine why biological control has stopped working.



Project Manager Qualifications and Organization Description

Project Manager: Dr. Brian Aukema will administer the project at the University of Minnesota, where he oversees the Forest Insect Laboratory. His students work on a variety of forest pest problems of both native and invasive species in the state of Minnesota and beyond (e.g., emerald ash borer on ash, gypsy moth on oak and aspen, mountain pine beetle on pine, thousand cankers disease on walnut, 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 federal government program administrators.

Prof. Aukema has successfully administered more than \$1.6 million in research project funding from a wide variety of state, province, 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 recognizing him as a promising early career faculty member. Recently, he received a Faculty Award for Mentorship in Entomology from the Department of Entomology's graduate students.

Organization: The University of Minnesota is the state's land-grant university with a teaching, outreach, and research emphasis.