

**Environment and Natural Resources Trust Fund  
2017 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 110-D**

Natural Products for Protecting Minnesota Natural Resources

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**Category:** D. Aquatic and Terrestrial Invasive Species

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**Total Project Budget:** \$ 247,000

**Proposed Project Time Period for the Funding Requested:** 2 years, July 2017 – June 2019

**Summary:**

We will develop, demonstrate, and disseminate methods to replace the use broad-spectrum pesticides that kill many insects by using natural products that eradicate only undesirable, invasive species insects.

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**Name:** Lawrence Wackett

**Sponsoring Organization:** U of MN

**Address:** 1479 Gortner Ave, 140 Gortner Lab  
St. Paul MN 55108

**Telephone Number:** (612) 625-3785

**Email** wacke003@umn.edu

**Web Address** \_\_\_\_\_

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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**Alternate Text for Visual:**

Visual illustrating the value of natural products for controlling invasive species insects

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



**PROJECT TITLE:** Natural Products for Protecting Minnesota Natural Resources

**I. PROJECT STATEMENT**

We will develop the use of natural chemicals to eradicate invasive insects with agents that do no harm to beneficial insects. Currently, most insecticides are broad-spectrum and kill favorable insects such as butterflies, bees, green lacewings, and ladybirds. The natural chemicals we will produce are specifically targeted toward deleterious, invasive insects. The invasive insects we will target are the emerald ash boarer, the gypsy moth, and insects that attack livestock. Just as pharmacists have long used natural plant extracts to treat specific diseases, we will extract specific natural products from good microorganisms to treat specific insect pests. Each insect requires specific natural products and this specificity is important as we can then avoid the use of broad-spectrum chemicals that kill beneficial insects. Significant past research by our group has demonstrated how the the different natural products can be produced using methods similar to food fermentations such as yogurt, wine, or beer. However, unlike the food processes, the natural, specific, insect-treating chemicals are extracted and used to protect trees and other natural resources. Currently, there are millions of dollars being spent to use blunt-action insecticides and brute force methods to deal with problem insects in the State of Minnesota. This project, if funded by the ENRTF, will develop, educate, and foster better practices for treating invasive insects in Minnesota and can help institute long-term, sustainable solutions that can be implemented in this state and elsewhere.

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1:** Producing biocatalyst

**Budget: \$ 90,000**

We will use University facilities at the BioTechnology Institute to develop the methods to produce the bio-component making the insect deterrents. This activity will be supervised by project personnel as described below and in the budget.

Outcome	Completion Date
1. Make bio-component of the natural product producer	June 30, 2018

**Activity 2:** Making natural product insect deterrents by fermentation

**Budget: \$ 83,000**

The project manager and other laboratory team member will make natural product insect deterrents suitable for testing with target insects in controlled facilities at the University of Minnesota.

Outcome	Completion Date
1. Produce initial natural product materials for insect testing	June 30, 2018
2. Optimize the levels of production of the insect deterrent materials	January 1, 2019

**Activity 3:** Testing efficacy of product with target insects

**Budget: \$ 74,000**

We will work with our collaborators in the Department of Agriculture, the MPCA, and the University of Minnesota to obtain and test efficacy of product produced for insect deterence.

Outcome	Completion Date
1. Show natural product materials work against insect pests present in Minnesota	June 30, 2019

**Activity 4:** Disseminating findings and informing stakeholders

**Budget: \$ 0**

We will organize and host a conference in the Institute on the Environment. The conference participants will include political leaders, people from relevant state agencies, concerned citizens, and the private sector. We will



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**2017 Main Proposal**

**Project Title: Natural Products for Protecting Minnesota Natural Resources**

disseminate our findings and explore the best means for deploying the insect deterrent methods developed here in this project.

Outcome	Completion Date
1. Disseminate information and move the best technology into practice in Minnesota	June 30, 2019

**III. PROJECT STRATEGY**

**A. Project Team/Partners**

The project manager is Distinguished McKnight Professor Lawrence Wackett (BioTechnology Institute). Other team leaders are Professors Carrie Wilmot (Department of Biochemistry, Molecular Biology and Biophysics), and Brian Aukema (McKnight Land-Grant Professor of Entomology). All of the team leaders are located on the University of Minnesota’s St. Paul campus. Faculty there work with target and non-target insects. The St. Paul campus has all the needed facilities for producing and testing the natural product materials. The BioTechnology Institute has world class facilities for producing biological materials. The team also has access to excellent greenhouse and insect facilities. The team has extensive contacts with the Minnesota Department of Agriculture and the Minnesota Pollution control Agency. One of us (Aukema) has extensive experience in the eradication of invasive insects, including gypsy moths and the emerald ash borer. The team also has experience in working with the University commercialization and venture office. That can be important for bringing new technology to the attention of Minnesota companies that may wish to produce an important natural product control agent to use by farmers and relevant personnel at State agencies.

**B. Project Impact and Long-Term Strategy**

The project has a strong impact on preserving and maintaining Minnesota resources. It stems from our developing technology to make natural product compounds of the type described here that will serve as specific insect eradication materials. Currently, invasive insect control methods use pesticides such as imidacloprid, permethrin, and carbaryl (Sevin). A major drawback of using these pesticide chemicals is that they kill non-target insects, including endangered and essential pollinators such as bees. The development and deployment of highly specific natural product components that can act as lures or deterrents has important implications for designing higher level and less hazardous methods for eradicating invasive insects that destroy the natural beauty of Minnesota resources and cost farmers millions of dollars in crop losses.

The project also has a strong long-term strategy component based on the extensive experience of the project team. The team has collectively developed numerous connections over the past twenty years to translate research into prototypes that industry can developed, and we have previously helped Minnesota companies in this regard. Additionally, the Institute on the Environment is adept at bringing together stakeholders that can move knowledge to state agencies and others in the field who can implement new technologies. The development of the fundamental concept underlying the present project was supported by \$2.2 million in funding from the Federal ARPA-E agency and by the Minnesota state-supported BioTechnology Institute at the University of Minnesota. That groundwork will be translated here to deal with the invasive insect species problems facing the natural resources of the State of Minnesota, and funds will be leveraged with already-secured monies to disseminate information obtained by the project. We expect that commercial production of the natural product materials for insect deterrence will be attractive to the private sector and the technology will be handed off to a Minnesota-based company, and become self-sustaining.

**C. Timeline Requirements**

This project will take 24 months to carry out as described above. Thereafter, it is expected that the products of the project to be handed off to state agencies and the private sector.

## 2017 Detailed Project Budget

**Project Title:** Natural Products for Protecting Minnesota Natural Resources

### IV. TOTAL ENRTF REQUEST BUDGET: 2 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
<b>Personnel:</b> The Project Manager, Lawrence Wackett, is not funded on this project but will be paid by his University salary, similar to co-PI, Professor Carrie Wilmot. Funds are requested for a postdoctoral, 2 years, total funding = \$120,000 (80% salary, 20% benefits). The postdoctoral will be the lead researcher on the project and direct others on the research. A technician will be supported for one year at \$45,000 (78% salary, 22% benefits). Also needed is an undergraduate helper for part-time at \$6,000 total (100% salary). Professor Brian Aukema will devote one month of his summer time to the project for each of two summers, and receive \$20,000 (75% salary, 25%	\$ 191,000
<b>Contract services:</b> Funds are requested for service provided by the University of Minnesota's BioTechnology Institute Pilot Plant to prepare the biocatalysts used in this proposed research.	\$ 30,000
<b>Equipment/Tools/Supplies:</b> Funds are for producing materials for field testing, in addition to routine lab supplies (chemicals, flasks, pipetters).	\$ 24,000
<b>Acquisition (Fee Title or Permanent Easements):</b>	N/A
<b>Travel:</b> Travel funds are requested to field sites for insect testing experiments.	\$ 2,000
<b>Additional Budget Items:</b>	N/A
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =</b>	<b>\$ 247,000</b>

### V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
<b>Other Non-State \$ To Be Applied To Project During Project Period:</b> Indicate any additional non-state cash dollars secured or applied for to be spent on the project during the funding period. For each individual sum, list out the source of the funds, the amount, and indicate whether the funds are secured or pending <i>approval</i> .	N/A	N/A
<b>Other State \$ To Be Applied To Project During Project Period:</b> Funds from the BioTechnology Institute at the University of Minnesota have been provided to support student research on	\$ 50,000	<i>Secured</i>
<b>Other State \$ To Be Applied To Project During Project Period:</b> Funds are secured and held in the Institute on the Environment at the University of Minnesota to hold conferences, workshops and other working groups to explore solutions to water issues in Minnesota and beyond the region. Funds will be used to sponsor a conference on invasive insects and their control in the state of Minnesota.	\$ 5,000	<i>Secured</i>
<b>In-kind Services To Be Applied To Project During Project Period:</b> Faculty salary time paid by the University of Minnesota that the PI will devote to the project over the summer months	\$ 15,000	<i>Secured</i>
<b>In-kind Services To Be Applied To Project During Project Period:</b> Unrecovered indirect costs @ 53% of modified total direct cost base (graduate student fringe is excluded) of \$107,521	\$ 131,000	<i>Secured</i>
<b>In-kind Services To Be Applied To Project During Project Period:</b> BioTechnology Institute Pilot Plant fee waiver. Since the PI is a member of the BioTechnology Institute, this project will have the entry fee waived for the use of the facilities to prepare natural product producing biocatalysts to be used in this proposal. The project will only be charged for materials used in production and the hourly wages of the staff at the facility that they work on this specific project.	\$ 20,000	<i>Secured</i>
<b>Funding History:</b> \$2,200,000 - ARPA-E - This project was started with funding from the ARPA-E program of the Department of Energy to make natural products to use as fuel. The project was very successful (see the national report, <a href="http://video.foxbusiness.com/v/4610974/generating-fuel-from-bacteria/?#sp=show-clips">http://video.foxbusiness.com/v/4610974/generating-fuel-from-bacteria/?#sp=show-clips</a> ) but the low price of oil has made this uneconomical as a biofuel. However, making natural product chemicals to control insect pests is environmentally sound and	\$ 2,200,000	<i>Spent</i>
<b>Remaining \$ From Current ENRTF Appropriation:</b>	N/A	N/A

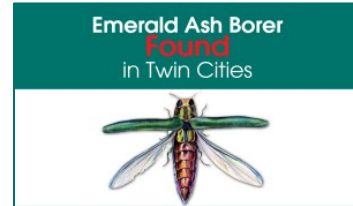
# Project: *Natural Products for Protecting Minnesota Natural Resources*

Our concept is like the old saying:



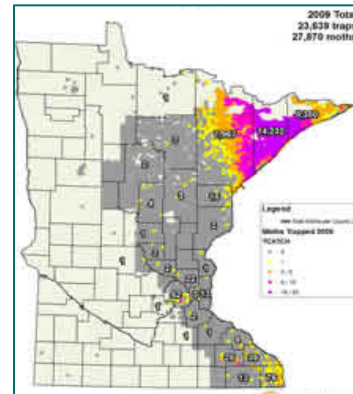
“Don’t throw out the baby with the bath water.”

“Don’t throw out the good insects ..... *with the bad.*”



Source: [www.takeactionfortrees.com](http://www.takeactionfortrees.com)

Gypsy moth found throughout MN



Source: [www.mda.state.mn.us](http://www.mda.state.mn.us)

## HOW?

Use selective natural products that disrupt the breeding of, or trap, invasive insects



## **PROJECT MANAGER QUALIFICATIONS AND ORGANIZATION DESCRIPTION**

### **PROJECT TEAM**

#### ***Project Manager***

##### **Lawrence P. Wackett, Distinguished McKnight University Professor**

BioTechnology Institute, University of Minnesota, St. Paul, MN

Lawrence Wackett is McKnight Distinguished Professor of Biotechnology with 27 years of experience in producing natural products using biotechnology.

#### ***Project co-Team Manager 1***

##### **Carrie Wilmot, Professor**

Biochemistry, Molecular Biology and Biophysics, University of Minnesota, St. Paul, MN

Carrie Wilmot brings strong expertise in structural biology and engineering proteins. She will bring expertise that is critical for the success of the project.

#### ***Project co-Team Manager 2***

##### **Brian Aukema, Ph.D., McKnight Land Grant Professor**

Department of Entomology, University of Minnesota, St. Paul, MN

Brian Aukema has deep expertise from years of studies on invasive insect species. He has expertise that will be essential for making the best natural products and testing their effectiveness against specific invasive species.

#### ***Project Team Description***

The project and co-project managers have a combined 40 years experience in natural product production or determining effects of such materials on problem insects. The team is well-connected with Minnesota State agencies, Minnesota industry, and seek to see their research translated for the improvement of the State and society.

### **ORGANIZATION DESCRIPTION**

The University of Minnesota supports this research project with laboratory space, infrastructure, administrative support, and the facilities of the BioTechnology Institute and the Institute on the Environment. The University, under President Eric Kaler and research Vice President Brian Herman, are dedicated to promoting University research that directly benefits society, especially the state of Minnesota and its citizens. We expect that we will receive outstanding support throughout the University for all phases of this project.