

**Environment and Natural Resources Trust Fund
2015 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 083-D

Biological Control of Canada Thistle

Category: D. Aquatic and Terrestrial Invasive Species

Total Project Budget: \$ 300,000

Proposed Project Time Period for the Funding Requested: 3 years, July 2015 - June 2018

Summary:

Develop biological control for Canada thistle, Minnesota's most prevalent noxious weed. Will reduce herbicide application, mowing and tillage which harm desirable plants, interfere with wildlife management, and impact water quality.

Name: Roger Becker

Sponsoring Organization: U of MN

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Images of Canada thistle, biocontrol weevil and thistles native to Minnesota.

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



I. PROJECT STATEMENT

1. Why this project needs to be done: The invasive plant, Canada thistle (*Cirsium arvense*) is a serious threat to natural and managed ecosystems in Minnesota, including rights-of-ways, riparian areas, and restored prairies. Biological control of Canada thistle would reduce use of herbicides, maintain water quality, and once established, minimize the costly and reoccurring expense of controlling this invasive pest. Canada thistle is the most prevalent noxious weed in the state, as a Minnesota prohibited noxious weed, control can be required by law. Absent biological control, currently available control options include herbicides, mowing, or tillage. These control methods harm desirable plants, interfere with wildlife management, and may impact water quality. Biological control of Canada thistle has not been actively promoted in Minnesota because of concern for native thistles. The State of Minnesota and the University of Minnesota cannot promote biological control until research defines the potential risk to native thistles. Native thistles provide bird and native pollinator food sources and increase biodiversity on the landscape. One native, Hill’s thistle, is listed as one of Minnesota’s Species of Special Concern.

2. Overall goals of this project: Develop a cost effective biological control program to manage the prohibited noxious weed, Canada thistle, and reduce harm to desirable native plants. We have experience in, and have worked with LCCMR in the past on biological control of purple loosestrife and leafy spurge, and are currently developing biological control of garlic mustard.

3. How this project will achieve these goals: We will determine whether *Ceutorhynchus litura* will attack Minnesota’s native thistles. If *C. litura* only develops on Canada thistle, a biological control program can be augmented in Minnesota by state agencies and land owners to provide cost-effective, long- term management of Canada thistle in Minnesota’s natural areas.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Collect and grow thistle plants.

Budget: \$60,000

We will collaborate with the Minnesota Biological Survey to locate sources for each of Minnesota’s seven native thistles. We will collect seeds/propagules and determine the best methods to propagate and overwinter the plants. Multiple plants of each species will be established so that replicated host-range field trials can be conducted. Scientist and technical staff at the University of Minnesota will conduct this work.

Outcome	Completion Date
Locate sources, collect and determine how to successfully establish and grow native thistle from root stalks or seeds at a common garden on the St. Paul campus. Canada thistle will be grown as a control plant.	November 2015
Successfully overwinter thistles. Develop an experimental design to accurately determine host specificity of <i>C. litura</i> . Establish study site with the appropriate design to conduct this research.	November 2016

Activity 2. Determine whether *Ceutorhynchus litura* attacks thistles native to Minnesota. Budget: \$120,000

Ceutorhynchus litura adults will be field-collected or purchased. All host-range tests will be conducted on caged thistle plants growing outside at the University of Minnesota, St. Paul campus. Three separate studies will be conducted with each thistle species in replicated field trials to include; feeding, oviposition (egg-laying) and life-cycle completion experiments. All tests will also be conducted on Canada thistle as a control plant (24 total tests). Scientist and technical staff at the University of Minnesota will complete this work.

Outcome	Completion Date
Purchase or field-collect <i>C. litura</i> adults	June, 2016
Conduct detailed host- range studies for a total of 24 tests	June, 2018



Activity 3. Determine weevil life-cycle and phenology in Minnesota.

Budget \$120,000

Determine phenology of *C. litura* at field sites throughout Minnesota each of three years of this project. Dissect Canada thistle plants at regular intervals during each growing season to determine the weevil’s life-cycle. Determine when weevils become active in the spring, when females lay eggs and when a new generation of adults emerge in late summer. This information will be critical to implement a Canada thistle biological control program in Minnesota. Scientist and technical staff at the University of Minnesota will complete this work.

Outcome	Completion Date
Conduct phenology studies	June , 2018

III. PROJECT STRATEGY

A. Project Team/Partners

Drs. Roger Becker (PI, Professor) and Elizabeth Katovich (Senior Scientist). University of Minnesota.
 Monika Chandler (Biological Control Coordinator). Minnesota Department of Agriculture.
 Laura Van Riper (Terrestrial Invasive Species Coordinator), Welby Smith (Research Scientist), and Dan Wovcha (Natural Resource Specialist). Minnesota Department of Natural Resources.

Receiving Funds: Drs. Roger Becker and Elizabeth Katovich, will lead the studies. Both cooperators have worked on previous and current LCCMR sponsored studies for purple loosestrife and garlic mustard biological control.

Not Receiving Funds: Laura Van Riper, Welby Smith, and Dan Wovcha, Minnesota Department of Natural Resources will provide access to the Minnesota Biological Survey, help locate native thistle populations, and issue appropriate collection permits. Monika Chandler, Minnesota Department of Agriculture, has years of experience working with the stem-mining weevil and will facilitate procuring, releasing and recovering the weevils.

B. Project Impact and Long-Term Strategy

Canada thistle is the most common noxious weed in Minnesota impeding management goals across several ecosystems. Utilizing biological control on large infestations of Canada thistle would prevent the need to apply herbicide, mow or till these sites. This would reduce negative impacts of these control methods protecting water quality, improving native forb diversity in prairies and other ecosystems, and by increasing nectar and pollen source diversity and abundance.

This proposal is the first step in a long-term implementation strategy for biological control of Canada thistle in Minnesota. Before we can proceed, it is necessary to determine whether *C. litura* attacks native thistles. If the weevil is specific to Canada thistle, we will submit a proposal to LCCMR for funding towards implementing a long-term Canada thistle biological control program. Activity 3 is beginning that process through improved understanding of the phenology of *C. litura* in Minnesota to facilitate rearing and release should our research show that we can proceed with this biological control effort.

C. Timeline Requirements:

Three years, from July 1, 2015 to June 30, 2018, will be required to accommodate the biology of the weevils and establishment of Canada thistle and native thistles necessary to conduct this research. We will locate, collect and establish native thistles during the 1st year, and study the biology of the species to inform the methodology needed to accurately test the host specificity of *C. litura*. The second and third years will be required to conduct extensive host-range testing on the seven native thistles and the control, Canada thistle. The field phenology studies of Activity 3 will be conducted throughout the three years.

2015 Detailed Project Budget

Project Title: Biological Control of Canada Thistle

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel:	
Scientists	\$10,500
Salary - Civil Service Bargaining Unit. Project Scientist(s) total FTE @ approx. 0.90 FTE/yr to conduct the research.	\$205,000
Total Salary	\$215,500
Fringe - Undergrad Student	\$777
Fringe - Civil Service Bargaining Unit	\$75,440
Total Fringe	\$76,217
Total Salary and Fringe	\$291,717
Contracts:	
Equipment/Tools/Supplies: Temperature probes, field supplies: flags, netting, stakes, pots, potting medium, cages, insect purchases, etc.	\$2,083
Acquisition (Fee Title or Permanent Easements):	N/A
Travel: Travel to research native thistle collection sites, to facilitate research e.g. C. litura phenology study, or to present or report findings.	\$2,600
Additional Budget Items: Watering charges and other service charges for greenhouse and field space. Fees set by the University and amount listed based on past experiences.	\$3,600
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$300,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Other Non-State \$ To Be Applied To Project During Project Period: PI is not receiving any salary funding from LCCMR. 5% of PI's time/yr totals \$7485/yr.	\$ 22,455	Secured
Other State \$ To Be Applied To Project During Project Period:	N/A	
In-kind Services To Be Applied To Project During Project Period: University indirect costs forgone due to state restrictions, 52% of budget.	\$ 156,000	Secured
Funding History: None for this effort on Canada thistle (though past garlic mustard, purple loosestrife biocontrol and water quality funding has been received from LCCMR).	N/A	
Remaining \$ From Current ENRTF Appropriation: None 'directly' related. Do have current LCCMR funding via MnDNR for garlic mustard biological control. Biological Control of Garlic Mustard \$140,000 awarded 2013 and Monitoring Biological Control of Garlic Mustard \$52,214 awarded 2013.	N/A	

Biological Control of Canada Thistle



Canada thistle is:

- the most common weed in natural areas, road-sides and rights-of-ways
- a Mn prohibited noxious weed
- control can be required by state law



Photos R. Becker

Stem-mining weevil, *Ceutorhynchus litura* for biological control of Canada thistle



Laura Parsons

Adult *C. litura*

C. Litura larvae



Norman E. Rees

Biological control can:

- reduce herbicide use in natural areas
- increase diversity of native plants and pollinator food sources
- help protect water quality

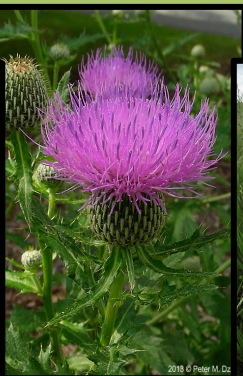
Seven thistles are native to Minnesota

Not common. Important for:

- Diversity
- Pollinators
- Preservation



Swamp thistle



Tall thistle



Flodman's thistle



Hill's thistle
(species of concern)



Field thistle



Wavyleaf thistle

Hybrid *C. altissimum*

x discolor

04/21/2014

Vita for Roger Becker

Title: Extension Agronomist - Weed Scientist
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Appointment: Extension 75% / Research 25%

Specific Areas of Responsibility: Weed management strategies in annual and perennial systems in disturbed and undisturbed habitats. Current projects include management of purple loosestrife in wetlands; garlic mustard and buckthorn in woodlands; and Canada thistle in native prairies, pastures and right-of-ways. Also prairie establishment, weed management in forages and in processing vegetables, and the environmental impacts of herbicide and non-herbicide weed management systems.

Education:

<u>Degree</u>	<u>Major</u>	<u>College/University</u>	<u>Years</u>
B.S.	Agronomy	Iowa State University	1972 - 1976
M.S.	Botany-Plant Physiology	Iowa State University	1976 - 1978
Ph.D.	Agronomy-Crop Physiology	Iowa State University	1978 - 1982

Professional Positions:

<u>Employer</u>	<u>Dates</u>	<u>Position</u>
Iowa State University	1978-1982	Extension Associate
Monsanto Company	1982-1985	Product Development Representative
Monsanto Company	1985-1987	Product Development Associate
University of Minnesota	1987- present	Assistant, Associate and Full Professor

Relevant Recent Publications:

- Becker, R.L., E.J.S. Katovich, H.L. Hinz, E. Gerber, D.W. Ragsdale, R.C. Venette, D.N. McDougall, R. Reardon, L.C. Van Riper, L.C. Skinner, and D.A. Landis. 2013. The Garlic Mustard (*Alliaria petiolata*) Case, What Makes a Good Biological Control Target. The Intersection of Science, Perspectives, Policy and Regulation. pp. 332-339 *In* Proc. XIII International Symposium on Biological Control of Weeds (ISBCW). Sept. 11-16, 2011. USDA Forest Service, FHTET-2012-07. January 2013. 536 p.
- Katovich E.J.S., R.L. Becker, D.W. Ragsdale, and L.C. Skinner. 2008. Growth and Phenology of Three Lythraceae Species in Relation to Feeding by *Galerucella californiensis* and *Galerucella pusilla*: Predicting Ecological Host Range from Laboratory Host Range Testing. *Inv. Plant Sci Management*. 1(2):207-215.
- Van Riper, L.C., R.L. Becker, L.C. Skinner. 2010. Population biology of garlic mustard (*Alliaria petiolata*) in Minnesota hardwood forests. *Inv. Plt. Sci Mgt*. 3:48-59.