

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

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**Project Title:**

**ENRTF ID: 153-F**

Promoting Conservation Biocontrol of Beneficial Insects

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**Category:** F. Methods to Protect, Restore, and Enhance Land, Water, and Habitat

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**Total Project Budget:** \$ 399,000

**Proposed Project Time Period for the Funding Requested:** 3 years, July 2017 - June 2020

**Summary:**

Research ways to conserve beneficial insects (bees, butterflies, predators, and parasitoids) in landscapes and restoration projects thru conservation biocontrol, cultural management, and biorational insecticides.

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**Name:** Vera Krischik

**Sponsoring Organization:** U of MN

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St. Paul MN 55108

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**Web Address** www.extension.umn.edu/garden/plant-nursery-health/

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**Location**

**Region:** Statewide

**County Name:** Statewide

**City / Township:**

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**Alternate Text for Visual:**

Visual aid on the elements of the research project.

<input type="checkbox"/>	Funding Priorities	<input type="checkbox"/>	Multiple Benefits	<input type="checkbox"/>	Outcomes	<input type="checkbox"/>	Knowledge Base
<input type="checkbox"/>	Extent of Impact	<input type="checkbox"/>	Innovation	<input type="checkbox"/>	Scientific/Tech Basis	<input type="checkbox"/>	Urgency
<input type="checkbox"/>	Capacity Readiness	<input type="checkbox"/>	Leverage	<input type="checkbox"/>		TOTAL	<input type="checkbox"/> %



**Project Title: Promoting conservation biocontrol of beneficial insects,**

**6. Methods to protect or restore land, water, and habitat**

**Dr. Vera Krischik, Department of Entomology, University of Minnesota, [krisc001@umn.edu](mailto:krisc001@umn.edu)**

**I. Project Statement:**

The project's goals are to research ways to conserve beneficial insects (bees, butterflies, predators, and parasitoids) in landscapes and restoration projects thru conservation biocontrol, cultural management, and biorational insecticides.

Numerous local and state programs are involved with habitat restoration, which requires bee-friendly plants to conserve beneficial insects. Beneficial insects include bees, butterflies, predators, and parasitoids. More than 99.9% of all insects are beneficial and these insects rely on pollen and nectar from plants to complete their life cycle. These restorations must be managed thru the principles of Integrated Pest Management (IPM). IPM promotes multiple tactics to manage and includes cultural control, biocontrol, conservation biocontrol, and using biorational insecticides friendly to beneficial insects. Conservation biocontrol is the use of sustainable, cultural tactics, such as overwintering sites, conservation of ground nesting sites, mulch piles, and appropriate mowing practices. Research and educational outreach are needed to demonstrate that these tactics increase beneficial insect abundance.

In addition, the production of bee-friendly plants usually requires the use of an insecticide during propagation and after installation. The EPA has registered biorational insecticides that are compatible with biocontrol, but are not widely used due to lack of data on conserving beneficial insects compared to conventional insecticides. We need to determine if biorational insecticides, such as s-kinoprene (prevents the growth of immature insects) and pymetrozine (stops the mouthparts of aphids from working) produce no residue and conserve beneficial insects compared to conventional, systemic insecticides. Also, we need to determine if the habitat that the restoration is installed into is free from pesticide residue. For instance, can roadside plants or ground covers contain pesticide residues from runoff, road solvents and herbicide use. We need to determine if pesticide residues are sufficient to kill foraging beneficial insects on ground covers or monarch immatures when they feed on milkweeds in restorations. We need to determine if current management practices produce residues in leaves that may harm native bees when they collect leaves for their nest cavities. We will promote the research results thru peer-reviewed publications, websites, webinars, bulletins, workshops, and talks. The goals are to:

1. Through research understand how to conserve beneficial insects in landscapes and restorations thru conservation biocontrol that includes cultural management (overwintering sites for native bees, nesting sites, mowing time) and the use of biorational insecticides.
2. Through research we will determine how to produce economically viable plants for restorations that were grown without systemic insecticides and comply with bee labeling legislation.



**II. PROJECT ACTIVITIES AND OUTCOMES. Total budget: \$399,000**

**Activity 1:** Develop research and outreach educational programs on conservation biocontrol of beneficial insects by promoting cultural and “biorational” chemical management in landscapes, parks, and restorations. **Budget: \$206,000**

<b>Outcome</b>	<b>Completion Date</b>
1. Research the use of overwintering sites (mulch piles and standing plants) and moving times (no mowing compared to current August mowing) for conserving beneficial insects and bees. Research the efficacy of “biorational” insecticides (chlorantraniliprole, spinosad, pymetrozine compared to neonicotinoids (imidacloprid, clothianidin)) on pests and whether the “biorational” insecticide conserves beneficial insects (lady beetles, lacewings, bumblebees, solitary bees) in landscapes. Residue of the insecticides must be determined.	June 30 2020
2. Research what bedding plants do not provide food for beneficial insects and pollinators and make plant lists of these non-pollinator friendly plants.	June 30 2020
3. Outreach website, webinars, and bulletins for dissemination by the PI, Master Naturalists, Master Gardeners, and Minnesota Extension Service.	June 30 2020

**Activity 2:** Develop research and outreach educational programs on conservation biocontrol of beneficial insects by understanding chemical management used in plant propagation in compliance with the new Minnesota bee labeling laws **Budget: \$193,000**

<b>Outcome</b>	<b>Completion Date</b>
1 Research the efficacy of “biorational” insecticides (chlorantraniliprole, s-kinoprene, pymetrozine compared to neonicotinoids (imidacloprid, clothianidin)) on pests and whether the “biorational” insecticide conserves beneficial insects (lady beetles, lacewings, bumblebees, solitary bees) in greenhouse propagation of plants for pollinators. Residue of the insecticides must be determined.	June 30 2020
2. Outreach website, webinars, and bulletins for dissemination by the PI, Master Naturalists, Master Gardeners, and Minnesota Extension Service.	June 30 2020

**III. PROJECT STRATEGY**

**A. Project Team/Partners, pending letters of support.** 1. Minnesota Honey Producers; 2. + 3. MN Beekeepers (Steve Ellis and Jeff Anderson); 4. Colorado State Beekeepers (President Beth Conrey); 5. Sarah Rudolf, Minnesota Pollution Control Agency; 6. Ralph Siefert, MPRB, Minneapolis Park and Recreation Board; 7. + 8. Crystal Boyd and Dana Robert, Minnesota Department of Natural Resources, 9. Geir Friisoe, MDA, 10. Cassie Larson, MNLA

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

The long term strategy is to conserve beneficial insects (butterflies, lady beetles, lacewings, bumblebees, solitary bees), preserve ecosystem processes, and reduce insecticide residue in water through cultural management and reduced conventional pesticide use.

**C. Timeline Requirements**

The research and outreach programs will continue over the 3 yr grant period with research in the field and greenhouse.

## 2017 Detailed Project Budget

**Project Title: Promoting conservation biocontrol of beneficial insects**

### IV. TOTAL ENRTF REQUEST BUDGET 3 years, 2017-2020

<u>BUDGET ITEM</u> (See "Guidance on Allowable Expenses", p. 13)	<u>AMOUNT</u>
<b>Personnel:</b> Students: Graduate Student \$16,442 salary, \$2763 health insurance, \$15,000 tuition, summer salary \$6,029, summer health insurance \$1,013=\$41,250/yr for 3yrs (55% Salary, 45% Benefits) and undergraduate lab assistants = \$10,000 /yr for 3yrs (100% Salary, 0% benefits) Non-students: Lab supervisor: \$50,00 x 26.4% fringe = \$63,200/yr for 2yrs (78% Salary, 22% Benefits)	\$ 282,000
<b>Professional/Technical/Service Contracts:</b> Residue analysis of imidacloprid performed at USDA AMS Lab in Gastonia, NC, EPA approved lab, cost \$220/sample, 270 samples	\$ 60,000
<b>Equipment/Tools/Supplies:</b> Research supplies Bumblebee colonies 120 (40/yr) @\$100 each =\$12,000; bee food, \$1,000; lacewings, lady beetles, monarch butterflies for cultural management and insecticide tests, \$10,000; greenhouse space for research, \$10,000; flowersing plants, \$7,000; insecticides, \$1,000; field charges, \$2,000; shipping samples to USDA, \$3,000; misc supplies to perform research, dry ice, storage vials, small scale, \$4,000	\$ 50,000
<b>Acquisition (Fee Title or Permanent Easements):</b>	\$ -
<b>Travel:</b> Instate travel to research sites, mileage for travel to and from research sites	\$ 3,000
<b>Additional Budget Items:</b> Publication costs, reports and fact sheets for distribution at meetings	\$ 4,000
<b>TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST</b>	<b>\$ 399,000</b>

### V. OTHER FUNDS (This entire section must be filled out. Do not delete rows. Indicate "N/A" if row is not applicable.)

<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 approval.	N/A	N/A
<b>Other State \$ To Be Applied To Project During Project Period:</b> Indicate any additional state cash dollars (e.g., bonding, other grants) 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 approval.	N/A	N/A
<b>In-kind Services To Be Applied To Project During Project Period:</b> Indicate any additional in-kind service(s) secured or applied for to be spent on the project during the funding period. For each type of service, list type of service(s), estimated value, and indicate whether it is secured or pending. In-kind services listed must be specific to the project.	\$3,205	secured
<b>Funding History: 2010-2013 LCCMR 221G Mitigating Pollinator Decline \$297,000; 2014-2017 LCCMR 6e Understanding Systemic Insecticides as Protection Strategy for Bees, \$326,00 ending June 30 2017; 2015 USDA NCIPM Mitigating Pollinator Decline webinar, website, Arboretum citizen science project, \$20,000; 2015 MNLA New Bee Labeling Laws: Determination of Residue in Flowers and Leaves from imidacloprid, Dinotefuran, and Pymetrozine use in GH Pots, \$10,000</b>	\$653,000	secured
<b>Remaining dollars from current ENRTF: 2014-2017 LCCMR 6e Understanding Systemic Insecticides as Protection Strategy for Bees, ending June 30 2017; unspent \$214,075</b>	\$214,075	unspent, but spent by June 30 2017

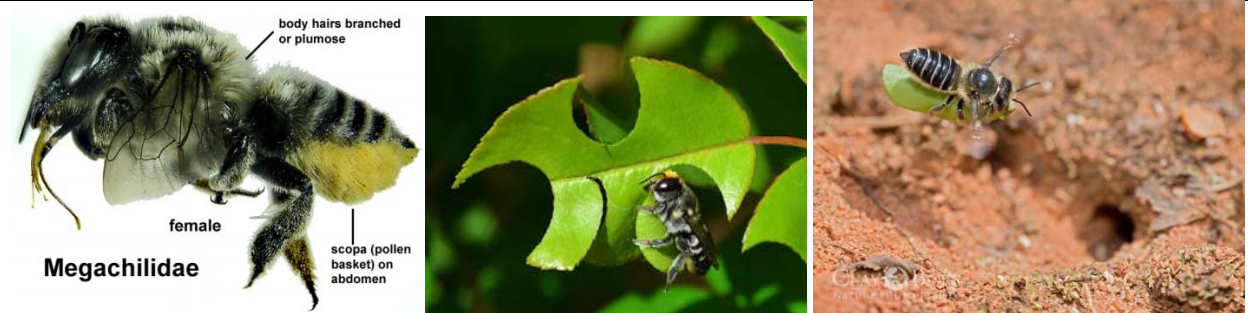
**2017 LCCMR Project Title: Promoting conservation biocontrol of beneficial insects**  
**Project PI: Vera Krischik, Department of Entomology, University of Minnesota,**  
<http://www.entomology.umn.edu/faculty-staff/vera-krischik>

1. Classic biocontrol is the importation of predators and parasitoids of the pest.
2. **Conservation biocontrol is managing by cultural methods such as, pollinator plants, native bee nesting sites, overwintering sites, mowing time, and biorational insecticide use to conserve beneficial insects.**
3. Augmentative biocontrol involves periodic release of biological control agents in greenhouses.



Beneficial insects feed on pollen and nectar in flowers of native and hierloom plants.

Above native ladybeetle, native bumblebee, honey bee, native lacewing; Krischik [ncipmhort.cfans.umn.edu/](http://ncipmhort.cfans.umn.edu/)



Native bees use leaves to line their ground/wood nests and lay an egg on the leaves and pollen ball. Insecticides in leaves may kill these bees as the larvae are very small when they eat the leaves and pollen. These bees are important pollinators of native plants, fruit crops and field crops.

EPA identifies biorational pesticides as having “fundamentally different modes of action” and “lower risks of adverse effects” than conventional (neurotoxin) insecticides.

Conventional, systemic insecticides move from the soil to the leaves and pollen and nectar of the plant. Bees and other beneficial insects are sensitive to systemic insecticides in pollen and nectar. A heart healthy aspirin that is 80 milligrams = 80,000 micrograms= 80,000,000 nanograms or ng. A bee is killed when it feeds on 4-40 ng of imidacloprid or 40-400 ppb imidacloprid in pollen or nectar.

The goals and objectives of this research and educational, outreach program are to conserve beneficial insects in landscapes, parks, and habitat restoration projects.

1. Develop research and outreach educational programs on conservation biocontrol of beneficial insects by promoting culture management, such as overwintering sites, native bee nesting sites, mowing times, and proper plant choice in landscapes and parks.
2. Develop research and outreach educational programs on conservation biocontrol of beneficial insects by understanding what chemical management will conserve beneficial insects in landscapes and parks.
3. Develop research and outreach educational programs on conservation biocontrol of beneficial insects by understanding what chemical management used in plant propagation will produce healthy plants for use in restoration projects that are in compliance with the new Minnesota bee labeling laws that conserves beneficial insects.

## **2017 LCCMR Project Title: Promoting conservation biocontrol of beneficial insects**

**Project Manager, Qualifications, and Organization Description, Dr. Vera Krischik**, Assoc. Professor, Landscape Ecology and Pesticides, Department of Entomology, University of Minnesota, St. Paul Campus, <http://www.entomology.umn.edu/faculty-staff/vera-krischik>

Dr. Vera Krischik is a tenured Faculty in the Entomology Department in the College of Food, Agricultural and Natural Resource Sciences at the University of Minnesota. Vera obtained her PhD from the University of Maryland and continued on as a PostDoc; was a researcher at the New York Botanical Garden and held a NSF sponsored Visiting Professor for Women from 1991-1993; and was an IPM coordinator at USDA, Washington DC from 1988-1994. Since 1995, Krischik has been a professor in the Department of Entomology at the University of Minnesota. Krischik teaches 2 courses; ENT 5009, Pesticide Use and Misuse; and ENT 4015, Ornamental and Turf IPM. Krischik was author on three books: one published in 1991, the first USDA grain insect management manual, that is still being published today, a second book in 1991 by John Wiley entitled "Microbial Mediation of Plant Insect Interactions" and another published in 2004 by the MN Agricultural Experiment Station on "IPM of Midwest Landscapes", 316 pp. Krischik has partnered with MDA, DNR, MNLA, MNTGF, and watershed districts for her outreach and research programs and publications. Krischik teaches at least 5 large workshops each year on proper pesticides use in cooperation with MDA and MNLA. She has trained 8 graduate students and 1 post doc. Since 1998 Krischik has been director of CUES: Center for sustainable urban ecosystems that promote sustainable landscapes and conservation of beneficial insects, online at [cues.cfans.umn.edu/](http://cues.cfans.umn.edu/). In 2010 and 2014 Krischik received an LCCMR grant on mitigating pollinator decline. Outreach pollinator educational products include 5 websites, a poster on the right plants for bees, 7 pesticide and bee bulletins, webinar, native bee and citizen science project, an online workshop, and many yearly talks.

### **Krischik's Websites**

NCIPM webinars+ website+native pollinator ID+plant videos <http://ncipmhort.cfans.umn.edu/>  
CFANS CUES website [cues.cfans.umn.edu/](http://cues.cfans.umn.edu/)  
UM extension nursery, landscape website [www.extension.umn.edu/garden/plant-nursery-health/](http://www.extension.umn.edu/garden/plant-nursery-health/)  
Original Cues website <http://cues.cfans.umn.edu/old/>  
Research on neonicotinoids and bumblebees <http://cues.cfans.umn.edu/old/pollinators/research.html>

### **Krischik's Peer Reviewed Publications**

1. Krischik V, M Rogers, G Gupta, A Varshney. 2015. Soil-applied imidacloprid is translocated to ornamental flowers and reduces survival of adult *Coleomegilla maculata*, *Harmonia axyridis*, and *Hippodamia convergens* lady beetles, and larval *Danaus plexippus* and *Vanessa cardui*, PLoS ONE March 23, 2015, DOI: 10.1371/journal.pone.0119133
2. Scholer J. and V. Krischik. 2014. Chronic exposure of imidacloprid and clothianidin reduce queen survival, foraging, and nectar storing in colonies of *Bombus impatiens*. PLoS ONE 9(3): e91573. doi:10.1371/journal.pone.0091573
3. Tenczar, E and V Krischik. 2007. Comparison of standard (granular and drench) and novel (tablet, stick soak, root dip) imidacloprid treatments for cottonwood leaf beetle management on hybrid poplar J. Econ. Entomol. 100: 1611-1621.
4. Krischik, V, A Landmark, G Heimpel. 2007. Effects of imidacloprid use in greenhouses on *Anagyrus pseudococci* (Girault) (Hymenoptera: Encyrtidae) J. Environ. Entomol. 36(5): 1238-1245.
5. Tenczar, E and V Krischik. 2007. Effects of ninebark phytochemistry on *Calligrapha spiraea* (Say) (Coleoptera:Chrysomelidae). Hort. Sci. 42(6): 1396-1399.
6. Rogers, ML Martin, and V Krischik. 2007. Effects of imidacloprid on green lacewing, *Chrysoperla carnea* (Neuroptera: Chrysopidae), used for biocontrol in greenhouses. Biological Control 42: 172-177.

### **Krischik's Extension Publications (2/26)**

Krischik, Vera A. 2015. Toxicity to pollinators of insecticides used in greenhouse, nursery, and landscapes, <http://www.extension.umn.edu/garden/plant-nursery-health/>  
Krischik, Vera A. 2015. [New federal, EPA and Minnesota labeling laws for protecting pollinator. MNLA Scoop Newsletter, 4 pp.](#)