



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2017 Work Plan

Date of Report: Feb 14, 2017
Date of Next Status Update Report: Feb 15, 2018
Date of Work Plan Approval: 06/07/2017
Project Completion Date: June 30, 2020

Does this submission include an amendment request? no

PROJECT TITLE: Promoting Conservation Biocontrol of Beneficial Insects

Project Manager: Vera Krischik
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Location: Statewide

Total ENRTF Project Budget:	ENRTF Appropriation:	\$400,000
	Amount Spent:	\$0
	Balance:	\$400,000

Legal Citation: M.L. 2017, Chp. 96, Sec. 2, Subd. 08b

Appropriation Language:

\$400,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to research integrated pest management strategies, including insecticide alternatives, and overwintering habitat sites to conserve beneficial insects, including bees, butterflies, and predator insects. The integrated pest management strategies will be used to develop best management practices to increase pollinator and beneficial insect diversity and abundance in various restored habitats. This appropriation is available until June 30, 2020, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Promoting conservation biocontrol of beneficial insects

II. 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, use of EPA registered biorational insecticides, and proper conventional insecticide use.

Numerous local and state programs are involved with habitat restoration, which require 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, including biocontrol, conservation biocontrol, and using biorational insecticides friendly to beneficial insects, and proper use of conventional insecticides. Conservation biocontrol is the use of sustainable, cultural tactics, such as overwintering sites, conservation of ground nesting sites, mulch piles, and appropriate mowing practices. IPM promotes proper use of conventional insecticides including application practices, such as avoiding drift, spraying when bees are not active, using thresholds of pest abundance, and monitoring to see if the application was successful. Research and educational outreach are needed to demonstrate that these tactics increase beneficial insect abundance. We will promote the research results thru peer-reviewed publications, websites, webinars, bulletins, workshops, and talks.

This outreach program and applied research is different from our 2014 LCCMR grant as we are investigating ways to manage restorations so that they are supportive of beneficial insects. We will produce outreach products (website, bulletins, webinars, workshop) and work with university and community groups to disseminate the research results and outreach programs. For products from previous work visit the pollinator conservation website(<http://cues.cfans.umn.edu/old/>) ; UMinnesota Extension website <http://www.extension.umn.edu/garden/plant-nursery-health/> ; NCIPM webinars website+pollinator+plant videos <http://ncipmhort.cfans.umn.edu/> ; and a list of pollinator publications at <http://www.entomology.umn.edu/faculty-staff/vera-krischik> ; MN Arboretum Pollinator Cubed Workshops <http://www.arboretum.umn.edu/P3Pesticides2.aspx>

III. OVERALL PROJECT STATUS UPDATES:

Project status as of February 15 2018

Project status as of August 15 2018

Project status as of February 15 2019

Project status as of August 15 2019

Project status as of February 15 2020

Project status as of August 15 2020

Final report summary: August 30 2020

Overall Project Outcomes and Results:

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 proper conventional and biorational insecticides, using the principles of integrated pest management (IPM).

IV. PROJECT ACTIVITIES AND OUTCOMES:

Activity 1: Conservation biocontrol in restorations. We will develop research and outreach educational programs on conservation biocontrol of beneficial insects by promoting cultural management, such as overwintering sites, native bee nesting sites, mowing times, and proper plant choice in small restorations. We plan to research the benefits of 4 types of cultural management:

1. Mulch piles or overwintering banks to conserve predatory insects and bees during the winter.
2. Duration of standing plant stems in spring so native bees can leave the stems as adults and not die if the stems are removed early.
3. Best seasonal times to mow to encourage new flowering.
4. Identify the best larval host plants in MN for butterflies and bees and the best pollen and nectar producing plants for adult beneficial insect feeding in restorations.

We plan to investigate the current levels of pesticide residue in plants in 4 areas that are considered good habitat for restoration.

1. Milkweed plants growing in roadsides and in restorations near high pesticide use areas may contain residues that affect monarch adults and larvae. Pesticide may be present from road deicers, mosquito abatement programs, and runoff (Repeated application of deicing salts test at 960 ppb imidacloprid has the potential to create residues that harm pollinators, since 40 ppb is the LD50 for bees, Niagara bee, August 2016; Kruschik 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. Orchard mason bee (*Osmia lignaria*) makes 25 pollen trips to support one egg. In addition, leaf cutter bees (*Megachile rotundata*) use pollen and rose petals to line their nests. We want to determine if the use of current insecticides impact the larvae of leaf cutter bees when their nests are provisioned with leaves and pollen balls. We will promote the proper use of EPA registered insecticides that are compatible with bees.

3. Basswood trees no longer create a good honey flow, according to MN bee keepers. We will investigate whether basswood trees near ditches contain pesticide residues in flowers.

4. Ground covers in agricultural fields are important for conserving soil and moisture, as well as providing pollen and nectar to beneficial insects. We will investigate whether these ground covers accumulate pesticides in sufficient amounts to harm beneficial insects.

LCCMR goals: We will work with small scale restorations in cities, counties, and the MN landscape arboretum to develop guidelines to protect beneficial insects and pollinators thru conservation biocontrol and IPM. We will determine conservation biocontrol management practices and determine pesticide residue in restorations that can influence beneficial insect survival and behavior. We will work with the MN listserv team, local community groups, MN Arboretum, and MN Extension Service (educators, Master Gardeners and Master Naturalists program) to disseminate these results.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 210,000
Amount Spent: \$ 0
Balance: \$210,000

Outcome	Completion Date
1. Research the use of 4 tactics: overwintering sites, mulch piles, standing plants, and moving for conserving beneficial insects .	Oct 1 2019
2. Research 4 types of areas used in restorations to determine if they have pesticide residue and if the levels found alter behavior or survival of beneficial insects.	March 1 2020
3. Create outreach website, webinars, and bulletins for information dissemination.	March 1 2020

Activity 1 status as of February 15 2018

Activity 1 status as of August 15 2018

Activity 1 status as of February 15 2019

Activity 1 status as of August 15 2019
Activity 1 status as of February 15 2020
Activity 1 status as of August 15 2020

Activity 2: Beneficial insect friendly pesticides. We will develop research and outreach educational programs on conservation biocontrol of beneficial insects by understanding what chemical management used in landscapes/restorations/greenhouse conserve beneficial insects. We will identify to consumers and professional land managers the appropriate pesticide and application methods to use to reduce drift, reduce exposure to bees foraging, and reduce nontarget effects on other species. For instance use of insecticides to control Japanese beetle adults on roses or Japanese beetle grubs in turf may negatively affect leaf cutter bees and other bees. In addition, we will research what plants can be exempt from MN bee labeling laws, since these plants do not provide sufficient pollen and nectar for beneficial insects.

Plant establishment in landscapes/restorations and the production of bee-friendly plants usually require the use of an insecticide during propagation and after installation. The EPA has registered insecticides that are compatible with biocontrol, but are not widely used due to lack of data and relevant information accessible to the grower. We need to determine if biorational insecticides, such as, chlorantraniliprole (very high LD₅₀), 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 insecticides. 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.

LCCMR goals: The project’s goals are to research ways to conserve beneficial insects (bees, butterflies, predators, and parasitoids) in landscapes and restoration projects thru the proper use of conventional and biorational insecticides. Plants not visited by bees will be identified, so they are exempt from special propagation practices. We will work with the MN listserve team, local community groups, MN Arboretum, and MN Extension Service (educators, Master Gardeners and Master Naturalists program) to disseminate these results.

Summary Budget Information for Activity 2:

ENRTF Budget: \$ 190,000
Amount Spent: \$ 0
Balance: \$190,000

Outcome	Completion Date
1 Research the efficacy of conventional and biorational insecticides (chlorantraniliprole, s-kinoprene, pymetrozine) compared to neonicotinoids (imidacloprid, clothianidin)) on pests and whether the insecticide conserves beneficial insects (lady beetles, lacewings, bumblebees, solitary bees) in propogation and restorations.	Oct 1 2019
2. Research what bedding plants do not provide food (nectar or pollen) for beneficial insects and make plant lists of these non-pollinator friendly plants.	March 1 2020
3. Create outreach website, webinars, and bulletins for information dissemination.	March 1 2020

Activity 2 status as of February 15 2018
Activity 2 status as of August 15 2018
Activity 2 status as of February 15 2019
Activity 2 status as of August 15 2019
Activity 2 status as of February 15 2020
Activity 2 status as of August 15 2020
Final Report Summary: August 15 2020

V. DISSEMINATION:

Description: Develop user workshops and friendly websites, containing webinars, videos, and bulletins on ways to conserve beneficial insects in restorations/landscapes and in plant propagation.

Status as of February 15 2018

Status as of August 15 2018

Status as of February 15 2019

Status as of August 15 2019

Status as of February 15 2020

Status as of August 15 2020

Final Report Summary: August 15 2020

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	Amount	Explanation
Personnel: Students: Grad student, \$21/hr, 16.9% health insurance, \$16,240 tuition; \$7,500 summer salary= \$42, 500/yr x 3yr=\$128,000; 1.5 FTE; Students: UG summer technicians \$10.00/hr x40 hrs x 20wk=\$8,00 x 2 yr=\$16,000, 0.2 FTE; Non-students: Lab scientist: 26pp x 80hrs x\$19.00/hr x 1.26 fringe=\$49,800/yr x 3yr=\$150,000, 3.2 FTE	\$289,000	Grad student, summer UG technician, research technician, and web master
Professional Technical Contracts: Residue analysis of imidacloprid performed at USDA AMS Lab in Gastonia, NC, EPA approved lab, GLP (180 x \$352=\$63,600; +\$225 x 24=\$5,400= total=\$70,000); UM Soil testing lab 180 samples x \$25=\$5,000	\$75,000	Residue analysis must be done at the EPA approved USDA AMS, Gastonia, NC lab to be valid
Equipment/Tools/Supplies: Research supplies Bumblebee colonies 30@\$120 each =\$4,000; bee food, \$1,000; <i>Osmia</i> bees, lacewings, lady beetles, monarch butterflies, parasitoids for experiments and insecticide tests, \$12,000; greenhouse space for research \$140/mo x 36mo=\$6,000; flowering plants, (plugs, pots, soil, fertilizers) \$1,000; insecticides, \$1,000; UM field charges, \$1,000	\$25,000	Equipment and supplies to maintain beneficial insects for bioassays with biorational and conventional insecticides; insecticides and supplies for growing plants for bioassays ; greenhouse space for maintaining insect colonies and performing bioassays; field supplies to investigate different cultural management tactics; field supplies to collect samples
Printing: Outreach bulletins for distribution at meetings, University contract printing at Kinko \$0.11BW/pg x6 pg=\$0.66 x 500=\$330 x 4bulletins=\$1,300 + other handouts=\$2,000; peer-review article publication costs journal \$2,000	\$4,000	Cost for duplicating management bulletins for use at meetings and talks; software for website

Travel: Instate travel (mileage) to research sites. Three tentative field sites for restoration research, Brainerd, Chaska, Stillwater, rental car, one year: 2 wk/mo x 5 mo=10 x \$260/wk= \$2,600 x \$01.7mi/UM fee=\$442+\$2600=\$3,042/yr x 2yr=\$6,100/field; Instate travel to outreach activities: 2 Workshops at arboretum and 10 talk= 20 days x \$45/day=\$900	\$7,000	Instate travel to research sites using UM car or personal car and reimbursed mileage.
TOTAL ENRTF BUDGET:	\$400,000	

Explanation of Use of Classified Staff: none

Explanation of Capital Expenditures Greater Than \$5,000: none

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 1.5 FTE for a graduate student, 0.2FTE for undergraduate technicians, and 3.0 FTE for a technician, = total of 4.7 FTE

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: USDA AMS NC residue lab to quantify imidacloprid, 0.5 FTE, = total 0.5 FTE

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
In-kind Services: University dollar value			
35% UM PI cost share	\$29,400/yr x 3yr=\$88,200 inkind	\$0	
50% UM overhead	\$200,000 inkind	\$0	
UM AES and extension funds	\$3,500	\$0	
TOTAL OTHER FUNDS:	\$291,700	\$0	

VII. PROJECT STRATEGY:

A. Project Partners:

Partners receiving ENRTF funding: none

Partners NOT receiving ENRTF funding, but on listserve and part of online advisory committee

Listserve team: A listserve and website will be generated in the first months of the grant to connect with interested parties on the outreach and applied research. Initial surveys will be conducted to develop IPM guidelines and BMP for restorations. Invited parties are listed below and also will include, any others that want to be added to the listserve.

Partners NOT receiving ENRTF funding

Listserve team: A listserve and website will be generated in the first months of the grant to connect with interested parties on the outreach and applied research.

1. Minnesota Honey Producers (Dan Whitney, Pres, statewide);
2. + 3. MN Beekeepers (Steve Ellis , St Cloud and Jeff Anderson, Eagle Bend, MN);
4. Colorado State Beekeepers (President Beth Conrey, Denver, CO);
5. Minnesota Pollution Control Agency (Sarah Rudolf, St. Paul, MN);
6. Minneapolis Park and Recreation Board (Ralph Siefert, Minneapolis, MN);
7. MDA (Raj Mann, Geir Friisoe, St Paul, MN);
8. MNLA (Cassie Larson, Roseville, MN);
9. UM Landscape Arboretum (Sandy Tanck);
10. UM Master Gardeners (Tim Kenny, Chaska, MN);
11. UM Master Naturalists (Brit Forsberg ; Amy Rager, Morris, MN);
12. MN DNR (Sarah Pennington, Brainerd, MN);
13. Wild Ones Native Plant (Stillwater Chapter);
14. UM Landcare (Les Potts);

15. Xerces Society (Eric Mader adjunct extension educator, UMN);
16. Pesticide Action Network NA, PANNA (Lex Horan, Minneapolis, MN);
17. MN Zoo (Erik Runquist, Apple Valley, MN);
18. Pollinator Friendly Org (Laurie Schneider, Stillwater, MN);
19. UM Raptor Center (Julia Ponder, St. Paul, MN);
20. Erin Rupp (Pollinate Minnesota, Lobbyist St Paul);
21. UM Hort (Mary Meyer, Chaska, MN); and any other interested groups or people.
22. Don MacSwain, Natural Resources Coordinator of Washington County Parks, St Croix Bluffs Park;
23. Jennifer Vieth, Executive Director of Carpenter Nature Center.
24. MN DOT.

Through conversations with different MN NGO's on the "MN pollinator google group" the listserv will expand its membership (Erin Rupp (Pollinate Minnesota, St Paul), Laurie Schneider (Pollinator Friendly Alliance, Stillwater), Margot Monson (Pollinator Friendly Alliance, St Anthony Park), Julia Kay (Wildones, Stillwater, MN), Julia Vanatta (Pollinator Revival, Minneapolis, MN), Patricia Hauser (Humming for bees, Minnetonka, MN), and Julia Kay). I already have worked with Laurie Schneider, Stillwater, "Pollinator Friendly Alliance" on picking out study sites; Sarah Foltz Jordon of the Xerces Society, Don MacSwain Natural Resources Coordinator of Washington County Parks, St Croix Bluffs Park; and Jennifer Vieth, Executive Director of Carpenter Nature Center. In Brainer, Sarah Pennington of the MN DNR has contacted me to work on some restorations in her area. I have spoken to Brit Frosberg of the UM Extension MN Naturalist Program and Sandy Tanck of the MN Arboretum on working with us on the research and outreach program. The outreach program will be posted on the three UM websites for which I am the webmaster, the UMinnesota Extension website <http://www.extension.umn.edu/garden/plant-nursery-health/>; the CFANS college website <http://cues.cfans.umn.edu> ; and the NCIPM webinars website+pollinator+plant videos website <http://ncipmhort.cfans.umn.edu/> . I will create a blog that will be updated each week with links to relevant information about beneficial insect conservation in restorations. The first year I will set up the website and the email listserv on the research. Every year in May I will organize a workshop at the MN Landscape Arboretum, just as I did the 3 workshops in 2014-2015 "Pollinator Cubed" <http://www.arboretum.umn.edu/P3Pesticides2.aspx> Each year I will produce at least one bulletin directed at different end users such as greenhouse/nursery growers, small restorations in county parks, and consumers on proper pesticide use and different restoration techniques. Our lab each year will provide 6 talks each year to small groups and at least 6 talks to UM associated groups

B. Project Impact and Long-term Strategy:

The project’s goals are to educate landscape managers (parks; state, county, city; municipal buildings, restoration managers, etc), and consumers on ways to conserve beneficial insects (bees, butterflies, predators, and parasitoids) thru conservation biocontrol, IPM , and proper insecticide use by providing workshops, websites, webinars, and bulletins based on the applied research.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
LCCMR 221G Mitigating Pollinator Decline	2010-2013	\$297,000
LCCMR 6e Understanding Systemic Insecticides as Protection Strategy for Bees	2014-2017	\$326,000
Non-state		
USDA SARE grant, Effects of neonicotinoids on bees	2010-2012	\$175,000
2015 MNLA, MN Nursery Association Grant, New Bee Labeling Laws: Determination of Residue in Flowers and Leaves from imidacloprid, dinotefuran, and pymetrozine use in greenhouse pots	2015	\$10,000

2015 USDA, NC IPM, grant develop webinar and website on pollinators, Mitigating Pollinator Decline webinar, website, Arboretum citizen science project	2015	\$20,000
TOTAL OTHER FUNDS:		\$828,000

VIII. REPORTING REQUIREMENTS:

- The project is for 3 years, will begin on 07/01/17, and end on 06/31/20.
- Periodic project status update reports will be submitted Aug 15 and Feb 15 of each year.
- A final report and associated products will be submitted between June 30 and August 15, 2020.

IX. VISUAL COMPONENT or MAP(S): Enclosed

X. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS: none

Environment and Natural Resources Trust Fund									
M.L. 2014 Project Budget									
Project Title: Promoting Conservation Biocontrol of Beneficial Insects									
Legal Citation: M.L. 2017, Chp. 96, Sec. 2, Subd. 08b									
Project Manager: Vera Krischik									
Organization: University of Minnesota									
M.L. 2014 ENRTF Appropriation: \$ 400,000									
Project Length and Completion Date: 3 Years, July 1 2017 until June 30, 2020									
Date of Report: Feb 7, 2017									
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity1 Budget	Activity1 Budget	Activity1 Amount Spent	Activity1 Balance	Activity2 Budget	Activity2 Budget	Activity 2 Amount Spent	Activity 2 Balance	TOTAL BUDGET
BUDGET ITEM	<i>Conservation biocontrol in restorations</i>				<i>Beneficial insect friendly pesticides</i>				
Personnel (Wages and Benefits): Overall:	\$139,000				\$150,000				\$289,000
Students: Grad student, \$21/hr, 16.9% health insurance, \$16,240 tuition; \$7,500 summer salary= \$42, 500/yr x 3yrs=\$128,000; 1.5 FTE									
Students: UG summer technicians \$10.00/hr x40 hrs x 20wks=\$8,000 x 2yrs=\$16,000, 0.2 FTE									
Non-students: Lab scientist: 26pp x 80hrs x\$19.00/hr x 1.26 fringe=\$49,800/yr x 3yrs=\$150,000, 3.2 FTE									
Professional Technical Contracts: Residue analysis of imidacloprid performed at USDA AMS Lab in Gastonia, NC, EPA approved lab, shipping samples overnight express on dry ice (180 x \$352=\$63,600; +\$225 x 24=\$5,400= total=\$70,000); UM Soil testing lab 180 samples x \$25=\$5,000	\$51,000				\$24,000				\$75,000
Equipment/Tools/Supplies: Research supplies Bumblebee colonies 30@\$120 each =\$4,000; bee food, \$1,000; <i>Osmia</i> bees, lacewings, lady beetles, monarch butterflies, parasitoids for experiments and insecticide tests, \$12,000; greenhouse space for research \$140/mo x 36mos=\$6,000; flowering plants, (plugs, pots, soil, fertilizers) \$1,000; insecticides, \$1,000; UM field charges, \$1,000	\$13,000				\$12,000				\$25,000
Printing: Outreach bulletins for distribution at meetings, University contract printing at Kinko \$0.11BW/pg x6 pg=\$0.66 x 500=\$330 x 4bulletins=\$1,300 + other handouts=\$2,000; peer-review article publication costs journal \$2,000	\$2,000				\$2,000				\$4,000
Travel: Instate travel (mileage) to research sites. Three tentative field sites for restoration research, Brainerd, Chaska, Stillwater, rental car, one year: 2 wks/mo x 5 mos=10 x \$260/wk= \$2,600 x \$01.7mi/UM fee=\$442+\$2600=\$3,042/yr x 2yrs=\$6,100/field; Instate travel to outreach activities: 2 Workshops at arboretum and 10 talk=20 days x \$45/day=\$900	\$5,000				\$2,000				\$7,000
	\$210,000				\$190,000				\$400,000

2017 LCCMR Project Title: Promoting conservation biocontrol of beneficial insects
Project PI: Vera Krischik, Department of Entomology, University of Minnesota

Activity 1A: Conservation biocontrol in restorations. Research and outreach educational programs will be performed to conserve beneficial insects by researching different cultural tactics in restorations.

			
Best type of overwintering 'banks' for predatory beetles.	Best seasonal mowing times to increase flowering.	Best seasonal time to remove dead plants to conserve native stem nesting bees.	Best larval host plants for MN bees and butterflies.

Activity 1B: Conservation biocontrol in restorations. Wild flowers in restorations will be investigated for pesticide residue levels that may affect beneficial insect conservation.

				
INPUT: Pesticide residues and salt from beet brine deicers may accrue in wild flowers.	INPUT: Pesticide residues from mosquito abatement may accrue in wild flowers.	INPUT: Pesticide residues from crop protection may accrue in wild flowers.	Pesticide residues in wild flowers in restorations.	Pesticide residues in milkweed and other wild flowers along roadsides.

Activity 2: Beneficial insect friendly pesticides. Research and outreach educational programs will be performed to conserve beneficial insects by researching EPA registered pesticides that conserve beneficial insects that can be used in propagation and in restorations. Data is needed on pesticide efficacy.

			
Leaf cutter bees are important pollinators of crops and wild flowers.	Leaf cutter bees collect leaves for larvae to eat and store in ground nests.	Insecticides used to control pests create toxic leaves.	Use bee friendly Acelepryn for crops, turf and flowers instead.

Promote the research results with websites, webinars, bulletins, listserves, and peer-reviewed publications. Visit Krischik's pollinator conservation websites: <http://cues.cfans.umn.edu/old/>; <http://www.arboretum.umn.edu/P3Pesticides2.aspx>; <http://ncipmhort.cfans.umn.edu/>; <http://www.extension.umn.edu/garden/plant-nursery-health/>; <http://www.entomology.umn.edu/faculty-staff/vera-krischik>