Environment and Natural Resources Trust Fund

M.L. 2021 Approved Work Plan

General Information

ID Number: 2021-164

Staff Lead: Corrie Layfield

Date this document submitted to LCCMR: July 21, 2021

Project Title: Invasive Species Biocontrol in Bee Lawns and Parklands

Project Budget: $425,000

Project Manager Information

Name: Vera Krischik

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Reporting

Date Work Plan Approved by LCCMR: July 20, 2021

Reporting Schedule: December 1 / June 1 of each year.

Project Completion: June 30, 2024

Final Report Due Date: August 14, 2024

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 06d

Appropriation Language: $425,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to establish a biocontrol program to manage the invasive Japanese beetle in a way that reduces insecticide use in bee lawns and pollinator restorations and the associated economic and environmental costs to wildlife and humans.

Appropriation End Date: June 30, 2024

Narrative

Project Summary: The proposed research and outreach program is to establish a biocontrol program to manage the invasive, exotic Japanese beetle to reduce insecticide use in bee lawns and parks.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

The Minnesota Department of Agriculture and the Minnesota Department of Natural Resources list Japanese beetle (JB, Popillia japonica) as a highly destructive, invasive exotic pest (USDA 2017, CAB 2005). Since introduction from Japan in 1916, JB has been defoliating over 300 species of plants

JB damages flowers, fruits, and foliage, which results in decreased food resources for bees and other wildlife. However, the spraying of insecticides on lawns for JB grubs and on plants and flowers for adults probably results in more non-targeted deaths of pollinators than the JB damage itself. Fortunately, JB has a natural biocontrol agent that was discovered in 1988 in Connecticut (Hanula and Andreadis 1988) that could be introduced into MN. This microsporidian (fungal) pathogen (Ovavesicula popilliae) was studied at Michigan State University (MSU) (Perry et al. 2013, Smitley 2011) and was released in four states. Research is needed to survey greater MN for the presence of both Japanese beetles and the pathogen, which was found in one locale in MN. Research is needed to identify, culture, and disseminate the biocontrol pathogen. Until the pathogen can be established, an integrated pest management program that identifies unintended impacts of current insecticides on pollinators needs to be developed.

What is your proposed solution to the problem or opportunity discussed above? i.e. What are you seeking funding to do? You will be asked to expand on this in Activities and Milestones.

Our proposed solution is to reduce economic and environmental damage caused by the exotic JB through two approaches: one short term and one long term. For long term, we will survey Minnesota for the presence of Japanese beetles and their possible infection by a beneficial pathogen called Ovavesicula popilliae. This pathogen was first described in Connecticut and infects JB tubules and spreads systemically (Andreadis and Hanula 1987). Research shows the fungus kills 25 to 50 percent of JB grubs. After obtaining approval from the Minnesota Department of Agriculture and the US EPA, we propose to establish this fungus statewide using a nursey system to supply volunteers from various organizations like Master Gardeners with infected beetles as well as using JB traps, after testing confirms this as an appropriate pathogen dispersal method.

Since it may take a long time for the natural pathogen to establish, we will develop near term practices as well. We will test four current EPA registered microbial insecticides and three conventional insecticides in the lab and field for efficacy of killing JB adults and grubs and for unintended impacts on pollinator species, like bumble bees. The information will be developed into outreach bulletins posted at our website.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

The long-term outcomes of the project are to develop a biocontrol program for the invasive JB, which will reduce insecticide applications in urban areas, especially lawns and restorations planted to support pollinators. In the short-term, the goal is to use EPA registered microbial insecticides and other bee friendly insecticides, that conserve pollinators, to control JB. We developed an advisory board from MN Department of Agriculture, Lawn to Legumes program, Golf Course Superintendents Association, Michigan State University researchers, MN Nursery and Landscape Association, and Minneapolis Park and Recreation Board, that have offered park sites for research and outreach.

Project Location

What is the best scale for describing where your work will take place?

Statewide

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Pathogenic biocontrol in bee lawns and parklands

Activity Budget: $200,000

Activity Description:

Activity 1. Long term management. Survey the state of MN for the presence of O. popilliae, which will be identified through collaborations with Dr. Dave Smitley of Michigan State University. Work with Drs. Raj Mann and Mark Abrahamson of the MDA to authorize the release of O. popilliae at 10 sites; 4 demonstration sites at parks and 6 golf courses with high JB populations. These parks eventually will serve as nursery sites for spreading the pathogen throughout Minnesota. Once the pathogen is established, we will work with outreach groups such as Master Gardeners and Master Naturalists to distribute and monitor JB pathogen establishment. We will continue checking the one positive location for O. popilliae in Minnesota and work with MSU to determine if it is any different than populations from MSU that have been released in other states (CO, KY, AR and KS). Monitor pathogen infection levels at introduction sites (10 sites: 4 parks and 6 golf courses), and monitor JB population levels at pathogen nursery sites and control sites located 5 - 10 km away.

Activity Milestones:

Description	Completion Date
3. Approval from MDA to release the pathogen	June 30, 2024
2. Conduct 40 surveys on pathogen and JB distribution in MN.	June 30, 2024
1. Receive training in identifying O. popilliae at Michigan State University; establish Krischik lab	June 30, 2024
4. Release pathogen at approved nursery sites	June 30, 2024
5. Perform lab trials to determine pathogen efficacy and spread.	June 30, 2024
6. Quantify number infected grubs and adults after pathogen release.	June 30, 2024

Activity 2: Biocontrol in bee lawns and parklands using IPM

Activity Budget: $225,000

Activity Description:

The efficacy of new EPA approved microbial insecticides and new conventional insecticides for killing JB will be researched. Also, It will be determined if these insecticides are friendly to bees when used for JB grub control on bee lawns and JB adult control on flowers. EPA registered microbial insecticides for bioassays are GrubGone (Bacillus thuringiensis galleriae, BTG, recently available), a soil-applied fungus Beauveria bassiana, parasitic nemaotdes Steinernema scarabaei (Nemagard, recently available), and bee friendly Acelepryn (chlorantraniliprole) compared to standard neonictoinoids (imidacloprid, MeritG and clothianidin, ArenaG). The effects of these microbial insecticides on Bombus impatens, bumblebees and Osmia, mason bees, will be performed in large tents in the greenhouse with label rates of microbes sprayed over artificial feeding stations containing pollen and nectar that the bees will collect for their nests. We have done these bioassays many times for our research and are proficient and collect viable data on the effects of label rates of insecticides on bee colony health. In addition, we will study whether commercially available JB traps can be used to disseminate BTG, as a model system for dispersing Ovavesicula. We will evaluate the correct timing for applying these insecticides while causing the least amount of pollinator harm.

Activity Milestones:

Description	Completion Date
1. Determine if the EPA registered microbial pathogens and bee friendly insecticides conserve pollinators.	June 30, 2024
2.Understand the efficacy of bee friendly EPA registered insecticides on JB grubs and adults.	June 30, 2024

3. Determine if JB traps can disseminate pathogens.	June 30, 2024
4. Outreach: Install demonstration education programs at key parks to promote the IPM and biocontrol	June 30, 2024

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Dr. David Smitely	Michigan State University	Dr. Smitley is a Professor and Past Head of the Department of Entomology at Michigan State University. He has worked for the last 10 years on understanding how the fungal pathogen can be identified and surveyed. A Post Doc trained at MSU will bring the research program back to Minnesota.	Yes

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.
The research and outreach program will help mitigate decline of native bees and beneficial insects that control pest insects. The USFWS identified insecticides and bee pathogens as a major factor contributing to the decline of the urban dwelling endangered rusty-patched bumblebee, Bombus affinis. Research on the natural occurring pathogen of JB will help manage JB populations and it does not affect pollinators. In park lands, restorations, and bee lawns site specific IPM programs are needed to control pests and conserve good insects. The IPM programs will be posted on two websites: the CUES CFANS college website http://cues.cfans.umn.edu; and the Conservation biocontrol: IPM and pollinators website http://ncipmhort.cfans.umn.edu/.

Outreach programs will be delivered through educational bulletins, websites, blogs, field days, demonstration projects at parks, talks in annual pesticide workshops, and talks in commodity workshops. Master Gardeners, Master Naturalists, and other groups will be identified as participants and will be asked to help with information dissemination.

The Advisory Board will meet by Zoom twice a year to discuss the research and outreach programs. The advisory board consists of members from MN Department of Agriculture, MN Department of Natural Resources, Minneapolis Park and Recreation Board, Golf course Superintendents Association, MN Nursery and Landscape Association, county parks, and NGOs. These members already volunteered sites for research and outreach demonstration projects. The research and outreach program will help mitigate decline of native bees and beneficial insects that control pest insects. All products and demonstration projects will give credit to the ENTRF funding in writing and with the icon of the loon.

Advisory Committee members and Participants contacted for Zoom meeting April 7 + Sept 24 2020
Advisory Committee:
Roberta Groening, Minneapolis Park & Recreation Board
Jeremy Barrick, Minneapolis Park & Recreation Board
Kaitlin Ryan, Minneapolis Park & Recreation Board
Mark Abrahamson, MDA
Raj Mann, MDA
Dan Shaw, MN DNR, Minnesota Board of Water and Soil Resources
Jack MacKenzie, Minnesota Golf Course Superintendents' Association
Jim Calkins, Research Information Director, Minnesota Nursery and Landscape Association (MNLA)
Dan MacSwain, Natural Resource Coordinator, Washington County Public Works Department
Steve Ellis, Be keeper
Laurie Schneider, Pollinator Friendly Alliance

Participants:
Jennifer Vieth, Carpenter Nature Center
Matthew Lagus, UM

Mark Hansen,Christmas Tree Growers
Daniel Whitney, MN Beekeeper
Laurie Schneider, NGO
Mary Meyer, UM
Sarah Foltz Jordan, Xerces Society
Erin Rupp, NGO
Nick Partington, UM
Julia Ponder, UM
Roy, Charlotte, DNR
Sarah Rudolf, MPCA
Patria Hauser, NGO
Sarah Pennington, DNR
Erin Raupp, NGO
Master Gardeners
Master Naturalists

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this be funded?

The research and outreach program will help mitigate decline of native bees and beneficial insects that control pest insects. New IPM programs will be implemented that employ microbial insecticides, such as BT galleriae (bacteria specific to JB grubs), Ovavesicula (fungus specific to JB grubs), and chlorantraniliprole, (Acelepryn insecticide friendly to bees). The USFWS identified insecticides in bee habitat as a major factor behind the decline of the urban dwelling rusty-patched bumblebee. MN efforts to increase restorations and bee lawns also need site specific IPM programs to control pests in these restorations. Future grants will be pursued for project continuation.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Understanding Systemic Insecticides as Protection Strategy for Bees	M.L. 2014, Chp. 226, Sec. 2, Subd. 06b	$326,000
Promoting Conservation Biocontrol of Beneficial Insects	M.L. 2017, Chp. 96, Sec. 2, Subd. 08b	$400,000

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Project investigator		Perform research, outreach, and financial administration.; Principal Investigator 36.5%Fringe, Fringe/Benefits = $319/$874= $1,193/yr for 3yrs=$3,579			36.5%	0.03		$3,579
Undergraduate research associate		Help with research and outreach programs			0%	0.3		$6,281
Research associate 2		Perform research and outreach programs			31.8%	3		$151,740
Post Doc		Direct and perform research and outreach programs			25.4%	2		$125,400
							Sub Total	**$287,000**
Contracts and Services								
Michigan State University, Dr. Dave Smitley lab	Professional or Technical Service Contract	Funds for training to identify the pathogen by morphological and chemical methods; training in pathogen rearing; training in pathogen detection and establishment in the field. Includes costs for chemicals and equipment, such as staff training $15,000; ID fungus @ $10/ JB x 1,500=$15,00.Total=$30,000		X		0.48		$30,000
USDA National Standards Lab, Gastonia NC Residue analysis of insecticides	Professional or Technical Service Contract	Funds for USDA Gastonia NC does pesticide analysis for a fee. We have used their services in all our grants to verify the solutions and LC50 of leaf tissue used in bioassays. Costs $130/sample x 38 samples=$5,000 This is a sole source lab with competive national prices..		X		3		$5,000
							Sub Total	**$35,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	Lab equipment to identify the pathogens, field equipment to release and survey the pathogens. Lab and field equipment to test the efficacy of the 4 EPA	Establish and maintain the pathogen Ovavesicula and perform research in					$62,000

		registered insecticides for research and in demonstration projects. Rent UM greenhouse for 3 years. Equipment/Tools/Supplies: Research supplies greenhouse space for research $500/mo x 36mos=$18,000; purchased sod for JB grubs= $4,000; insecticides= $2,000; UM field plot charges=$1,000; Elisa development reagents, buffers, glassware, equipment= $18,000; ultralow freezer to store samples=$3,400;JB traps and collection supplies= $4,000; containers, netting=$5,000; Bombus colonies, $6,600. Total = $62,000	the lab and field on efficacy and establishment.					
	Tools and Supplies	Supplies to make demonstration programs at 4 sites, such as parks and UM experiment station grounds, parks using permanent signs with handouts. At each site a plot 20ft x 10ft will be made of a bee lawn, non-removal Japanese beetle trap, 3 large signs explaining biocontrol and IPM of JB at each site. Costs are signages around $1,500 each x 4 sites =$6,000. Creating plots will cost $500 x 4= $2,000. Bee lawns will be created using plugs of grasses and nectar plants to create a bee lawn, as seeds will take too long to establish and for sterling panels to kill current grass ,compost, fertilizer, plant plugs, hoses, sprinklers, watering wands, vertical sign posts, drills to install signs, mail boxes to hold handouts, and visual aides, such as JB traps tethered to the vertical posts.	Supplies to make demonstration programs at 4 sites, such as parks and UM experiment station grounds, parks using permanent signs with handouts. At each site a plot 20ft x 10ft will be made of a bee lawn, non-removal Japanese beetle trap, 3 large signs explaining biocontrol and IPM of JB at each site. Costs are signs around $1,500 each x 4 sites =$6,000. Creating plots will cost $500 x 4= $2,000. Bee lawns will be created using plugs of grasses and nectar plants to create a bee lawn, as seeds will take too long to establish and for sterling panels to kill current grass ,compost, fertilizer, plant plugs, hoses, sprinklers, watering wands, vertical sign posts, drills to install signs, mail boxes to hold handouts, and visual aids, such as JB traps tethered to the vertical posts. Total = $8,000					$8,000
							Sub Total	**$70,000**
Capital Expenditures								
							Sub Total	**-**

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Instate travel to research sites, demonstration sites, meetings, trapping JB in TC and greater MN, and development of 3 outreach demonstration sites Minneapolis, Chaska, Stillwater; UM rental car $988 for 3 months=$2,964 + mileage $0.17/mi x 2,000 mi=$340 = $3,304/yr for 3 yrs=$9,912; hotel and per diem for overnights for 12 nights ($76/diem + $100/lodging=$176) = 2,112. Total=$12,000	Instate travel to research sites, demonstration sites, meetings. Renting UM car, mileage, per diem, hotel					$12,000
							Sub Total	**$12,000**
Travel Outside Minnesota								
	Miles/ Meals/ Lodging	Air Fare $336 x4 trips =$1,344; $56/diem+$106 lodging=$162/day for 34 days=$5,508. Total=$7,000	Outstate travel to receive training on pathogen identification and survey techniques: Training at MSU to learn molecular techniques and field work. Training is only possible at MSU.	X				$7,000
							Sub Total	**$7,000**
Printing and Publication								
	Printing	Costs associated with demonstration site signage, posters, and handouts	Educational program for consumers and professional landscape managers to use pollinator friendly management programs for JB. Research based bulletins for distribution at meetings, University contract printing at Kinko $0.18 color/pg x 6 pg=$1.10 x 1,000=$1,100 x 6 bulletins=$6,600					$6,600
	Publication	Page costs associated with publishing research in peer reviewed publications.	Fees associated with publishing in professional journals.; peer-review article publication costs =3@$2,000 each=$6,000					$6,000

							Sub Total	**$12,600**
Other Expenses								
		Mailing samples and supplies	Mail samples to USDA for residue analysis and shipping JB to MSU, $100/box for 14 boxes=$1,400					$1,400
							Sub Total	**$1,400**
							Grand Total	**$425,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Contracts and Services - Michigan State University, Dr. Dave Smitley lab	Professional or Technical Service Contract	Funds for training to identify the pathogen by morphological and chemical methods; training in pathogen rearing; training in pathogen detection and establishment in the field. Includes costs for chemicals and equipment, such as staff training $15,000; ID fungus @ $10/ JB x 1,500=$15,00.Total=$30,000	The Smitely lab at Michigan State University will bill the University of Minnesota a fee that includes costs for lab technician time, reagents, and equipment usage. The fee will be similar in principle to what we were charged in previous LCCMR grants by the USDA AMS National Standards Science Lab in Gastonia, NC with Dr. Jonathan Barber for pesticide residue analysis. Pesticide residue analysis also uses expensive analytical equipment that takes technician time, reagents, and equipment usage. We will make sure that the charges are justifiable for the research. This is a sole source lab. The costs will be appropriate as it is a sole source lab, we are cooperating as researchers in writing papers together, and we are cooperating with the USDA APHIS Otis lab, at Buzzards Bay, MA with Dr. Phil Lewis and so there is oversightof the charges. This is the only lab in the US that analyzes samples for the microbial fungal pathogen Ovavesicula that kills Japanese beetles. **This is a single source contract.**
Contracts and Services - USDA National Standards Lab, Gastonia NC Residue analysis of insecticides	Professional or Technical Service Contract	Funds for USDA Gastonia NC does pesticide analysis for a fee. We have used their services in all our grants to verify the solutions and LC50 of leaf tissue used in bioassays. Costs $130/sample x 38 samples=$5,000 This is a sole source lab with competive national prices..	The USDA AMS National Standards Science Lab in Gastonia, NC with Dr. Jonathan Barber is the only lab in the US that analyzes samples for pesticide residue and certifies the result according to EPA Best Management Lab Practices. This is a sole source lab and no other federal, state, or private business offers residue analysis, sample safety, and certification are available. **This is a single source contract.**
Travel Outside Minnesota	Miles/Meals/Lodging	Air Fare $336 x4 trips =$1,344; $56/diem+$106 lodging=$162/day for 34 days=$5,508. Total=$7,000	The grant requires the Post Doc to go to Michigan State University to the lab of Dr. David Smitely to learn how to identify the pathogen by molecular methods, since using microscopes and morphology has high error rates and takes time. Only in Dr. Smitely's lab can we learn the research. The Post Doc will develop in MN the techniques to identify the pathogen. Also, the Post Doc will learn how to survey the pathogen in the field and perform experiments on efficacy that Dr. Smiley has developed. We need to establish this pathogen in MN and we have a unique opportunity thru collaboration with MSU to do this. Establishing the pathogen in MN will reduce JB numbers and economic and environmental costs.

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
Cash	Federal money to the MDA called Specialty Grants to fund state research on plants and pest management.	Future grants will be pursued for project continuation.	Potential	$50,000
In-Kind	55% indirect cost waiver fee=$119,300 x 55%=$65,615	Cost sharing by PI of salary and fringe	Secured	$65,615
			State Sub Total	**$115,615**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$115,615**

Attachments

Required Attachments

Visual Component

File: 9f60d5d0-a76.pdf

Alternate Text for Visual Component

Research, outreach education, and demonstration projects to conserve pollinators by using biocontrol with a native fungus to control the exotic Japanese beetle in bee lawns, parks, and restorations....

Optional Attachments

Support Letter or Other

Title	File
2020-164 Krischik Invasive Species Biocontrol of Bee Lawns and Parklands cv	1f147900-51c.pdf
LCCMR APRROVED_2021-164 Krischik Updated Research Addendum (4) March18	bf2f0320-bfe.docx
Background check Certification Form for ENTRF Funding Recipients	4bc53662-5a6.pdf

Media Links

Title	Link
Krischik UM website: Pollinator Conservation and IPM	http://ncipmhort.cfans.umn.edu/
Krischik UM website: UM CFANS CUES	http://cues.cfans.umn.edu/

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

budget updated to $425,000 limit; activities made clearer

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I agree to the UMN Policy.

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

UNIVERSITY OF MINNESOTA
Driven to Discover®

2021-2024 LCCMR, Biocontrol in bee lawns and parklands

Vera Krischik, Department of Entomology, Univ. Minnesota, krisc001@umn.edu, 612.625.7044, https://ncipmhort.dl.umn.edu, cues.cfans.umn.edu/

Activity 1: For long-term management and biocontrol of exotic Japanese beetle, *Popillia japonica*, a host specific and native fungal pathogen called *Ovavesicula popilliae* needs to be cultured and released. Beetles collected in MN were studied by Michigan State University and the pathogen was found in low numbers in MN. Surveys will reveal the pathogens presence statewide in MN. The pathogen will be cultured, distributed, and its efficacy evaluated through research.

First introduced to the US from Japan in 1916, Japanese beetle was commonly found in MN by the 1990's. Adult feeding by Japanese beetles result in damage to foliage and fruits and reduction in food for bees and wildlife.

Japanese beetles feed on pollen and ovaries of flowers depriving bees of food. Flowers that are damaged will not make fruits, such as berries, for wildlife.

The long term research outcome is to establish an endemic pathogen to kill Japanese beetle. The pathogen *Ovavesicula popilliae* was first described in CT and was introduced by researchers into MI, KY, AR, and KS.

Results shows that infected grubs are between 25 to 50 % less likely to survive winter. Populations of beetles decrease by 60 % in 5 years. The pathogen has been found in MN thru collaboration with Michigan State University.

Activity 2: For short-term management, research on the efficacy of new EPA approved microbial products, GrubGone (*Bacillus thuringiensis galleriae*), soil applied fungus *Beauveria bassiana*, parasitic nematodes, and bee-friendly insecticide chlorantraniilprole will be studied. The outcome will be site specific IPM protocols, demonstration projects in parks, and educational programs for outreach to increase implementation.

Bee lawns have been established in MN in state and local programs to help provide habitat and flower resources to native bees, butterflies, and endangered rusty patched bumblebee.

The most common exotic pest of bee lawns is Japanese beetle. The highest use of insecticides in urban areas is to control Japanese beetle as adults on plants and grubs in the soil under grass.

Research on IPM and biocontrol to manage Japanese beetle and protect pollinators is needed. Demonstration projects in parks will help with IPM adoption.

Outcomes are to provide IPM management that protects pollinators in established bee lawns and restorations using biocontrol to reduce non-target effects from insecticides for native pollinators and beneficial insects.