



Environment and Natural Resources Trust Fund (ENRTF)

M.L. 2020 ENRTF Work Plan (Main Document)

Today's Date: 08/19/2019

Date of Next Status Update Report: April 1, 2021

Date of Work Plan Approval:

Project Completion Date: June 30, 2023

Does this submission include an amendment request?

PROJECT TITLE: Bee Minnesota – Protect our Native Bumblebees

Project Manager: Dr Declan Schroeder

Organization: University of Minnesota

College, Department, or Division: Veterinary Population Medicine

Mailing Address: 225 Veterinary Medical Center, 1365 Gortner Ave

City, State, Zip Code: St Paul, MN, 55108

Project Manager Direct Telephone Number: 612-626-1916

Email Address: dcschroe@umn.edu

Web Address: <https://vetmed.umn.edu/bio/veterinary-population-medicine/declan-schroeder>

Location: state wide

Total Project Budget: \$650,000

Amount Spent: \$0

Balance: \$650,000

Legal Citation: M.L. 2020, Chp. xx, Sec. xx, Subd. xx

Appropriation Language:

PROJECT STATEMENT:

Our goal is to protect native pollinators from risk of disease transmission and population declines. By screening and neutralizing bee pathogens we wish to promote best management practices to maintain honey bee health and prevent pathogen spillover into native bee populations. Native bumblebees, *Bombus* spp., are important pollinators of wild flowering plants and crops such as tomatoes and berries, and are appreciated for their beauty. Unfortunately, five of Minnesota's twenty-three species of native bumblebees are considered vulnerable, endangered, or critically endangered by the International Union for Conservation of Nature. The global decline in bee populations has been attributed to habitat loss, pesticides, parasites, and **pathogens**. For some bumblebee species, a leading problem may be infectious diseases. For example, the spread of the bumblebee pathogen, *Nosema bombi*, exacerbated through commercial rearing and distribution of *Bombus impatiens* across the U.S., was associated with declining bumblebee species. Another emerging threat is viral pathogen transmission among pollinator species as they forage on common flowers. For example, there is evidence that Deformed wing virus (DWV), may be transmitted from honey bees to bumblebees if diseased honey bees deposit viruses on flower parts (spillover) and other bees subsequently pick them up when visiting the same flowers. Very little is known about pathogen prevalence in bumblebees in Minnesota. To first understand and then mitigate further declines in these important pollinators, it is critical to collect baseline data on archetypal pathogens in our local populations of honey bees and bumblebees. Finding a solution or even a cure to bee pathogens is a high priority for our assembled team; therefore, we propose to run an innovative pilot study in an attempt to neutralize DWV. Finally, we will protect our native pollinators by educating beekeepers about the critical "public health" need to keep managed bees as healthy as possible.

II. OVERALL PROJECT STATUS UPDATES:

First Update April 1, 2021

Second Update October 1, 2021

Third Update April 1, 2022

Fourth Update October 1, 2022

Fifth Update April 1, 2023

Final Report between project end (June 30) and August 15, 2023

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1 Title: Screen for Deformed Wing Virus (DWV) and Nosema in bumblebees and quantify potential for virus transmission between honey bees and bumblebees.

Description: There is potential for pathogens to be transmitted from honey bees to bumblebees while foraging on flowers, but the extent of this transmission in nature has not been explored. In three locations where we manage honey bee colonies (8 colonies per location: Minneapolis, the MSP airport, and in Rochester), we will use a new sequencing assay, first developed in the Schroeder Lab, to quantify the prevalence and abundance of DWV and Nosema in three species of bumblebees collected while foraging. We also will monitor pathogen load in honey bees foraging on the same species of flowers during early, mid, and late summer and throughout the year in our managed honey bee colonies. Furthermore, we will also set out pathogen-free *Bombus impatiens* colonies (reared from wild-caught queens) in the same locations to monitor possible infection over the season, and how the infection affects their health and reproduction.

ACTIVITY 1 ENRTF BUDGET: \$475,000

Outcome	Completion Date
1. Screen for presence of DWV and Nosema in three common bumblebee species and surrounding honey bee colonies	<i>October 2022</i>
2. Monitor potential for virus transmission into <i>B. impatiens</i> colonies placed near honey bee colonies, and if pathogen is found, quantify effects on bumblebee colony health	<i>December 2022</i>

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ACTIVITY 2 Title: Explore potential to neutralize DWV in bees.

Description: Run laboratory-based cage and cell culture assays to determine if DWV can be neutralized in honey bees and bumblebees. It was recently reported that an effective treatment for a related virus of DWV, namely Sacbrood virus, was discovered. This treatment is based on a specific antibody raised from egg yolk against the virus which was used to immunize honey bee pupae. This work will be repeated here to determine whether DWV can be neutralized in both honey bees and bumblebees. Antibody synthesis, formulation, and production will be carried out in collaboration with Dr Ben Hause (vaccine production specialist).

ACTIVITY 2 ENRTF BUDGET: \$88,500

Outcome	Completion Date
1. Preparation, synthesis, formulation, and testing of DWV specific antibodies in honey bee and bumblebee tissues	<i>July 2021</i>
2. Application of DWV antibodies in caged honey bees and bumblebees	<i>May 2022</i>

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Fourth Update October 1, 2022

Fifth Update April 1, 2023

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ACTIVITY 3 Title: Beekeeper and community “public health” education about native and non-native bees in Minnesota.

Description: Minnesota’s bee diversity boasts over 450 species and includes both native and non-native, managed and wild species. While we recognize the important role of managed honey bees in Minnesota, it is critical to provide outreach regarding the value of our native bee pollinators and how unmindful bee management might negatively impact native bee health. We propose an educational campaign (Bee Minnesota) that increases understanding of the roles of native and managed bees in Minnesota. Additionally, we will engage backyard beekeepers in the cities of Minneapolis and

Rochester to participate as beekeeper citizen scientists via pathogen and pest sampling in their honey bee colonies. Everyone will be kept updated as to progress made throughout the project by means of a well-managed and curated website.

ACTIVITY 3 ENRTF BUDGET: \$86,500

Outcome	Completion Date
1. Provide education via a bee public health campaign to promote practices and policies that support wild, native bees	<i>April 2023</i>
2. Establish and disseminate updated beekeeping best management practices to protect wild, native bees in Minnesota	<i>June 2023</i>

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IV. DISSEMINATION:

Description: also see ACTIVITY 3

The Bee Lab and Bee Squad manage several active social media channels as well as a website and an electronic newsletter. In addition to using these communication tools to disseminate project data, D. Schroeder, M. Spivak, E. Evans, R. Masterman and several Bee Squad team members frequently present to both the public and beekeepers throughout Minnesota. Both E. Evans and R. Masterman are Extension Educators within Minnesota Extension. They will disseminate information using well developed communication channels within the Minnesota Extension system

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the [ENRTF Acknowledgement Guidelines](#).

First Update April 1, 2021

Second Update October 1, 2021

Third Update April 1, 2022

Fourth Update October 1, 2022

Fifth Update April 1, 2023

Final Report between project end (June 30) and August 15, 2023

V. ADDITIONAL BUDGET INFORMATION:

A. Personnel and Capital Expenditures

Explanation of Capital Expenditures Greater Than \$5,000:

Explanation of Use of Classified Staff:

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours for entire duration of project: 13582.4hrs	Divide total personnel hours by 2,080 hours in 1 yr = TOTAL FTE: 6.53
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Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:

Enter Total Estimated Contract Personnel Hours for entire duration of project: 480 hrs	Divide total contract hours by 2,080 hours in 1 yr = TOTAL FTE: 0.23
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VI. PROJECT PARTNERS:

- A. Partners outside of project manager's organization receiving ENRTF funding: Dr Ben Hause (Tallgrass Biologics LLC) & a website design company (TBD)
- B. Partners outside of project manager's organization NOT receiving ENRTF funding: n/a

VII. LONG-TERM- IMPLEMENTATION AND FUNDING:

The Bee Lab at the University of Minnesota has an active Extension and Outreach program run by Dr. Rebecca Masterman (honey bees) and Dr. Elaine Evans (native bees, especially bumblebees) who will continue to disseminate results after project completion. Drs. Schroeder and Spivak will publish research findings and present to scientific communities. Funds from this project will build on federal resources being used to pursue these goals, greatly expanding the scope of our efforts.

VIII. REPORTING REQUIREMENTS:

- Project status update reports will be submitted April 1 and October 1 each year of the project
- A final report and associated products will be submitted between June 30 and August 15, 2023

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

- A. Budget Spreadsheet
- B. Visual Component
- C. Research Addendum

Attachment A: Project Budget Spreadsheet
 Environment and Natural Resources Trust Fund
 M.L. 2020 Budget Spreadsheet

Legal Citation:

Project Manager: Dr Declan Schroeder

Project Title: Protect our Native Bumblebees

Organization: University of Minnesota

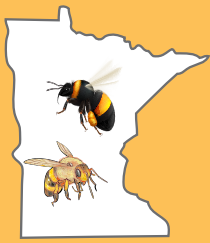
Project Budget: \$650,000

Project Length and Completion Date: 3 years, 06/30/2023

Today's Date: 03/15/2019



ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
BUDGET ITEM				
Personnel (Wages and Benefits)		\$ 466,743	\$ -	
Project manager (Pathogen specialist): Dr Declan Schroeder, 0.15 FTE yr 1, 0.1 FTE yrs 2 and 3, 36.0% fringe = \$67,698				
Project partner (Bee specialist): Dr Marla Spivak, 0.01 FTE, 3 years, 36.0% fringe = \$3,957				
Project partner (Bumblebee specialist): Dr Elaine Evans, 0.2 FTE, 3 years, 36.0% fringe = \$51,531				
Project partner (Beekeeper & Community Education officer): Dr Rebecca Masterman, 0.2 FTE, 3 years, 36.0% fringe = \$56,294				
Molecular biologist - Post Doc: 1.0 FTE, 3 years, 24.3% fringe = \$187,901				
Molecular lab research technician : 0.5 FTE, 2 years, 29.5% fringe = \$44,470				
Bee field technicians & Public campaign - 5 members of the Bee Squad: 4 @ 0.10 FTE yrs 1-2 and 0.03 FTE yr3; 1@ 0.01 FTE for 3 years; 29.5% fringe = \$54,892				
Professional/Technical/Service Contracts			\$ -	\$ -
Contract with Tallgrass Biologics for the synthesis, formulation & preparation of antibodies to cure bees. Tallgrass Biologics has a pending patent on the technology to be used in this study.		\$ 10,000		
Website to be designed by Bee Minnesota staff in collaboration with a third party (TBD) aimed specifically for LCCMR, beekeepers & general public in mind. Objective is to keep everyone updated and informed as to progress and conclusions reached throughout the duration of the project.		\$ 2,500		
Equipment/Tools/Supplies				\$ -
Field supplies (traps, nets, tubes, specimen preservation etc.)		\$ 8,800		
Pathogen screening molecular consumables (Nucleic acid extraction, molecular grade chemicals, RT-PCR, NGS sequencing etc.) for 2,250 bee samples		\$ 119,200		
Pathogen neutralization molecular consumables (cell lines, cages, RT-PCR assays & Sequencing)		\$ 35,702		
Capital Expenditures Over \$5,000		\$ -	\$ -	\$ -
Fee Title Acquisition		\$ -	\$ -	\$ -
Easement Acquisition		\$ -	\$ -	\$ -
Professional Services for Acquisition		\$ -	\$ -	\$ -
Printing			\$ -	\$ -
Leaflets		\$ 1,375		
Scientific publications		\$ 2,000		
Travel expenses in Minnesota			\$ -	\$ -
Approximately 4350 miles @ mileage rate of 0.58/mile - official UMN reimbursement rate, for field sample collection		\$ 2,530		
Approximately 2000 miles @ mileage rate of 0.58/mile - official UMN reimbursement rate, for beekeeper recruitment, outreach and communication		\$ 1,150		
Other				
			\$ -	\$ -
COLUMN TOTAL		\$ 650,000	\$ -	\$ -
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT				
	Status (secured or pending)	Budget	Spent	Balance
Non-State: General Mills		\$ 100,000	\$ -	
State:		\$ -	\$ -	\$ -
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS				
	Amount legally obligated but not yet spent	Budget	Spent	Balance
		\$ -	\$ -	\$ -



BEE MINNESOTA

Protect our Native Bumblebees

I. Screening honey bees and bumblebees for pathogens



1. Pathogens from honey bees onto flowers
2. Bumble bees visit same flowers
3. Pathogen spillover



Pathogens pose a serious risk to declining bumblebees, such as the Rusty Patched Bumblebee.

II. Disease Prevention



Vaccination of bees against pathogens

III. Public Bee Health



Sharing information to increase health of honey bees and native bees

