



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2013 Work Plan

Date of Status Update Report: October 2, 2013

Date of Next Status Update Report: January 2014

Date of Work Plan Approval: June 11, 2013

Project Completion Date: June 30, 2016

Is this an amendment request? No

PROJECT TITLE: Bee Pollinator Habitat Enhancement

Project Manager: Marla Spivak

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Location: Ramsey Co, Carver Co, and Statewide

Total ENRTF Project Budget:

ENRTF Appropriation: \$200,000

Amount Spent: \$0

Balance: \$200,000

Legal Citation: M.L. 2013, Chp. 52, Sec. 2, Subd. 04h

Appropriation Language:

\$200,000 the first year is from the trust fund to the Board of Regents of the University of Minnesota to assess the potential to supplement traditional turf grass by providing critical floral plant resources to enhance bee pollinator habitat. This appropriation is available until June 30, 2016, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Bee Lawns: A Unique Way to Help Pollinators

II. PROJECT STATEMENT:

The goal of our proposed research is to develop an innovative way of helping bee pollinators while enhancing the environment and protecting natural resources. We are seeking options for turf areas that are not used for human recreation but are still maintained by mowing and intensive inputs of water, fertilizers and pesticides. Planting bee lawns would reduce these inputs and provide low-growing floral areas, which would beautify Minnesota and provide a creative model for a simple yet effective way to help pollinators and protect our natural resources.

Bee pollinators (honey bees, *Apis mellifera*, and over 400 species of native bees) are in trouble. Bee health is failing across MN and the nation due to a scarcity of bee-friendly flowers leading to nutritional deficiencies, chronic exposure to pesticides, and debilitating diseases, and parasites (Spivak et al., 2011). Bees play a key role in American agriculture through pollination; the U.S. grows more than one hundred crops that either need or benefit from pollinators with an economic value estimated at \$20 billion in 2000. The Upper Midwest states, including MN, ND and SD, are the top honey producing states in the nation. Commercial beekeepers transport their colonies to our region for the summer months for honey production after fulfilling pollination contracts in other parts of the nation. People are taking action to rectify the decline of pollinators by becoming beekeepers, reducing pesticide exposure to bees, and planting flowers to support the nutritional needs of all bees. Seed mixtures and designs for bee-friendly flower gardens are becoming prevalent across the nation. The National Resource Conservation Service and Farm Services Agency have implemented incentive programs for pollinator landscape enhancement through the 2008 Farm Bill, which are becoming increasingly popular. We propose to research the potential multiple benefits of a unique type of landscape - bee lawns - to support pollinators and reduce intensive inputs.

Turfgrass makes up a significant part of the urban landscape but provides no nutritional resources for pollinators. Some turf areas, such as those in out-of-play roughs on golf courses, cemeteries, large commercial properties and boulevards, are rarely used by people and primarily serve an aesthetic purpose. There is recent interest in the use of lower-input grasses in these turf areas as a way to reduce inputs of water, fertilizer, and pesticides (Watkins et al., 2011). Many of these areas may also be useful as bee lawns; i.e., a low-input turf area that also contains low-growing flowering plants that can be utilized by important bee pollinators. These low-growing flowering plants would need to have characteristics that contribute positively to a sustainable landscape that maintains turf function (slow vertical growth rate, contribution of nitrogen due to nitrogen fixation, ability to vegetatively reproduce in a perennial system, positive aesthetics in urban settings). Bee lawns would provide a natural buffer to water resources in areas where low-growing, more manicured looking lawns are preferred. Although this idea is novel, the use of non-turfgrass species in lawns is not. In the mid-20th century and before, white clover seed was often included in lawn seed mixtures in order to decrease the need for nitrogen fertilization. Before bee lawns can be recommended, we must research the correct grass-flower combination that would fulfill the requirements of a bee lawn (produces flowers useful to pollinators and tolerates mowing while maintaining the function and aesthetics of the turf).

We propose two activities: 1) Bee lawn evaluation trials, and 2) Public demonstration plots. Research will be conducted in 25 plots containing turfgrass-flowering plant combinations split between the St Paul campus and the University of Minnesota Landscape Arboretum. These research plots also will serve as demonstration plots for public viewing. In this way, we combine research and outreach in a transparent and effective way. People interested in growing a bee lawn can observe the progression of flowering through two years and choose among different flowering densities and turf options to suit their landscape needs and uses.

III. PROJECT STATUS UPDATES:

Project Status as of: January 2014

Project Status as of: September 2014

Project Status as of: March 2015

Project Status as of: December 2015

Final Report Summary:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: *Bee Lawn Evaluation Trials*

Description: This activity outlines our proposed research. We will evaluate a series of grasses in mixtures with low-growing flowering plants that can sustain growth within the turf, tolerate mowing and continue flowering after occasional mowing. We will evaluate low-input grasses (examples of species that could be tested include Chewings fescues, hard fescue, sheep fescue, tall fescue, and prairie junegrass - a native grass currently being improved for turf use at the University of Minnesota). The flowering plants we will evaluate include native low-growing forbs such as lanceleaf coreopsis, field mint (*Mentha arvensis*), and blue-eyed grass (*Sisyrinchium angustifolium*). Our consultation with Ron Bowen at Prairie Restoration, Princeton, MN, and Pollinator Specialists at Xerces Conservation Society indicate that it may be difficult to identify a variety of native species that can tolerate mowing and continue to bloom. Therefore we will also evaluate a series of low-growing, flowering non-native legumes (examples include alfalfa, Kura clover, white clover) that we know can withstand mowing. In all cases, we will ensure our floral selection does not contain species known to be highly invasive. The turf-floral evaluation trial will be established in late summer 2013 at both the St. Paul campus of the Univ. MN and also at the MN Landscape Arboretum. A total of at least 25 turfgrass-flowering plant combinations will be included. The species will be selected after thorough review of the literature and extensive consultation with horticulturalists with flowering plant expertise.

Plots will be planted in four replications in a randomized complete block design. Data will be collected through June 2015 on overall turf quality, floral abundance, freedom from turfgrass diseases, the ratio of grass to floral mixture over the years, and bee visitation rates (honey bee and native bees),. For most qualitative measurements (turf quality, disease incidence, color, etc.) a typical 1-9 visual scale will be used. In cases where a quantitative measure is more appropriate, we will use digital image analysis (drought stress, plot density, etc.) or the intersect grid method where a grid is overlaid onto the plot and data is collected at each grid intersect (this method is commonly used by turfgrass researchers and will be used for floral abundance and species composition measurements). Data will be analyzed to determine the top-performing mixtures. For bee visitation, native and honey bee visitation on the bee lawn plots will be monitored using standardized methods developed by Dr. Sam Droege of the USGS¹ and routinely used in the Spivak lab. We will sweep-net bees, using insect nets, along transects through each plot every 2 weeks through the growing season (April – September). In addition, pan (cup) traps will be placed along side of the plots for 24 hours every 2 weeks. The traps consist of colored cups containing water mixed with a small amount of dish soap. The bees are attracted to the colored cups and fall into the water because the soap decreases the surface tension. These two measures provide unbiased estimates of bee species diversity and abundance. This measure is necessary to document the benefit of the habitat to bee pollinators, and to inform people about the number of bees they can expect to attract to different floral mixtures within the turf.

This research will comprise the Master’s thesis for a new graduate student co-advised by M. Spivak and E. Watkins. Technician (A. Hollman) from the Turf lab will assist with plantings and maintenance of the plots. We intend to complete research in the summer of 2015 but will need time during the academic year 2015-16 to complete analyses and write-up.

Summary Budget Information for Activity 1:

Bee Lawn Evaluation Trials

ENRTF Budget: \$ 137,176

Amount Spent: \$ 0

Balance: \$ 137,176

Activity Completion Date: June 30, 2016

Outcome	Completion Date	Budget
<i>1. Bee lawn plots planted, and top-performing bee lawn turf-floral mixtures will be identified, based on criteria listed above</i>	June 30, 2016	\$137, 176

Project Status as of: January 2014

Project Status as of: September 2014

Project Status as of: March 2015

Project Status as of: December 2015

¹ www.pollinators.nbio.gov/documents/Handy%20Bee%20Manual.pdf

Final Report Summary:

ACTIVITY 2: *Public Demonstration Plots*

Description: Here we outline our outreach activities. With our two-year timeline, we will combine the plot uses so that the research plots used in Activity 1 can also serve as demonstration plots for public viewing.

We will sponsor two Bee Lawn public field days, one on the St. Paul campus and one at the Landscape Arboretum in the summer of 2014 and again in 2015. We will target homeowners, turf professionals, beekeepers, parks and ground managers across the Twin Cities greater metro and extension educators throughout the state. Visitors will be introduced to the concept of a bee lawn, and will be shown the different turf-floral mixtures. We anticipate that some will prefer more turf than flowers to reduce encountering bees while using the lawn. Others that maintain a lawn for aesthetics, rather than function, might prefer a higher density floral mixture in the turf. We will discuss with the public our research progress on species composition, turf quality, disease incidence, bee visitation rates, and bee species abundance and diversity.

Because of the large public visitor base at the Landscape Arboretum (approximately 350,000 annual visitors) this site is ideal for public demonstrations. Dr. Mary Meyer working with a student summer intern at the Arboretum will create signage and maintain the demonstration sites, and will develop educational materials on growing and maintaining bee lawns. The public field days (open houses) will reach a wide audience at the Arboretum.

As described in the Dissemination section below, we will create a Bee Lawn web presence on both the University of Minnesota Bee Lab and Turf sites that describes the bee lawn options and gives research updates. We will also develop fact sheets, brochures and planting recommendations, which will be publicized through the University of Minnesota Yard and Garden News, the Xerces Society web site and educational programs. Additionally, at the Arboretum site, we will display a Quick Response code (or similar technology) on primary signage at the plots so that the public can access information about the research when visiting the Arboretum.

Finally, we will use develop virtual tours of the research plots that can be viewed on the Bee Lab and Turfgrass science websites. We have utilized virtual research demonstrations in the turfgrass science program for our fall 2012 field day (see: turf.umn.edu/home/). Our experience in this area will allow to us to improve our delivery and use feedback from stakeholders to improve the virtual experience. The primary delivery system for this virtual tour will be video (with additional information such as plot maps and location information linked on the website), but we will also explore other options as new technologies arise. For instance, Watkins (CoPI) is currently working on the use of augmented reality for teaching plant science. Augmented reality would allow someone that is visiting a research plot with a smartphone or similar web-connected device, to view additional information on that smartphone while at the plots. The additional information can be overlaid onto the view of the plots that is seen through the devices camera. The augmented reality platform will utilize location information (GPS) and image analysis (what the camera on the phone is seeing) to determine which information to display at any given time. This is an exciting new way to interact with the public, and the bee lawn plots will be a great venue for this type of delivery system.

In addition to M. Meyer and the summer intern, G. Reuter (Technician for Bee Lab, who is primarily responsible for coordinating and teaching all public beekeeping short courses) will assist with all field days and other educational programming, and with web site updates. A part-time undergraduate student (academic year appointment) will assist with development of video production for the virtual tours. As with Activity 1, we anticipate needing time beyond 2 years to complete materials for Dissemination and outreach programming.

Summary Budget Information for Activity 2:

Public Demonstration Plots

ENRTF Budget: \$ 62,824

Amount Spent: \$ 0

Balance: \$ 62,824

Activity Completion Date: June 30, 2016

Outcome	Completion Date	Budget
1 <i>Research/ demonstration plots viewed at Field Days / Open Houses</i>	Sept 30, 2015	\$ 32,254
2. <i>Fact sheets, brochures and planting recommendations</i>	June 30, 2016	\$ 12,000
3. <i>Virtual tours</i>	June 30, 2016	\$ 18,570

Project Status as of: January 2014
Project Status as of: September 2014
Project Status as of: March 2015
Project Status as of: December 2015
Final Report Summary:

V. DISSEMINATION:

Description:

We will update the research through both the bee research website (beelab.umn.edu) and the turfgrass science website (turf.umn.edu). In both cases, we will post occasional research blog updates, post important data, and produce slideshows or videos that show the important research that is being conducted. Upon completion of the research, we will publish research results in peer-reviewed research journals. Both the bee research program and the turfgrass science program have been interviewed by multiple media outlets (in the case of the bee research program, many national outlets) and we expect that these opportunities would also serve as outlets for information on bee lawns. At the conclusion, we will seek additional opportunities for demonstrating our research results in larger scale plots and publishing results in consumer-friendly formats.

In future years, we can broaden our outreach activities to include education to MNDOT for roadside plantings that require mowing, and conferences for grounds managers and urban landscape companies to incorporate bee lawns on their sites. These activities could be held at the Landscape Arboretum, and include a tour of the plots. The Arboretum could provide continuing promotion and publicity for bee lawns in the future.

Project Status as of: January 2014
Project Status as of: September 2014
Project Status as of: March 2015
Project Status as of: December 2015
Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget:

Budget Category	\$ Amount	Explanation
Personnel:	\$ 164,987	1 Grad Student Asst, 2 part-time technicians, 0.5 mo summer salary for PI and co-PI, 1 part-time undergraduate, one summer intern
Equipment/Tools/Supplies:	\$ 12,013	Materials to plant and maintain Bee Lawn demonstration plots
Printing:	\$ 12,000	Educational materials
Other:	\$ 11,000	Bee Lawn field days and open house on St Paul campus and Landscape Arboretum
TOTAL ENRTF BUDGET:	\$ 200,000	

Explanation of Use of Classified Staff: Not applicable

Explanation of Capital Expenditures Greater Than \$3,500: Not applicable

Number of Full-time Equivalent (FTE) funded with this ENRTF appropriation: 0.915 FTE

Number of Full-time Equivalent (FTE) estimated to be funded through contracts with this ENRTF appropriation:

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
Non-state			
	\$ 2,000	\$	Xerces Society, Project Partner Assistance
	\$15,000		MacArthur Fellowship Funds, awarded to M. Spivak
State			
	\$ 16, 146	\$	M. Spivak, 5% salary/fringe cost-share
	\$ 10,101	\$	E. Watkins, 5% salary/fringe cost-share
	\$ 2,693	\$	M. Meyer, 1% salary/fringe cost-share
TOTAL OTHER FUNDS:	\$ 45,940	\$	

VII. PROJECT STRATEGY:

A. Project Partners:

Marla Spivak, Professor in Entomology, University of MN: PI will oversee research and outreach, administration of funds, supervise employees and co-advise graduate student; requesting funds. Eric Watkins, Assoc. Professor in Horticultural Science will co-advise graduate student, assist with plot establishment, data collection and analysis for Activity 1 and give presentations to stakeholder groups associated with research results from both Activities. Dr. Watkins’ research program focuses on the improvement of turfgrasses for use as low-input turf in cold climates; requesting funds. Mary Meyer, Professor, Horticultural Science, will provide public education and demonstrations at Arboretum for Activity 2; requesting funds. Eric Mader, Adjunct Asst. Extension Prof and Pollinator Program Director, Xerces Society for Invertebrate Conservation, will offer native plant species suggestions and create education materials, deliverable to audiences nationwide through the Xerces Society for Invertebrate Conservation website; providing in-kind support –see attached letter.

B. Project Impact and Long-term Strategy:

The Bee Squad, a fee-based program, was launched by Dr. Marla Spivak within the University of Minnesota Bee lab in April, 2012 to provide hands-on assistance to urban beekeepers in the Twin Cities area (www.beelab.umn.edu). The goals of the program are to: 1) provide personalized, hands-on training for new and experienced beekeepers during key times over the beekeeping season; 2) provide full beekeeping service for home and land owners that want bee hives on their property but do not want the responsibility of managing the bees (e.g., the Bee Squad will maintain a hive for President and Karen Kaler at Eastcliff); and 3) collect information on bee health in the Twin Cities area to feed into national bee health databases and educational programs. Beginning in 2014, we will add programming to provide landscape designs and assistance in planting bee-friendly gardens to increase the availability of habitat for honey bees and native bees. In 2015, we hope to add recommendations for planting bee lawns. Through the Bee Squad program at the University of MN, the exceptional educational opportunities through the MN Landscape Arboretum, and the excellent national reputation of the Xerces Society for leading changes in public practice and policy to protect pollinators, we expect that bee lawns will be promoted through the state and nationally.

C. Spending History:

Funding Source	M.L. 2007 or FY08	M.L. 2008 or FY09	M.L. 2009 or FY10	M.L. 2010 or FY11	M.L. 2011 or FY12-13

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VIII. ACQUISITION/RESTORATION LIST:

IX. MAP(S):

X. RESEARCH ADDENDUM: This project involves both applied research and outreach. We have considerable research expertise in bees (M. Spivak), turf (E. Watkins). However we will consult and work closely with partners and colleagues (Xerces Society Pollinator Specialists Eric Mader and Mace Vaughan, Prairie Restoration owner Ron Bowen and Landscape Arboretum personnel, Mary Meyer) that will peer-review our research as we implement it.

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted not later than January 2014, September 2014, March 2015, and December 2015. A final report and associated products will be submitted between June 30 and August 15, 2016 as requested by the LCCMR.

Attachment A: Budget Detail for M.L. 2013 Environment and Natural Resources Trust Fund Projects

Project Title: *Bee Lawns: A Unique Way to Help Pollinators*

Legal Citation: *M.L. 2013, Chp. 52, Sec. 2, Subd. 04h*

Project Manager: Marla Spivak

M.L. 2013 ENRTF Appropriation: \$ 200,000

Project Length and Completion Date: *June 30, 2015*

Date of Update: *October 2, 2012*

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Balance	Activity 2 Budget	Amount Spent	Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	Bee Lawn Evaluation Trials			Public Demonstration Plots				
Personnel (Wages and Benefits) TOTAL for SPA	125,163		125,163	39,824		39,824	164,987	164,987
Marla Spivak, Project Manager, \$14,262 (0.5 mo summer salary, 7% fringe benefits + 3% inflation) 0.05 FTE								
Eric Watkins, Project co-manager, \$15,552 (1 mo summer salary, 7% fringe benefits + 3% inflation) 0.11 FTE								
1 Graduate Research Assistant (Masters degree), \$74,239 (academic year and summer salary, fringe benefits and tuition +3% inflation) 0.50 FTE								
Gary Reuter, Bee Technician and Outreach, \$21,254 (15% salary, 39.6% fringe + 3% inflation) 0.15 FTE								
Andrew Hollman, Turf Technician, \$21,110 (15% salary, 39.6% fringe + 3% inflation) 0.15 FTE								
Undergraduate, Academic year, \$7,800 (\$10/hr, 10 hr/ wk)								
Summer intern at Arboretum, \$10,770								
Equipment/Tools/Supplies Costs are estimates. Actual costs will be billed	12,013		12,013	0		0	12,013	12,013
Seed	3,500		3,500	0		0	3,500	3,500
Fertilizer	1,263		1,263	0		0	1,263	1,263
Biodegradable seed germination blankets	5,000		5,000	0		0	5,000	5,000
Soil probes	1,450		1,450	0		0	1,450	1,450
Insect nets, bowl traps, pins and labels	800		800	0		0	800	800
Printing <i>Educational materials: signs, website work, brochures, handouts, pubs, press releases, fact sheets, online updates, references, making your own Bee Lawn</i>	0		0	12,000		12,000	12,000	12,000
Travel expenses in Minnesota	0		0	0		0	0	0
Other <i>Open House Bee Lawn Days (educational tours onsite, St Paul campus and Landscape Arboretum)</i>	0		0	11,000		11,000	11,000	11,000
COLUMN TOTAL	\$137,176	\$0	\$137,176	\$62,824	\$0	\$62,824	\$200,000	\$200,000