



Environment and Natural Resources Trust Fund (ENRTF) M.L. 2016 Work Plan

Date of Report: May 29, 2016

Date of Next Status Update Report: October 2016

Date of Work Plan Approval: June 7, 2016

Project Completion Date: June 30, 2019

Does this submission include an amendment request? no

PROJECT TITLE: Bee Pollinator Habitat Enhancement – Phase II

Project Manager: Marla Spivak

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Location: Statewide

Total ENRTF Project Budget:

ENRTF Appropriation: \$387,000

Amount Spent: \$0

Balance: \$387,000

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 08a

Appropriation Language:

\$387,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to continue assessment of the potential to supplement traditional turf grass by providing critical floral plant resources to enhance bee pollinator habitat. Plant materials and seeds must follow the Board of Water and Soil Resources' native vegetation establishment and enhancement guidelines. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Bee Pollinator Habitat Enhancement - Phase 2

II. PROJECT STATEMENT:

Why: We received funding in 2013 to develop an innovative way of helping pollinators by florally enhancing turf areas that are not heavily used for human recreation. We identified some promising native floral species that withstand mowing pressure and continue to flower when seeded into lawn areas. The native flowers include: self-heal (*Prunella vulgaris* var. *lanceolata*), ground plum (*Astragalus crassicaarpus*), calico aster (*Symphotrichum lateriflorum*), and lanceleaf coreopsis (*Coreopsis lanceolata*). Seeds for these plants are available locally from native seed vendors except *Prunella vulgaris* var. *lanceolata*. We consulted with Dan Shaw at the Board of Water and Soil Resources (BWSR) about the use of this ecotype, any potential problems or risks with it use, and where we could obtain local seed (see attached letter from BWSR). Dan Shaw contacted local native plant nurseries (Prairie Moon, Shooting Star Native Seeds, Prairie Meadows, Prairie Restorations, Minnesota Native Landscapes) and none of them sell the local ecotype. Several of the nurseries said they will begin collecting seed and welcome the opportunity to harvest and market this ecotype to fulfill the large public demand for flowering lawns in Minnesota (see Activity 1 for more information). Thus, we are working with native seed growers and BWSR to develop local seed sources for this plant, and to increase availability of seed for the other species for future studies and for use by the public. As native species take several years to establish, we are requesting Phase 2 funding to test new native flowering species, and to verify that the flowering lawn options we have developed enhance bee visitation while maintaining the function and aesthetics of mowed and manicured turf. While we will continue to showcase the bee lawns in public demonstration areas, it also is important to understand citizen's concerns about pollinators and flowering lawns as well as their ideas for how these lawns could be used to benefit their families, businesses, and communities. In this way, public land managers can be informed about the most effective and efficient ways to implement flowering lawns.

Goal: Our goal is to provide a concrete way to support the nutritional needs of all bees. Bee pollinators, including honey bees and some of the 400 species of bees native to Minnesota, are in decline 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). Minnesota is leading the nation in legislative initiatives to help pollinators, and as a result, public awareness about the plight of pollinators is at an all time high. People are hungry for action-steps they can take to help.

Outcomes: The addition of native flowers into turf will provide nutritional resources for pollinators, and will reduce intensive inputs of water, fertilizers and pesticides. Flowering lawns could provide a natural buffer to water resources in areas where low-growing, more manicured looking lawns are preferred. Flowering lawns would beautify Minnesota, protect our natural resources, and help achieve important state and federal pollinator protection initiatives.

How: We propose 2 activities: 1) Quantify bee abundance and diversity, and floral blooms on lawns in four Minneapolis parks enhanced with native flowers compared to existing lawns in four paired parks containing only white clover; 2) Continue outreach activities through public demonstration plots, and evaluate key concerns and new ideas public and private landowners and landscape maintenance personnel have about using flowering lawns. Due to their location, our 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.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of October 2016:

Project Status as of April 2017:

Project Status as of October 2017:

Project Status as of April 2018:

Project Status as of October 2018:

Project Status as of April 2019:

Overall Project Outcomes and Results:

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Floral enhancement of urban lawns and pollinator community response

Description:

In Phase 1 of this project, we found that *Festuca brevilipa* (hard fescue) and *Poa pratensis* (Kentucky bluegrass) allow a significantly higher establishment of flowering plants compared to other grass species. For established turf lawns that are well managed (highly fertilized and controlled for broadleaf weeds), we found the best way to establish native flowers was to seed them after scalping (mowing to a very low height of cut) of the lawn. In established turf that is not well managed, no scalping was needed; the native flowers established after direct seeding. *Prunella vulgaris* (self-heal) establishes particularly well in moist fertile sites even after regular mowing to 3.5 inches. The native forb *Astragalus crassicaarpus* (ground plum) establishes better in sandy soils and low fertility sites after mowing. Among other native plants we tested —*Menthe arvensis*, *Coreopsis lanceolate*, *Monarda punctate*, *Astragalus canadensis*, and *Symphotrichum lateriflorum*— two species, *Symphotrichum lateriflorum* and *Coreopsis lanceolate*, seem to withstand mowing and hold the most promise for our future trials in Phase 2.

While we will continue testing the establishment of these and additional native flowering species in lawns, it is important to verify that the flowering turf options we are developing actually enhance bee visitation while maintaining the function and aesthetics of mowed and manicured turf. To measure the effectiveness of flowering lawns to provide floral nutritional resources for bees, we will compare bee visitation on lawns enhanced with native floral species to bee visitation of lawns containing only white clover, *Trifolium repens*. In collaboration with the Minneapolis Park and Recreation Board we have identified 8 parks in the city of Minneapolis for our bee visitation trials (these park lawns are primarily comprised of Kentucky bluegrass). In 4 of the 8 parks, we will enhance one large turf area (approximately 400 m² in each park) with a mixture of native flowers. In the other 4 parks, chosen by proximity and similarity in type of public use, same size plots will be delineated that already contain white clover (but no other flowering species). We will pair these parks based on proximity to allow comparisons between parks with and without enhanced floral resources. The paired parks we are considering include:

1. Audubon and Windom (northeast Minneapolis)
2. Willard and Hall (north Minneapolis)
3. Kenwood and Painter, (southwest Minneapolis)
4. Matthews and Longfellow (south Minneapolis)

We will establish native flower mixture lawns using methods developed based on our work in Phase 1 of this overall project. The native flowering plants will be established from seed acquired through partnerships with local seed producers, facilitated and approved by BWSR. Local ecotype seeds from ground plum (*Astragalus crassicaarpus*), calico aster (*Symphotrichum lateriflorum*), and lanceleaf coreopsis (*Coreopsis lanceolata*) are available from local native seed nurseries. Seed from self-heal (*Prunella vulgaris* var. *lanceolata*) is not available locally, but seed producers (e.g., Prairie Moon, Prairie Restorations Inc., Minnesota Native Landscapes) have agreed to harvest some, to be available in 2017. As we plan to begin seeding our small experimental plots in August 2016, Dan Shaw from BWSR, has attached a letter that states:

"It is my recommendation to use the seed source from Oregon in this case, as the species is relatively common across the United States, the study plots are relatively small (around 650 square feet), located in a metropolitan area, and precautions can be put in place to minimize genetic risks to local populations of the species. Results from this study will also help initiate production of local seed sources. If the Oregon source is approved the following precautions should be used to protect local populations

-Planting locations should be a maximum of ¼ miles from known "local" populations.

-Seed heads should be removed each fall followed by disposal of the seed.

-Herbicide treatments or repeated tilling (three times during the growing season) should be conducted over the entire area that was seeded for the study for a minimum of one season following completion of the study."

We will encourage these producers to increase availability of these seeds for sale to the homeowners and businesses interested in establishing flowering lawns in the future (see attached letter from BWSR).

In August 2016, existing lawn areas will be mowed to a short height of cut (0.75 inches). These areas will then be core-aerified, after which seed of native flowering plants will be applied to the area using a drop spreader. Trial areas will then be irrigated as needed during establishment to ensure the development of a successful stand.

We will collect information on the abundance and richness of bees visiting both the enhanced and the unenhanced paired park lawns. Visitation will be quantified by collecting bees directly from blooms along specified transects through the plots. All non-honey bee specimens will be curated and databased in collaboration with Dr. Dan Cariveau and Dr. Ralph Holzenthal in the Entomology department at the University of Minnesota.

We will collect data on plant establishment in our plots throughout the season to better understand how flowering plants establish and recover after mowing in park lawns. We will document plant and floral abundance within one square meter quadrats every 5 meters along both sides of a 30-meter transect in the enhanced parks. This data will inform how well our flowering plants have established, and will be correlated with bee visitations to enhanced plots compared to control plots to show that the enhanced plots do provide nutritional floral resources for bees.

Summary Budget Information for Activity 1:

ENRTF Budget: \$ 221,308
Amount Spent: \$ 0
Balance: \$ 221,308

Outcome	Completion Date
1. Plant native flowering plant species in lawns at four Minneapolis parks.	November, 2016
2. Quantify number and diversity of bee pollinators on turf enhanced with native flowers and compare to unenhanced park turf with common flowering weeds.	November 2018
3. Quantify floral abundance and rate of bloom after mowing	November, 2018

Activity Status as of October 2016:

Activity Status as of April 2017:

Activity Status as of October 2017:

Activity Status as of April 2018:

Activity Status as of October 2018:

Activity Status as of April 2019:

Final Report Summary:

ACTIVITY 2: Showcase flowering lawns through demonstration plots, and evaluate landowner concerns and ideas about using flowering lawns.

Description: In Activity 1, we will establish large areas of florally enhanced turf at four parks in Minneapolis that are accessible by the public. We will add signage to each location giving visitors information about the current research and our findings from Phase 1 of this project. This information will likely be accessed with a QR code or other location-enabled technology. We will utilize these plots to learn about park users — their concerns and ideas about pollinators and florally enhanced lawns. Early interviews focus on what park users like about the parks, how they use them (particularly turf areas), and their knowledge about pollinators. Later interviews add the users’ opinions about the flowering lawns. We will conduct these voluntary interviews of random park users with electronic tablet survey instruments. We will also invite stakeholders from Minnesota such as public land managers and maintenance personnel to visit the site for focus group interviews, so we can compare the unique challenges of implementation and management of these enhanced turf areas. All data from participants will be de-identified and we will carefully follow the protocols approved for these types of studies. This information will

be used to develop general and targeted outreach materials as well as management protocols for public land managers.

Summary Budget Information for Activity 2:

ENRTF Budget: \$ 165,692
Amount Spent: \$ 0
Balance: \$ 165,692

Outcome	Completion Date
1. Develop outreach content describing florally-enhanced lawns and how they can help pollinators	March 2017
2. Place signs with outreach information at research sites in four parks in Minneapolis, and on Park Board website.	July 2017
3. Quantify number of distinct concerns and intensity of the concern by demonstration site park visitors, potential adjacent private land owners, and public park land managers.	September 2018
4. Develop presentations and suggestions for mitigation of these concerns that could be used by park managers in Minnesota who want to increase their use of florally-enhanced lawns in public parks, including improved educational materials, clear signage, web & social media info easily accessed and utilized by park managers, homeowners, and other stakeholders	June, 2019

Activity Status as of October 2016:

Activity Status as of April 2017:

Activity Status as of October 2017:

Activity Status as of April 2018:

Activity Status as of October 2018:

Activity Status as of April 2019:

Final Report Summary:

V. DISSEMINATION:

Description: At least two field days will be held at one of the enhanced parks, one each year in 2017 and 2018. These will be free and open to the public; we will advertise as appropriate to ensure good attendance. Researchers involved with this project will give talks and demonstrations on how to establish a flowering lawn and the benefits this type of lawn can provide. Throughout the project, we will post project updates and information to both the bee lab (beelab.umn.edu) and turfgrass science (turf.umn.edu) web sites. We will be in contact with appropriate state agencies, such as BWSR, about linking to project results on state agency websites. The Minneapolis Park and Recreation Board has close involvement with this project and will also post results and updates on their website. We will use social media to give updates on the project as well, specifically the Bee Lab and Bee Squad Facebook pages and the Bee Squad (@UmnBeeLab_Squad) and Turfgrass Science (@urbanturfmn) Twitter feeds. Results will be presented during field days (Minnesota Turf and Grounds Field Day on the UMN St. Paul campus); professional trade meetings (Northern Green Expo in Minneapolis each January); and scientific professional meetings (for example: Entomological Society of America, Crop Science Society of America and Society of Natural Resources). Additionally, we often receive requests from other group (Master Gardeners, garden groups, etc.) to speak and have a history of taking advantage of those opportunities.

Status as of October 2016:

Status as of April 2017:

Status as of October 2017:

Status as of April 2018:

Status as of October 2018:

Status as of April 2019:

Final Report Summary:

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	\$ Amount	Overview Explanation
Personnel:	\$ 364,165	1 Project manager and 2 collaborator at 4.1% FTE each year for 3 years (\$64,021); 2 graduate research assistants at 50% FTE each year for 3 years (\$242,410); 1 research technician at 13% FTE each year for 3 years (\$32,532); 2 undergraduate assistants at 3% and 1.5% FTE each summer for 3 years (\$25,222)
Equipment/Tools/Supplies:	\$2,400	Supplies for demo sites (seed, fertilizer for establishment, biodegradable germination blankets, etc.) Estimated \$800/ year (\$2,400)
Printing:	\$4,000	Educational and Outreach Materials: e.g., signs, brochures, handouts, pubs, press releases, fact sheets, estimated \$1,300/ year for 3 years (\$4,000)
Travel Expenses in MN:	\$9,000	Vehicle expenses (leasing from UMN, gas, mileage) to visit Mpls Park research plots during summer months; estimated \$3000/ year for 3 years (\$9,000)
Other:	\$7,500	Survey research estimated \$500/ year; mailings, data analysis, info materials, website work and additions; specific event expenses (tent rental, refreshments) estimated at \$2,305/ year for 3 years (\$7,415)
TOTAL ENRTF BUDGET: \$387,000		

Number of Full-time Equivalent (FTE) Directly Funded with this ENRTF Appropriation: 3.89

B. Other Funds: NA

VII. PROJECT STRATEGY:

A. Project Partners:

Project partners not receiving funds:

- Minneapolis Park and Recreation Board, providing assistance in locating Minneapolis parks for Activity 1, and in survey work for Activity 2
- Board of Water and Soil Resources, assistance with sourcing of local seeds for flowering lawns (see letter from Dan Shaw, BWSR).

Project partners receiving funds:

- Dr. Eric Watkins, Associate Professor, Horticultural Science, University of Minnesota, will co-advise the graduate student for Activity 1 and assist in project design and implementation.

- Dr. Kristen Nelson Professor in Forest Resources, and in Fisheries, Wildlife, and Conservation Biology, University of Minnesota, is natural resource sociologist who will advise a second graduate student in Objectives 3 and 4 of Activity 2, and assist with project design and implementation.

B. Project Impact and Long-term Strategy: Minnesota is leading the nation in legislative initiatives to help pollinators, and as a result, public awareness about the plight of pollinators is at an all time high. The addition of native flowers into turf will provide nutritional resources for pollinators, and will reduce intensive inputs of water, fertilizers and pesticides. Flowering lawns could provide a natural buffer to water resources in areas where low-growing, more manicured looking lawns are preferred. Flowering lawns would beautify Minnesota, protect our natural resources, and help achieve important state and federal pollinator protection initiatives.

As we are working with native seed growers and the Board of Water and Soil Resources (BWSR) to develop local seed sources for this plant, this project will increase availability of seed for use by the homeowners and businesses that want to plant flowering lawns. Our combined extension and outreach experience will ensure that we continue to disseminate information about the benefits of flowering lawns and how best to incorporate them to protect and enhance our natural resources.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
ENRTF Bee Pollinator Habitat Enhancement M.L. 2013, Chp. 52, Sec. 2, Subd. 04h	July 1, 2013 – June 30, 2016	\$200,000

IX. VISUAL COMPONENT or MAP(S): attached

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than October 2016, April 2017, October 2017, April 2018, October 2018 and April 2019. A final report and associated products will be submitted between June 30 and August 15, 2019.

**Environment and Natural Resources Trust Fund
M.L. 2016 Project Budget**



Project Title: Bee Pollinator Habitat Enhancement – Phase II

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 08a

Project Manager: Marla Spivak

Organization: University of Minnesota

M.L. 2016 ENRTF Appropriation: \$387,000

Project Length and Completion Date: 3 Years, June 30, 2019

Date of Report: May 29, 2016

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	<i>Floral enhancement of urban lawns and pollinator community response</i>			<i>Showcase flowering lawns through demonstration plots, and evaluate landowner concerns and ideas about using</i>				
Personnel (Wages and Benefits)	\$209,908	\$0	\$209,908	\$154,277	\$0	\$154,277	\$364,185	\$364,185
Partial summer salary (0.5 month, 66% salary, 34% fringe benefits, 4.1% FTE each person, each year for 3 years): Project Manager Marla Spivak (total 3 yrs \$29,917), and collaborators E. Watkins (3 yrs = \$15,574) and K. Nelson (3 yrs = \$18,530). Total = \$64,021								
Graduate Research Assistants, 1 Masters (total 3 yrs = \$137,264), 1 PhD (total 3 yrs = \$105,147). 51% salary + 49% fringe benefits and tuition, except for PhD student on advanced GRA, reduced fringes). 50% FTE each student, each year.. Total = \$242,410								
Research Technician, Andrew Hollman (79% salary, 21% fringe benefits) 13% FTE each year for 3 years. Total = \$32,532								
UndergraduateField Assistants, 100% salary for two students, 3% FTE each year for 3 years for first student. 1.5 FTE/ year for 3 years for second student . \$12,611 each student for 3 yrs; Total = \$25,222								
Equipment/Tools/Supplies								
Supplies for demo sites (seed, fertilizer for establishment, biodegradable germination blankets, etc.) Estimated \$800/ year for 3 years	\$2,400	\$0	\$2,400					\$2,400

Printing								
Educational and Outreach Materials: e.g., signs, brochures, handouts, pubs, press releases, fact sheets, estimated \$1,333/ year for 3 years				\$4,000		\$4,000		\$4,000
Travel expenses in Minnesota								
Vehicle expenses (leasing from UMN, gas, mileage) to visit Mpls Park research plots during summer months; estimated \$3000/ year for 3 years	\$9,000	\$0	\$9,000					\$9,000
Other								
Survey research estimated \$500/ year; mailings, data analysis, info materials, website work and additions; specific event expenses (tent rental, refreshments) estimated at \$2,305/ year for 3 years				\$7,415	\$0	\$7,415		\$7,415
COLUMN TOTAL	\$221,308		\$221,308	\$165,692		\$165,692	\$387,000	\$387,000

Bee Pollinator Habitat Enhancement – Phase 2

Flowering Lawns

M. Spivak, E. Watkins, K. Nelson, UMN
and Minneapolis Park and Recreation Board

Outcomes:

- Support bee health and nutrition
- Reduce intensive inputs on turf – water, fertilizer, pesticides
- Protect and enhance Minnesota natural resources



Example of existing, non-native
flowering turf along Minneapolis
Parks
Ground Rounds Scenic Byway



Trifolium repens – White Clover, non-
native, commonly found in lawns

Activities:

- 1) Quantify bees and floral blooms on lawns enhanced with native flowers compared to lawns containing only white clover
- 2) Continue outreach activities through public demonstration plots, and evaluate public concerns about and ideas for using flowering lawns

From Phase 1: Native flowers with potential to enhance mowed turf



Prunella vulgaris
var. *lanceolata*
Self-heal



Astragalus crassicus
Canadian milkvetch



Symphotrichum lateriflorum
Calico aster