



# Environment and Natural Resources Trust Fund (ENRTF) M.L. 2014 Work Plan

**Date of Report:** January 15, 2014  
**Date of Next Status Update Report:** December 15, 2014  
**Date of Work Plan Approval:**  
**Project Completion Date:** June 30, 2017  
**Does this submission include an amendment request?**

**PROJECT TITLE: Enhancing Pollinator Landscapes**

**Project Manager:** Marla Spivak  
**Organization:** University of Minnesota  
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**Location: Ramsey Co and Statewide**

<b>Total ENRTF Project Budget:</b>	<b>ENRTF Appropriation:</b>	<b>\$864,000</b>
	<b>Amount Spent:</b>	<b>\$0</b>
	<b>Balance:</b>	<b>\$864,000</b>

**Legal Citation:** M.L. 2014, Chp. 226, Sec. 2, Subd. 06a

**Appropriation Language:**

\$864,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to identify sources of nectar and pollen for native pollinators and honey bees and coordinate ongoing and future efforts to enhance pollinator habitat and opportunities for pollinator nesting and foraging. This appropriation is available until June 30, 2017, by which time the project must be completed and final products delivered.

## **I. PROJECT TITLE: Enhancing Pollinator Landscapes**

### **II. PROJECT STATEMENT:**

**Why?** Pollinators help our crops so much that we tend to forget it is a two-way street—we must also help our pollinators. The current, widespread decline of pollinators has become critical and threatens their well-being and even their very existence. Neither native wild bees nor managed honey bees are secure. The causes of decline are not completely known, but many known causes can be combated. Loss of nesting sites, fewer flowers, increased disease, more insecticides, and other causes all combine. Fortunately, the present crisis for pollinators comes at a time when society recognizes the severity of the problem and is motivated to act to improve pollinator resources and environment. Improving conditions for pollinators will also improve conditions for birds and other wildlife, reduce soil erosion, improve water quality, and further beautify the landscape of our state.

**Goals.** The goal of this project is to provide new and reliable supplies of nectar and pollen for wild bees and honey bees, across the entire growing season in key beekeeping regions of Minnesota. Specific aims are to 1) coordinate and help conduct statewide surveys and identification of Minnesota's existing native bee populations, estimated between 300-400 species; 2) identify and document forbs, and other plants that contribute the most to nectar and pollen resources for all bees, and specifically that contribute to continuous honey production for managed honey bees; and 3) begin to identify and document plants and plant communities that provide nesting and overwintering sites for Minnesota's native bees.

**How?** Supplies of food and habitat for pollinators must be enhanced by strategic changes in land-use. This project will help create a new and critically needed interdisciplinary faculty position to lead and coordinate the research proposed here, and to help consolidate and accelerate the many other pollinator efforts that are ongoing and planned, including: i) research, extension and public programs on honey bee health and best beekeeping practices, (UMN and Beekeeping Associations); ii) surveying and compiling of the state's first database of wild pollinators (UMN and MNDNR); iii) documenting the impact of grazing on native plants and pollinators (USGS); iv) reconstructing habitats and corridors for pollinator nesting and foraging (DNR, BWSR, NRCS, USFWS, Pheasants Forever, and The Nature Conservancy); v) developing community educational projects on pollinators and habitat (UMN, Pheasants Forever, DNR); vi) prairie butterfly conservation and breeding (MN Zoo); vii) Monarchs in the Classroom (UMN); and viii) understanding systemic pesticide impacts on bees (UMN, MDA).

**Outcomes** include a statewide working group on pollinator habitat and ecosystem services, led by a new faculty member, landscape maps and assessments, demonstration sites, best management practices, peer-reviewed scientific papers, and long-term plans for sustaining pollinators and helping Minnesota beekeepers. Results will help private land owners and public land managers. The project will provide examples for other states in our region to adapt and expand.

### **III. PROJECT STATUS UPDATES:**

**Project Status as of** December 15, 2014

**Project Status as of** August 15, 2015

**Project Status as of** February 15, 2016

**Project Status as of** September 15, 2016

**Project Status as of** March 15, 2017

**Overall Project Outcomes and Results: June 2017**

**IV. PROJECT ACTIVITIES AND OUTCOMES:**

**ACTIVITY 1: New Faculty Position to research, teach, and coordinate pollinator ecology, U MN**

**Description:** Due to recent attention about the unprecedented decline of bees, a number of statewide projects have been initiated to study and conserve MN insect pollinators. This attention and study is timely, even overdue, for this economically and ecologically important group. But to be efficient, the diverse efforts must be coordinated. This activity will create a new and critically needed interdisciplinary faculty position to lead and coordinate efforts at the U MN, and to help consolidate and accelerate the many other pollinator efforts that are ongoing and planned across the state (listed on page 1). This faculty position will include research responsibilities on a basis of 70% time, to help expand our base of knowledge about pollinators, and also teaching responsibilities at 30% time to educate others and train the next generation in methods relevant to pollinators and the project.

At the U MN, a new professor position on pollinator habitat ecology would be distinct from, but would complement and enhance, efforts of M. Spivak (expertise in honey bee pathology, breeding and behavior), K. Oberhauser (monarch butterfly biology and citizen science), and other faculty that study prairie-grassland ecology, flowering cover crops in agricultural lands, beneficial insect ecology and biological control, and effects of pesticides on pollinators and other beneficial insects. We anticipate that after a national search, the new professor will begin working no later than September 2015.

**Summary Budget Information for Activity 1:**

**ENRTF Budget: \$ 329,144**  
**Amount Spent: \$ 0**  
**Balance: \$ 329,144**

**Activity Completion Date: September 15, 2015**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. New Assistant Professor of Pollinator Habitat Ecology hired and initiates new interdisciplinary research and teaching program.	September 2015	\$329,144
2. Coordination of efforts at the UMN on pollinators and habitat. Collaborations formed with other statewide pollinator projects.	June 30, 2017	
3. Curriculum adaptations and new course offerings in place.	June 30, 2017	
4. Pollinator research programs beyond this project established and underway.	June 30, 2017	

**Activity Status as of December 15, 2014**

**Activity Status as of August 15, 2015**

**Activity Status as of February 15, 2016**

**Activity Status as of August 15, 2016**

**Activity Status as of March 15, 2017**

**Final Report Summary: June 30, 2017**

**ACTIVITY 2: Wild Bee Pollinator Surveys in Prairie-Grassland Habitats**

**Description:** An estimated 350-400 species of native bees reside in MN, but this estimate has never been validated. It is critical to conduct thorough field surveys of native bees for current documentation of their species diversity and abundance. A survey consists of sampling bees over a three-year period in critically defined regions of Minnesota, preserving the bees for museum storage, identifying the bees to species, and entering the bee information into a comprehensive database. Surveys of wild bees in a particular region must be conducted over a minimum of three years due to natural fluctuations in population abundance of bees over time; one-year sampling efforts may not reveal rare or declining species, and are not representative of long-term population changes. Surveys involve sampling defined areas over regular periods (e.g., biweekly, or

monthly), following standard procedures: transects are delineated and bees are collected with insect nets in morning and afternoon sampling bouts; bowl-traps are set out along transects to collect a wider sample of bees and other insect pollinators over frequent intervals throughout the season. All collected bees are later mounted on insect pins, labeled, and identified to species. Finally, the information about each bee is entered into a database for access and archival storage. Pinning and labeling, although delicate and detailed work, can be done by undergraduates. Identifying bees to species requires highly trained specialists, of which fortunately several are at U MN. The DNR will be compiling the first database and state list of wild bees in MN (Wild Bee Surveys in Prairie-Grassland Habitats), to which we will contribute our specimen data.

We will collect bees from various sites within three areas in southeastern MN with a history of bee collections (see Visual Map and Graphic, attached). These surveys will complement those proposed by the DNR, which will be conducted on high quality native prairie and restored prairie-grassland sites throughout the Minnesota Prairie Region in western MN. Focusing survey effort on areas with historical bee collections will enable comparison of current collection records with museum specimens. We are in communication with the project managers of the DNR to closely coordinate and collaborate on our proposed activities.

Several Minnesota bumble bee species are considered to be in decline (*Bombus pensylvanicus*, *B. affinis*, *B. terricola*, *B. fervidus* and *B. ashtoni* (Cameron et. al 2011, Evans et. al 2008)). However, to accurately determine if a species is in decline, the diversity and abundance of present-day bees must be compared to a historical database of bees collected in the same area. The first such historical comparison of MN bees was conducted recently by J. Gardner (Master’s thesis), who documented species loss (11 species) and gain (4 species) of one family of bees, the Megachiliadae (leafcutter bees) in Itasca State park by comparing his 3-year collection with museum specimens collected in Itasca State Park in the 1930s. Our survey will use a similar approach to examine changes in species diversity in southeastern MN since the 1930s.

Diversity and species richness of native bees, and abundance of honey bees, will be determined using a trapping system developed by Sam Droege of the USGS. The traps consist of colored cups containing water and detergent. The cups are placed atop stakes and spaced at regular intervals in a sampling area. Bees are attracted to the colors. Traps will be set for designated intervals and times, such as every 24 hours every three weeks over the summer. These cup traps support an estimate of species richness and diversity. Additional collections will be made by sweep netting vegetation to collect larger pollinators such as bumble bees. Sweep net surveys will be conducted periodically along multiple transects per plot---such as along ten 100 m transects per plot every three weeks. Additionally, within each plot, multiple spot surveys will focus on bee-preferred flower patches. Blue vane traps will be set out during sweep net surveys as an additional complement.

**Summary Budget Information for Activity 2:**

**ENRTF Budget: \$ 215,713**  
**Amount Spent: \$ 0**  
**Balance: \$ 215,713**

**Activity Completion Date: June 30, 2017**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Bees surveyed over 3 year period in three southeastern MN sites using standardized sampling methods in collaboration with DNR	June 30, 2017	\$ 215,713
2. Bees identified and curated for museum storage	June 30, 2017	
3. Species richness and abundance of bees collected from southeastern MN compared to historical museum specimens in that area to document loss or gain of pollinator species.	June 30, 2017	
4. Bee information entered into a comprehensive database compiled by DNR.	June 30, 2017	

**Activity Status as of December 15, 2014**

**Activity Status as of August 15, 2015**

**Activity Status as of February 15, 2016**

**Activity Status as of August 15, 2016**

**Activity Status as of March 15, 2017**

**ACTIVITY 3: MN Floral Resources for Bees**

**Description:** We will identify and document forbs and other plants that contribute the most to nectar and pollen resources for all bees on conservation and production lands, while providing benefits such as wildlife habitat, water purification, carbon storage, and soil improvement.

The background for this activity is that flowers differ widely in their value to bees. Flowers vary greatly in the amount and nutritional content of the nectar and pollen that they produce. Some bee species require specific flowers to complete their development, and such specialist bees are more likely to be in need of conservation. We presently know too little of the specialist bee-flower relationships for Minnesota bees. Documentation of plant species from which bees are collected during field surveys will create a list of which bees use which flowers. More detailed plant use information can be gathered from identification of pollen collected by bees by microscopic analysis.

For honey bees, the traditional floral resources and honey producing plants in Minnesota include early blooming trees (willow, maple, oaks), dandelions, fruit trees and other flowering trees and shrubs, particularly American basswood and European lindens, clovers, alfalfa, many species of wild and garden flowers, and late blooming flowers like asters, goldenrod and sunflowers. As some clover plants (sweet clovers) are listed as invasive by many agencies, it is critical to find alternative native or non-native, but non-invasive, floral sources that can be viable substitutes for these clovers. The value of native flowers for commercial honey bees is not known. Learning which if any native flowers are used by honey bees can inform other state projects, such as those sowing native flowers in prairies, along roadsides, as crop borders, or in other managed areas, for the benefit of commercial honey bee populations.

In particular, this activity will bring together three ideas, which are only partially understood: (A) the attractiveness of specific flowering plants to bees, and (B) the flowering season of native plants in MN, and (C) the suitability of specific flowering plants for conservation projects. The combination of these three ideas will support recommendations to landowners for efficiently increasing pollinator resources. To this end we propose five actions.

(1) Gather the existing knowledge on favorability of native grassland forbs for wild and honey bees from the standard scientific literature and in consultation with local experts.

(2) Place honey bee colonies near native forbs and determine which contribute most to honey production and pollen collection. We will place healthy honey bee colonies near areas selected to have good populations of native flowers. We will quantify the diversity of pollens collected by honeybee colonies to estimate overall use of floral resources across the foraging range of the honey bees (i.e. 2 mile radius from colonies, or 8,000 acres). Colonies at each location will have pollen traps and collected pollen will be classified where possible to species, using a pollen reference library currently being compiled in M. Spivak's lab. In addition, honey samples will be collected from the combs inside the same colonies at each site for analysis of pollen grains trapped in the honey, which will help determine the primary sources of honey. This analysis will quantify how much of the total honey-bee diet comes from wildflowers in the surrounding area, and will help inform how much wildflower acreage is needed to support honey bee colonies as a primary pollen and nectar source.

(3) We will examine pollen collected by wild bees to understand the categories of plants that successfully supply pollen to these bees. We will survey existing habitats with high densities of forbs within representative background landscapes, collect bees from flowers and pollen from bees to determine floral use, and make basic estimates of floral availability. This will allow us to evaluate which flowers are used by which wild bees. We will concentrate in two different regions of Minnesota conducive to wild bees, including southeast and southwest as possible. Pollen will be identified to the finest level feasible, ideally to genus and where possible to species.

(4) Position the estimated best candidate flower species in small monoculture plots near each other and determine which are visited most by wild bees. From our background research list we will establish common

gardens with candidate forbs planted in small monoculture plots, with randomization and replication. The goal will be to present wild bees with a common native garden in two or more different surrounding landscapes, such as in a high percentage agriculture or a high percentage conservation lands. This can be accomplished by such methods as planting native flowers or placing pallet planters of candidate species in desired landscapes. In these gardens all flowers of all candidate species will be equally available to bees in the area so we can determine preference. We will quantify the amount of flowers per plant species and determine bee use and preference.

(5) Document and explore the costs and logistics of planting these native forbs as a resource for landowners looking to plant pollinator plots.

**Summary Budget Information for Activity 3:**

**ENRTF Budget: \$ 177,064**  
**Amount Spent: \$ 0**  
**Balance: \$ 177,064**

**Activity Completion Date: June 30, 2017**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Existing knowledge on favorability of native grassland forbs for wild and honey bees gathered and indexed.	Feb 30, 2015	\$177,064
2. Determination of native forbs species that contribute most to honey production and pollen collection by honey bees.	June 30, 2017	
3. Determination of floral preferences and pollen species collected by wild bees through survey work in natural areas and in replicated monoculture plots of best candidate flower species	June 30, 2017	
4. Documentation of costs and logistics of planting identified native forbs as a resource for landowners looking to plant pollinator plots.	June 30, 2017	

**Activity Status as of** December 15, 2014

**Activity Status as of** August 15, 2015

**Activity Status as of** February 15, 2016

**Activity Status as of** August 15, 2016

**Activity Status as of** March 15, 2017

**Final Report Summary:** June 30, 2017

**ACTIVITY 4: Wild Bee Nesting Sites**

**Description:** Pollinators need floral resources during the growing season but also need nesting sites for reproduction and over-wintering. Therefore, management of areas that are designed to help pollinators must provide for nesting, and again very little is known about that topic. Many bee species nest underground but approximately 30% nest in stems, trunks, and other parts of the above-ground vegetation. Spring burning or fall harvesting of biomass can interfere with above-ground nesting sites and other practices such as grazing could conceivably interfere with below-ground sites. This activity will begin to identify and document plants and plant communities that provide nesting and overwintering sites, especially for Minnesota’s cavity-nesting native bees, and provide ideas and advice to moderate possible damage to those sites.

The first fall, we will examine senesced aboveground vegetation characteristic stem diameters that could be used by wild bees and create a database of the sizes and characteristics of vegetation that contains evidence of overwintering pollinators. Subsequently we will also create “trap nests” using natural vegetation that bees would encounter in the area. These new forms of trap nests will be made from remnant plant stems of various species, some placed and oriented vertically to simulate standing vegetation and some horizontally to simulate vegetation that has been crushed down. We will place the trap nests in sampling areas and record which plants are used and the overall presence and when possible, the species identification of stem nesting bees. We will

also test methods of visual surveys, such as examining hollow plant stems with a miniature borescopes to determine if they are being used as nest sites.

The areas selected for study in this activity will correspond where possible with other activities on the project, but additional areas where we, members of the DNR, or others have encountered and reported stem-nesting bees will also be candidates for survey. Results will be part of the recommendations on plants species to benefit pollinators.

**Summary Budget Information for Activity 4:**

**ENRTF Budget: \$142,078**  
**Amount Spent: \$ 0**  
**Balance: \$ 142,078**

**Activity Completion Date: June 30, 2017**

<b>Outcome</b>	<b>Completion Date</b>	<b>Budget</b>
1. Investigate plants and plant communities that provide nesting and overwintering sites for Minnesota’s native bees	June 30, 2017	\$142,078
2. Senesced aboveground vegetation surveyed and database of the contents created	Dec 15, 2014	
3. Traditional and innovative trap nests placed in the field to begin surveys.	June 15, 2015	
4. Visual survey methods examined.	Aug 15, 2016	
5. Bees inhabiting “trap nests” made from natural vegetation evaluated.	June 30, 2017	
6. Recommendations to eliminate or moderate possible damage to overwintering native bee sites and lists of plant species that benefit stem-nesting pollinators.	June 30, 2017	

**Activity Status as of** December 15, 2014

**Activity Status as of** August 15, 2015

**Activity Status as of** February 15, 2016

**Activity Status as of** August 15, 2016

**Activity Status as of** March 15, 2017

**Final Report Summary:** June 30, 2017

**V. DISSEMINATION:**

**Description:** With the hiring of a new faculty member who specializes in pollinator biology and ecology, we will form a statewide working group to foster collaboration and coordination of all surveys and studies of pollinators and pollinator habitat. We will work closely with MN DNR, MN NRCS, Pheasants Forever, other state agencies and interested associations to construct a database of MN bees, landscape maps and assessments, demonstration sites, best management practices, peer-reviewed scientific papers, and long-term plans for sustaining pollinators and helping Minnesota beekeepers. Results will provide tangible ways that private land owners and public land managers can provide pollinator habitat for MN insect pollinators. The project will provide examples for other states in our region to adapt and expand.

**Status as of** December 15, 2014

**Status as of** August 15, 2015

**Status as of** February 15, 2016

**Status as of** August 15, 2016

**Status as of** March 15, 2017

**Final Report Summary:** June 30, 2017

**VI. PROJECT BUDGET SUMMARY:**

**A. ENRTF Budget Overview:**

<b>Budget Category</b>	<b>\$ Amount</b>	<b>Explanation</b>
Personnel:	\$ 784,000	1 Asst Professor at 1 FTE for 3 years; 1 post-doctoral researcher at 1 FTE for 3 years; 1 research coordinator at 1 FTE for 3 years; 1 Entomological specialist/research asst at 50% FTE for 2 years, 4 research technicians at 30% FTE each, 2 years each.
Equipment/Tools/Supplies:	\$ 23,000	Supplies for collecting, pinning and curating insects, insect nets, stem-trap nests, voice recorders, flagging, meter tape, planting of common gardens, plants, shovels, use of truck with water tank, etc.
Printing:	\$ 12,500	Preparation of printed extension materials for dissemination, plus peer-reviewed publication at standard open access fees
Travel Expenses in MN:	\$ 42,500	Travel to field sites to conducts surveys, and collecting bees on common gardens; travel to assemblies/ meetings to share research and results
Other:	\$ 2,000	Specialized pollinator training for staff; estimated reached by researching fees for courses and training materials.
<b>TOTAL ENRTF BUDGET:</b>		<b>\$ 864,000</b>

**Explanation of Use of Classified Staff:**

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

**Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 12.5 FTE**

**Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF**

**Appropriation: NA**

**B. Other Funds:**

<b>Source of Funds</b>	<b>\$ Amount Proposed</b>	<b>\$ Amount Spent</b>	<b>Use of Other Funds</b>
<b>Non-state</b>			
General Mills, research donation to M. Spivak, cash support	\$ 50,000	\$	Funds will be used toward establishing a pollen reference library. Pollen collected from bees in Activity 3a and b, and supplies for pollen ID will be identified by personnel hired on General Mills funds.
<b>State</b>			
University of Minnesota: College of Food, Agriculture and Natural Resource Sciences (CFANS) and College of Biological Sciences (CBS)	\$ 220,000	\$	In-kind "start-up" funds for new faculty member; standard amount to equip a new lab and begin research; see letter of support from Dean Levine (CFANS) and Dean Elde (CBS)

<b>TOTAL OTHER FUNDS:</b>	<b>\$270,000</b>	<b>\$</b>	
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**VII. PROJECT STRATEGY:**

**A. Project Partners:**

**Marla Spivak**, Professor in Entomology, U MN is project manager and will be responsible submitting project reports. **Clarence Lehman**, Associate Dean for Research in the College of Biological Sciences and Professor in Ecology, Evolution and Behavior, U MN, with M. Spivak will lead the search and hiring for a new faculty position related to this project. This faculty position will include research responsibilities on a basis of 70% time, to help expand our base of knowledge about pollinators, and also teaching responsibilities at 30% time to educate others and train the next generation in methods relevant to pollinators and the project. Two University of Minnesota colleges, CFANS and CBS, will supply space and collegiate support. Together with that new faculty member, M. Spivak and C. Lehman will oversee the research and outreach activities and will be responsible for administration of funds and the direction of employees. Entomological specialists **Elaine Evans, Colleen Satyshur**, and **Joel Gardner** will be key participants. M. Spivak will contribute in-kind expenses toward the analysis of pollen in her lab, and both M. Spivak and C. Lehman will contribute time to the project, funded by other sources.

**B. Project Impact and Long-term Strategy:**

The current, widespread decline of pollinators has become critical and threatens our supply of fruits and vegetables. The causes of decline of honey bees and wild, native bees are not completely known, but include fewer flowers, increased disease and pests, more insecticides, and loss of nesting sites. Fortunately, the present crisis for pollinators comes at a time when society recognizes the severity of the problem and is motivated to act to improve pollinator resources and environment. The goal of this project is to enhance pollinator habitat by providing new and reliable supplies of nectar and pollen for wild bees and honey bees, across the entire growing season in key beekeeping regions of Minnesota. This project will help create a new and critically needed interdisciplinary faculty position to lead and coordinate the research proposed here, and to help consolidate and accelerate the many other pollinator efforts that are ongoing and planned in this state. Improving conditions for pollinators will also improve conditions for birds and other wildlife, reduce soil erosion, improve water quality, and further beautify the landscape of Minnesota.

**C. Spending History:**

<b>Funding Source</b>	<b>M.L. 2009 or FY10</b>	<b>M.L. 2011 or FY12-13</b>	<b>M.L. 2013 or FY14</b>
USDA-NIFA (M. Spivak PI) for 3 year study in Prairie Pothole Region of ND on "Influence of mid-continent land-use trends on floral diversity and pollen availability to sustain bee health, diversity and ecosystem services"	\$499,044		
General Mills Research donation to reference library for honey bee collected pollens (M. Spivak PI)		\$150,000	
ENRTF for Bee Pollinator Habitat Enhancement (Bee Lawns) (M. Spivak PI)			\$200,000

**VIII. ACQUISITION/RESTORATION LIST:**

**IX. VISUAL ELEMENT or MAP(S):** See attached.

**X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET:**

**XI. RESEARCH ADDENDUM:**

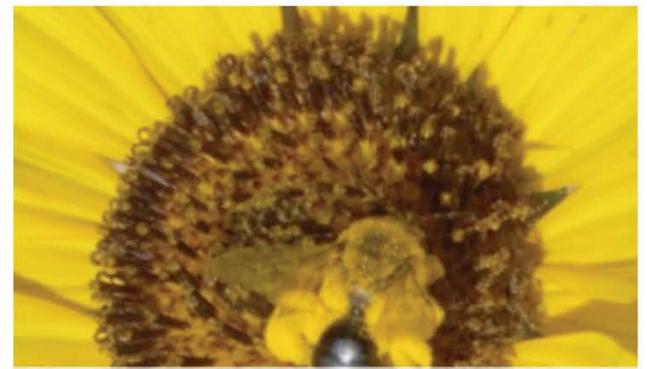
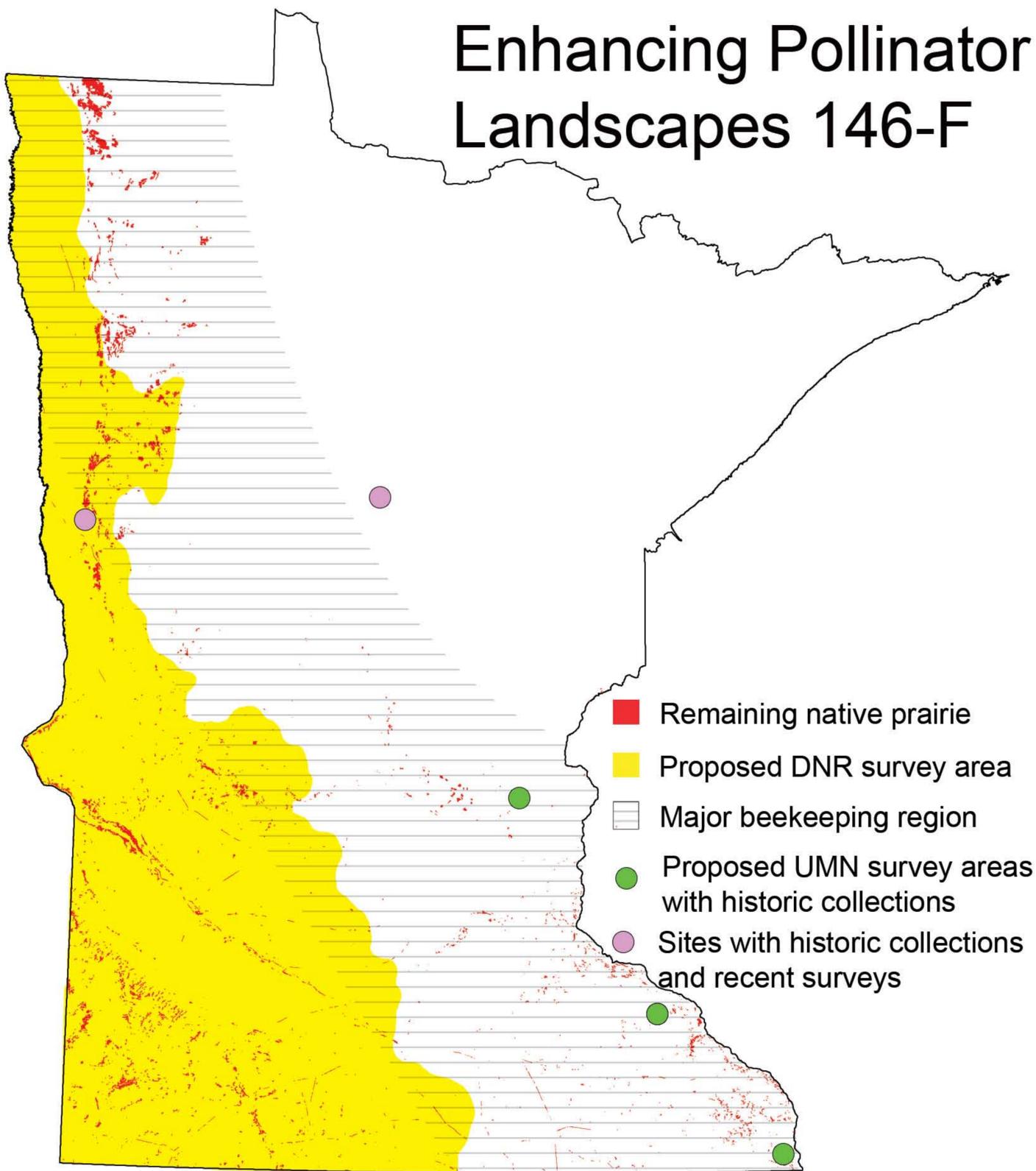
**XII. REPORTING REQUIREMENTS:**

Periodic work plan status update reports will be submitted no later than December 15, 2014, August 15, 2015, February 15, 2016, September 15, 2016 and March 15, 2017. A final report and associated products will be submitted between June 30 and August 15, 2017.



Environment and Natural Resources Trust Fund														
M.L. 2014 Project Budget														
Project Title: Enhancing Pollinator Landscapes, 146-F														
Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 06a														
Project Manager: Marla Spivak														
Organization: University of Minnesota														
M.L. 2014 ENRTF Appropriation: \$864,000														
Project Length and Completion Date: 3 years, June 30, 2017														
Date of Report: January 15, 2014														
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget	Amount Spent	Activity 1 Balance	Activity 2 Budget	Amount Spent	Activity 2 Balance	Activity 3 Budget	Amount Spent	Activity 3 Balance	Activity 4 Budget	Amount Spent	Activity 4 Balance	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	Pollinator Ecologist: New UMN Faculty Position			MN Bee Surveys			MN Floral Resources for Bees			Wild Bee Nesting Sites				
<b>Personnel (Wages and Benefits)</b>	\$ 329,144.00		\$ 329,144.00	\$ 195,713.00		\$ 195,713.00	\$ 135,565.00		\$ 135,565.00	\$ 123,578.00		\$ 123,578.00	\$ 784,000.00	\$ 784,000.00
New UMN Assistant Professor: \$329,144 (\$67% salary + 33.11% benefits) 1 FTE for 3 years														
Elaine Evans, Post-doctoral researcher: \$170,360 (66.4% salary + \$33.6% benefits)1 FTE for 3 years, Activity 2														
Colleen Satyshur, Research Coordinator: \$179,011 (66.4% salary, 33.6% benefits), 1 FTE for 3 years, Activities 2 and 3														
Joel Gardner, Entomological specialist and research assistant: \$44,073 (66.4% % salary, 33.6% benefits), 2 years, 0.5FTE, Activity 2 and 4														
Research technicians: \$46,059.75 (92.6% salary, 7.4% benefits), 4 months/year, 2 years,4 individuals/year, Activities 2 and 3.														
<b>Equipment/Tools/Supplies</b>														
Supplies for collecting, pinning and curating insects, insect nets, stem trap nests				\$ 5,000.00		\$ 5,000.00	\$ 1,000.00	\$ -	\$ 1,000.00	\$ 4,000.00	\$ -	\$ 4,000.00	\$ 10,000.00	\$ 10,000.00
Field equipment: voice recorders, flagging, meter tape, etc							\$ 1,000.00	\$ -	\$ 1,000.00				\$ 1,000.00	\$ 1,000.00
Set up common gardens: cost of plants, pots, shovels, rental of semi for transporting pallet-planters or rental of water truck							\$ 12,000.00	\$ -	\$ 12,000.00				\$ 12,000.00	\$ 12,000.00
<b>Printing</b>														
Peer reviewed publications at standard open access fees: \$1,500 each				\$ 2,000.00	\$ -	\$ 2,000.00	\$ 1,500.00	\$ -	\$ 1,500.00	\$ 1,500.00	\$ -	\$ 1,500.00	\$ 5,000.00	\$ 5,000.00
Design and printing Extension Materials				\$ 2,500.00	\$ -	\$ 2,500.00	\$ 2,500.00		\$ 2,500.00	\$ 2,500.00		\$ 2,500.00	\$ 7,500.00	\$ 7,500.00
<b>Travel expenses in Minnesota</b>														
Travel to field sites for conducting surveys and collecting bees and planting common gardens				\$ 10,000.00	\$ -	\$ 10,000.00	\$ 21,000.00	\$ -	\$ 21,000.00	\$ 10,000.00	\$ -	\$ 10,000.00	\$ 41,000.00	\$ 41,000.00
Travel to assemblies in Minnesota to share research and				\$ 500.00		\$ 500.00	\$ 500.00	\$ -	\$ 500.00	\$ 500.00	\$ -	\$ 500.00	\$ 1,500.00	\$ 1,500.00
<b>Other</b>														
Specialized pollinators training for staff: \$2,000, estimate reached by researching fees for courses and training							\$ 2,000.00	\$ -	\$ 2,000.00				\$ 2,000.00	\$ 2,000.00
<b>COLUMN TOTAL</b>	<b>\$ 329,144.00</b>	<b>\$ -</b>	<b>\$ 329,144.00</b>	<b>\$ 215,713.00</b>	<b>\$ -</b>	<b>\$ 215,713.00</b>	<b>\$ 177,065.00</b>	<b>\$ -</b>	<b>\$ 177,065.00</b>	<b>\$ 142,078.00</b>	<b>\$ -</b>	<b>\$ 142,078.00</b>	<b>\$ 864,000.00</b>	<b>\$ 864,000.00</b>

# Enhancing Pollinator Landscapes 146-F



Many *Andrena* spp. have a specialized diet, collecting pollen from a limited variety of flowers, often in one genus.

Many *Lasioglossum* spp. have a generalized diet, collecting pollen from a wide variety of flowers.



*Bombus affinis* populations have declined dramatically since 2000.



Many wild bees nest underground, requiring various soil types and covers.



## Proposed wild bee survey areas

Remaining native prairie was mapped by the Minnesota County Biological Survey: 1987-2011 as reported by the MN DNR May, 2011.



Honey bees live in colonies of up to 40,000 bees that are managed by beekeepers. An average of 30% of all honey bee colonies die annually across the United States. Minnesota is the 5th highest honey producer in the U.S.



Trap nests are used to monitor cavity nesting bees. Pictured below are bee larvae and pupae from a trap nest.

