2014 Project Abstract
For the Period Ending June 30, 2016

PROJECT TITLE: Wild Bee Pollinator Surveys in Prairie-Grassland Habitats
PROJECT MANAGER: Gerda Nordquist
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FUNDING SOURCE: Environment and Natural Resources Trust Fund
LEGAL CITATION: M.L. 2014, Chp. 226, Sec. 2, Subd. 05i

APPROPRIATION AMOUNT: $370,000

Overall Project Outcomes and Results

Wild bees are important for their pollination services and also for their contributions to species diversity in prairie-grasslands. Many prairie plant species require pollinators for seed production and bees are often cited as the most important pollinator group. Native prairies once covered a third of Minnesota, but less than two percent of this habitat remains today. The impact of this habitat loss to wild bees is unknown due to large gaps in our knowledge of Minnesota's wild bees. The primary objective of this project was to fill in these knowledge gaps. This was accomplished by compiling existing records of wild bees statewide and conducting surveys of wild bees in prairie-grassland habitats of western Minnesota. The association of wild bees with native plant species and the effects of prairie restoration efforts on bee species diversity are poorly understood. To address these information needs, both native prairie and restored grassland sites were surveyed for bees and associated flowering plants.

To build upon the 1919 publication, *The Hymenoptera of Minnesota,* by Frederic Washburn that listed only 66 bee species, 11 museum collections in the Upper Midwest were accessed for bee specimens from Minnesota. Numerous personal collections, reports and publications were reviewed. Distributional data was obtained for over 30,000 bee specimens, resulting in a preliminary Minnesota wild bee list that presently stands at 418 reported species with an additional 29 species requiring expert evaluation (Attachment 1, Appendices 1, 2). In addition, the statewide distribution of known species was greatly expanded. For example, a common sweat bee (*Halictus ligatus)* was known from only one county in 1919, but this project has compiled records from an additional 44 counties (Attachment 2).

Surveys for wild bees were conducted at 75 locations in western Minnesota, May through October 2015 and May through June 2016 (Attachment 3). Fifty-five native prairie sites distributed across western Minnesota and eight restored grassland sites were sampled every three weeks to obtain seasonal information on bees and flowering plants, and comparative information on bees found in native prairie versus restored grassland. The remaining twelve sites were sampled every three weeks to augment county records. Over 10,000 bee specimens were collected through this effort. Specimens have been prepared and data entered into databases that will be used to inform researchers and land managers.

Important bee and plant records were obtained. The rare and declining yellow banded bumble bee (*Bombus terricola*) was documented in Stevens County. This is a county record for the species and also the first time this bee has been recorded visiting snowberry plants, genus *Symphoricarpos*. Equally notable is the absence of another declining species, the rusty patched bumble bee (*Bombus affinis*). Twenty-eight county records for plants were collected during these surveys, as well as information on blooming phenology (Attachment 4).

Project Results Use and Dissemination

Data collected from this project is stored in the MNDNR Natural Heritage Information System and bee specimens are being deposited in the Insect Collection at the University of Minnesota. These will be available to researchers, land managers, and the public.

Several MNDNR websites were developed that summarize the goals and accomplishments of this project and address wild bees and other pollinators:

- *Native Bees of Minnesota's Grasslands* presents the goals and accomplishments of this project (http://www.dnr.state.mn.us/mbs/grasslandbees.html).
- *Minnesota's Pollinators* webpage (http://www.dnr.state.mn.us/pollinators/index.html)
- *Minnesota Pollinator Resources* webpage (http://www.dnr.state.mn.us/pollinator_resources/index.html).
- *Pollinator Resource Values for Upland & Wetland Prairies* webpage and booklet (http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf).

The project coordinator/bee specialist (Crystal Boyd) has delivered information on this project through presentations, publications, interviews and educational events. She co-organized a Tallgrass Prairie Bee Identification Workshop and has highlighted Minnesota's wild bees at a wide variety of public venues (refer to Supplementary Materials).

Date of Status Update: September 14, 2016

Final Report

Date of Work Plan Approval: June 4, 2014

Project Completion Date: June 30, 2016

PROJECT TITLE: Wild Bee Pollinator Surveys in Prairie-Grassland Habitats

Project Manager: Gerda Nordquist

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Location: Statewide for scientific collections and literature review; for field surveys, the Minnesota Prairie Region*, including and/or impacting Becker, Big Stone, Blue Earth, Brown, Chippewa, Clay, Cottonwood, Dodge, Douglas, Faribault, Freeborn, Grant, Kandiyohi, Kittson, Jackson, Lac Qui Parle, LeSueur, Lincoln, Lyon, Mahnomen, Marshall, Martin, McLeod, Meeker, Morrison, Mower, Murray, Nicollet, Nobles, Norman, Otter Tail, Pennington, Pipestone, Polk, Pope, Red Lake, Redwood, Renville, Rice, Rock, Roseau, Sibley, Stearns, Steele, Stevens, Swift, Todd, Traverse, Waseca, Watonwan, Wilkin, Yellow Medicine counties.

*As delineated in the Minnesota Prairie Conservation Plan. 2011. Minnesota Prairie Plan Working Group, 55 pp.

Total ENRTF Project Budget:		
	ENRTF Appropriation:	**$370,000**
	Amount Spent:	**$368,831**
	Balance:	**$1,169**

Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 05(i)

Appropriation Language:
$370,000 the second year is from the trust fund to the commissioner of natural resources to assess the current status and distribution of wild bee pollinators in prairie-grassland habitats of Minnesota.

I. PROJECT TITLE: Wild Bee Pollinator Surveys in Prairie-Grassland Habitats

II. PROJECT STATEMENT: Wild bees are important for their pollination services and also for their contributions to species diversity in prairie-grasslands. Many prairie plant species require pollinators for seed production and bees are often cited as the most important pollinator group. Native prairies once covered a third of Minnesota, but less than two percent of this habitat remains today. The Minnesota Prairie Conservation Plan seeks to protect or reestablish functional prairie systems, which are measured by "stable or increasing native plant diversity and condition." The importance of plant-pollinator interactions is recognized by prairie restoration efforts, but there are large gaps in our knowledge of Minnesota's wild bees. For example, Minnesota's first and only statewide list of bee species was published in 1919. It reported only 88 species, compared to neighboring Wisconsin that reported 388 bee species in 2008. The state list of Species of Greatest Conservation Need (2006) does not include any native bees due to a scarcity of information about their distribution and status. However, the Xerces Society lists at least two bumblebee species that are perceived to be declining in Minnesota and smaller, less noticeable species may face similar declines. A compilation of bee survey and research efforts that have occurred since the 1919 list was published is clearly needed. A more complete list of bee species occurring in Minnesota and a registry of survey efforts and researchers will form a foundation from which future pollinator research can benefit.

Assessment of the current status and distribution of bee species requires field surveys. Proposed surveys throughout the prairie region of western Minnesota will document the diversity and distribution of wild bees on prairie-grasslands and form the basis for measuring differences in the bee fauna documented from prairies in the past to those found on native and restored prairies today. These surveys will complement efforts to resurvey historical locations in southeastern Minnesota by the University of Minnesota (*Enhancing Pollinator Landscapes, ENRTF 146-F*). The findings from both projects will be used to augment the state list of bees, provide natural history information for bee species status assessments, and inform revisions to the state list of Species of Greatest Conservation Need, scheduled for completion in 2015.

The effects on bee species diversity of various prairie restoration efforts needs to be assessed so that appropriate choices of native plant species are made that benefit wild bees. This project will conduct paired surveys of bees on native prairie and restored prairie-grasslands. Associated data on the vegetation composition and quality, and the abundance and richness of plants in flower during the surveys, will be documented. The information obtained by these paired surveys, in coordination with the findings of floral resource surveys planned by the University of Minnesota (*Enhancing Pollinator Landscapes, ENRTF 146-F*), will refine restoration decisions to enhance both the bee pollinator populations and the prairie-grassland habitat. It may also inform native plant choices for the proposed Pollinator Garden at the Minnesota Landscape Arboretum (*Bee Discovery Center at the Minnesota Landscape Arboretum, ENRTF 073-C*) and community pollinator projects proposed by Pheasants Forever (*Minnesota Pollinator Partnership, ENRTF 072-C*).

III. PROJECT STATUS UPDATES:

Project Status as of January 1, 2015
NOTE: ENRTF Budget figures for Activities 1-3, below, were adjusted to match those in the Budget spreadsheet.
Since the beginning of this project, efforts focused on augmenting the list of Minnesota's wild bees with existing information. Bee specimens were examined at three museum collections and data were received from another. Records also were obtained from personal collections, student theses, informal reports and published literature. The resulting list of 425 species of wild bees in Minnesota greatly exceeds the previous report of 66 species in *Hymenoptera of Minnesota* (F. Washburn, 1919). Development of a working list of Minnesota's bees and a map

showing the number of bee species in each county are underway (refer to MNDNR's *Native Bees of Minnesota's Grasslands* webpage (http://www.dnr.state.mn.us/mbs/grasslandbees.html).

Planning and preparation for the 2015 bee field surveys was initiated. Survey protocols were developed and bee traps were constructed. Minnesota Biological Survey (MBS) plant ecologists were consulted about high-quality native prairie sites and how to assess floral resources. Biometricians were consulted about site selection, the number of replicates for native prairie/restored grassland comparisons, and suggestions for long-term monitoring of these sites.

Preliminary field surveys of native prairie sites were conducted in late summer/fall 2014 to test and refine survey protocols. Approximately 100 bee specimens collected from these surveys were prepared and labeled for inclusion into the Insect Collection at the University of Minnesota. Because specimen data from this collection are only available from labels, a project was initiated to enter data into an electronic format with the help of citizen volunteers. To date, they have entered over 2,000 records of the estimated 27,000 bee specimens from the University of Minnesota collection. This database is compatible with MNDNR's Natural Heritage Information System and will incorporate new records obtained during this project.

Project Status as of July 1, 2015
Work continues on compilation of existing records for bees in Minnesota. Minnesota bee holdings from several collections in the Upper Midwest were examined. Data were recorded from the oldest and most recent specimens of each species represented for a county. To date, state distributional records have been obtained from approximately 29,000 specimens. With the help of volunteers and a collaborator from the ENRTF-funded *Enhancing Pollinator Landscapes* project, information from bee specimens at the University of Minnesota's Insect Collection are being entered into databases. To date 9,200 specimens have been entered. These records will be compiled and displayed as distribution maps for Minnesota's bee species (refer to Attachment 1).

A specimen of the bee species, *Trachusa zebrata*, was collected from Pine County in 1909. This specimen is the type specimen on which the species was originally described.

Survey sites were selected, transects of bowl traps were established, and field surveys were conducted regularly to document wild bees and associated flowering plants. Under Activity 2, high quality native prairie habitat was sampled throughout the Minnesota Prairie Region (see Attachment 3). Under Activity 3, a subset of high quality prairie sites in the southern half of the region was paired with nearby grasslands that have undergone some restoration to native vegetation. In addition to running transects, field teams targeted other areas for hand-netting. Nearly 3,000 bees have been collected thus far and prepared as voucher specimens.

The yellow-banded bumble bee (*Bombus terricola*) was documented in Stevens County during surveys. This species has suffered severe declines over much of its range in the eastern and central United States. In the process of documenting bee species, this project has collected 15 county records of native plants from 8 counties.

The current tally of Minnesota bee species now stands at 426 species.

Amendment Request (08/28/2015):
Expenditures for out-of-state travel to museum collections were less than the estimated amount. We request that the remaining $5,008 from Activity 1/Other category be moved to Activity 2/Field survey equipment. This will address an anticipated need for additional field survey and specimen preparation supplies.
Amendment Approved by LCCMR 09/01/2015

Project Status as of February 11, 2016

The state species list of Minnesota bees continues to be compiled – current tally stands at 426 species, with 29 problematic species requiring expert opinion. DNR volunteers and staff working under the ENRTF grant *Enhancing Pollinator Landscapes* have databased 14,000 bee specimens, to date, from the University of Minnesota Insect Collection. Additional specimens were submitted from the Minnesota Biological Survey and Three Rivers Park District. Discussions are ongoing with Dr. Dan Cariveau, University of Minnesota, and staff from the DNR data governance and Natural Heritage Information System about data sharing and storage.

Field surveys of wild bees and flowering plants in native prairie and restored grasslands were conducted during this period. Pan-trap transects were run from May through October on eleven prairie sites in the Lake Agassiz Aspen Parklands and Red River Valley ecological sections. Eight prairie and eight restored grassland transects were run in the North-central Glaciated Plains ecological section. Thirteen additional transects were added at restored grasslands across the prairie region to collect county records. Approximately 6,400 bee specimens were collected from these transects and more than 1,400 bee specimens were collected from expanded surveys in other parts of the prairie region. Voucher specimens were prepared; labeling and data entry are ongoing. In addition, 17 plant county records were obtained from the vegetation surveys associated with the bee transects.

Amendment Request (02/11/2016):

Expenditures for professional contracts will be handled by in-house staff. We request that $5,000 from Activity 2/statistical guidance and $5,000 from Activity 3/vegetation analysis be moved to Activity 2/Personnel. This will allow the project to utilize internal resources to address statistical guidance and vegetation analysis.

Expenditures for in-state travel in Activity 3 were less than the requested amount. We request that $12,000 from Activity 3/Travel expenses in Minnesota be moved to Activity 2/Field survey equipment and $20,000 be moved to Activity 1/Personnel. This will address an anticipated need for additional staff, field survey equipment, and specimen preparation supplies during the 2016 field season.

Amendment Approved by LCCMR 02/22/2016

Amendment Request (06/17/2016)

Due to the previous amendment request to change professional contracts to in-house staff, the Direct & Necessary charges will increase. We request that $2,000 from Activity 2/Personnel be moved to Activity 2/Direct & Necessary.

We anticipate that expenditures for in-state travel in Activity 3 will exceed that category's remaining budget. We request that $7,000 from Activity 2/Personnel be moved to Activity 2/Travel expenses in Minnesota.

Overall Project Outcomes and Results

Wild bees are important for their pollination services and also for their contributions to species diversity in prairie-grasslands. Many prairie plant species require pollinators for seed production and bees are often cited as the most important pollinator group. Native prairies once covered a third of Minnesota, but less than two percent of this habitat remains today. The impact of this habitat loss to wild bees is unknown due to large gaps in our knowledge of Minnesota's wild bees. The primary objective of this project was to fill in these knowledge gaps. This was accomplished by compiling existing records of wild bees statewide and conducting surveys of wild bees in prairie-grassland habitats of western Minnesota. The association of wild bees with native plant species and the effects of prairie restoration efforts on bee species diversity are poorly understood. To address these information needs, both native prairie and restored grassland sites were surveyed for bees and associated flowering plants.

To build upon the 1919 publication, *The Hymenoptera of Minnesota,* by Frederic Washburn that listed only 66 bee species, 11 museum collections in the Upper Midwest were accessed for bee specimens from Minnesota.

Numerous personal collections, reports and publications were reviewed. Distributional data was obtained for over 30,000 bee specimens, resulting in a preliminary Minnesota wild bee list that presently stands at 418 reported species with an additional 29 species requiring expert evaluation (Attachment 1, Appendices 1, 2). In addition, the statewide distribution of known species was greatly expanded. For example, a common sweat bee (*Halictus ligatus)* was known from only one county in 1919, but this project has compiled records from an additional 44 counties (Attachment 2).

Surveys for wild bees were conducted at 75 locations in western Minnesota, May through October 2015 and May through June 2016 (Attachment 3). Fifty-five native prairie sites distributed across western Minnesota and eight restored grassland sites were sampled every three weeks to obtain seasonal information on bees and flowering plants, and comparative information on bees found in native prairie versus restored grassland. The remaining twelve sites were sampled every three weeks to augment county records. Over 10,000 bee specimens were collected through this effort. Specimens have been prepared and data entered into databases that will be used to inform researchers and land managers.

Important bee and plant records were obtained. The rare and declining yellow banded bumble bee (*Bombus terricola*) was documented in Stevens County. This is a county record for the species and also the first time this bee has been recorded visiting snowberry plants, genus *Symphoricarpos*. Equally notable is the absence of another declining species, the rusty patched bumble bee (*Bombus affinis*). Twenty-eight county records for plants were collected during these surveys, as well as information on blooming phenology (Attachment 4).

Project Results Use and Dissemination

Data collected from this project is stored in the MNDNR Natural Heritage Information System and bee specimens are being deposited in the Insect Collection at the University of Minnesota. These will be available to researchers, land managers, and the public.

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- *Pollinator Resource Values for Upland & Wetland Prairies* webpage and booklet (http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf).

The project coordinator/bee specialist (Crystal Boyd) has delivered information on this project through presentations, publications, interviews and educational events. She co-organized a Tallgrass Prairie Bee Identification Workshop and has highlighted Minnesota's wild bees at a wide variety of public venues (refer to the Supplementary Materials).

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Species List of Wild Bees in Minnesota

Description: Existing information on the statewide distribution, habitat association, and natural history traits of wild bees (including native and non-native species) found in Minnesota will be compiled from regional and national repositories, published literature, and unpublished reports. The data from specimen examination and literature review will be compiled in species summaries, distribution maps and a statewide bee species list.

Approach: Bee specimens in museum collections will be examined and associated information recorded. The objective is to obtain geospatial and habitat information from every county represented by a bee specimen in each collection. In situations where counties span more than one ecological province, specimen data from each province within a county will be collected. Data from the oldest and newest specimens of a species will be recorded for historical perspective. Compilation of this information, through databases, GIS layers and webpage development, will identify data gaps that direct future survey efforts, provide baseline data that inform conservation and management priorities, and facilitate contributions from citizen scientists. This project will work closely with the new pollinator faculty position at the University of Minnesota (refer to *Enhancing Pollinator Landscapes, ENRTF 146-F*) to ensure consistency in database development and interdisciplinary access to the growing data set on Minnesota's pollinators.

Summary Budget Information for Activity 1:

ENRTF Budget: $ 92,492
Amount Spent: $ 91,992
Balance: $ 500

Activity Completion Date: June 30, 2016

Outcome	Completion Date	Budget
1. Specimen data on bees collected from national and regional museums	April 2016	$ 29,992
2. Literature and reports reviewed for information on Minnesota bees	April 2016	$ 19,000
3. Distribution and natural history data entered into database	April 2016	$ 27,500
4. Prepare and distribute species list of bees in Minnesota	Continuing	$ 9,126
5. DNR Direct and Necessary Cost	June 2016	$ 6,874

Project Status as of January 1, 2015

Data from Minnesota bee specimens were collected at University of Minnesota – Twin Cities and Duluth, and at North Dakota State University, Fargo. A list of Minnesota bee holdings was received from the American Museum of Natural History, New York. To date, species names and distribution information have been obtained from approximately 28,000 specimens. Visits to additional collections are planned for winter 2015.

In addition to museum records, the working list of Minnesota bee species now includes records from personal collections, student theses, informal reports and published literature. Any species records that are not corroborated will remain tentative until confirmed. The current tally of bee species in Minnesota stands at 425 species. This represents a substantial increase over the 66 species reported in Frederic Washburn's 1919 report, *Hymenoptera of Minnesota*.

Compilation of these records at the county level is summarized in Attachment 5 for the University of Minnesota – Twin Cities collection. Previously, this collection information was only accessible from specimen labels. Now, however, seven citizen volunteers are helping to enter these data into a database that will benefit bee specimen management at the Insect Collection, as well as make this information readily available to researchers, resource managers and members of the public. Currently, the volunteers have databased over 2,000 of the estimated 27,000 specimens in this collection.

National data aggregators and MNDNR data managers were consulted for advice on data management strategies, resulting in the pilot database developed through this project. This database will accommodate new and historic bee information, is compatible with the MNDNR's Natural Heritage Information System, and is also being used by staff working under the ENRTF *Enhancing Pollinator Landscapes* project. File structures were created to track updates to the growing list of bees documented in Minnesota.

As illustrated in Attachment 5, the prairie region of the state has fewer species records compared to other areas in Minnesota. This is likely due to a lack of survey effort in these counties. For example, Murray County in

southwestern Minnesota has no records of bees, yet it contains extensive, high-quality native prairie in the Chanarambie Creek area. Surveys of prairie-grasslands planned for summer 2015 should provide important records of bees in these underrepresented counties.

Project Status as of July 1, 2015
Additional data from Minnesota bee specimens were obtained from collections at the University of Wisconsin—Madison, Field Museum of Natural History, Illinois Natural History Survey, Iowa State University, and South Dakota State University. Data compilation and management of the bee collection at the University of Minnesota –Twin Cities is ongoing. To date, species names and distribution have been obtained from approximately 29,000 specimens. Visits to additional collections, such as Winona State University and the Science Museum of Minnesota, are planned for winter 2016.

The current tally of Minnesota bee species now stands at 426 species. This number is expected to change, as taxonomic problems are resolved and volunteers continue databasing specimens housed at the University of Minnesota Insect Collection. To date, 3,700 specimens have been databased by volunteers. Joel Gardner, a collaborator from the University of Minnesota's ENRTF-funded *Enhancing Pollinator Landscapes* project, has databased an additional 5,500 specimens. Data management strategies continue to evolve, and the project's coordinator/bee specialist (Crystal Boyd) has begun data sharing conversations with the new pollinator professor at the University of Minnesota, Dr. Dan Cariveau.

One exciting discovery is that the type specimen of *Trachusa zebrata* was originally described from a specimen collected from Pine County, Minnesota in 1909. It had been erroneously reported from Wisconsin in historical literature and Amy Wolf's 2008 publication "Bees of Wisconsin." This correction was confirmed by Dr. John Ascher, a leading bee expert from the National University of Singapore.

Project Status as of February 11, 2016
The state species list of bees currently stands at 426 species, with an additional 29 problematic species. This number is expected to change as taxonomic problems are resolved and volunteers continue databasing specimens housed at the University of Minnesota Insect Collection. To date, more than 6,400 specimens have been databased by DNR staff and volunteers. Data will be combined with an additional 7,900 historic records databased by Joel Gardner through the ENRTF-funded grant *Enhancing Pollinator Landscapes*.

A data request was sent to the Stearns County History Museum, which confirmed that it does not house any historic insect specimens. Data requests will be sent to additional museums in winter 2016, such as the Headwaters Science Center in Bemidji, Minnesota.

Bee data from collaborators contributed to more accurate species distribution maps. Staff from the Minnesota Biological Survey collected 58 bee specimens in April, June, and August 2015 in Beltrami and Lake of the Woods counties while conducting mammal and bird surveys. Three Rivers Park District also donated 364 bee specimens from 11 samples taken approximately weekly from June to September 2015 in Hennepin County. A citizen scientist submitted bumble bee specimens from the North Shore for identification, including one specimen of the declining yellowbanded bumble bee (*Bombus terricola*) from Lake County. Previous DNR surveys resulted in ~7,900 bee specimens that are currently being databased.

A series of data governance meetings were held in fall 2016, including one meeting in collaboration with Dr. Dan Cariveau from the University of Minnesota. Data-sharing strategies were discussed, and a project definition was drafted. The project coordinator (Crystal Boyd) attended Access database classes at the Science Museum of Minnesota.

Final Report Summary:
Additional distributional information on Minnesota bees was obtained from the insect collection at the Headwaters Science Center in Bemidji. Over the course of this project, data on Minnesota bees were collected from 11 museum collections and 16 additional sources, including personal collections, student theses, informal reports, published literature, and collaborators.

The current tally of bee species in Minnesota stands at 418 confirmed bee species, with 29 additional problematic species. This represents a substantial increase over the 66 species reported in Frederic Washburn's 1919 publication, *The Hymenoptera of Minnesota*.

Management of bee specimen data continues. To date, DNR staff and volunteers have databased over 7,900 specimens from previous DNR surveys and over 9,900 specimens housed at the University of Minnesota Insect Collection. Joel Gardner, working under the ENRTF project *Enhancing Pollinator Landscapes,* has databased more than 11,900 additional bee specimens at the University of Minnesota Insect Collection. This effort has enabled digital access to label data that was previously available only through in-person visits or requests for physical specimen loans.

Washburn reported a common sweat bee (*Halictus ligatus)* from just one county in 1919, but this project has expanded the bee's known distribution to 45 counties (Attachment 2). Knowledge of the distribution of bee species in Minnesota has been greatly expanded through this project. Several examples of noteworthy discoveries are described below.

While reviewing literature, the type specimen for *Trachusa zebrata* was determined to be from Minnesota. A type specimen is the specimen on which the description of a new species is based. The type location had been erroneously reported as Wisconisin.

Examination of collections confirmed a record for the yellow banded bumble bee (*Bombus terricola*) from Lake County. This species is experiencing significant decline and is listed as a Species in Greatest Conservation Need (SGCN) in Minnesota. A photograph taken by a collaborator from the Washington County Parks District confirmed the presence of the rusty patched bumble bee (*Bombus affinis*), another declining SGCN species.

National data aggregators and MNDNR data managers were consulted for advice on data management strategies, resulting in the pilot database developed through this project. This database will accommodate new and historic bee information, is compatible with the MNDNR's Natural Heritage Information System, and is also being used by staff working under the ENRTF *Enhancing Pollinator Landscapes* project. File structures were created to track updates to the growing list of bees documented in Minnesota. A series of data governance meetings were held, including one in collaboration with the new pollinator professor at the University of Minnesota, Dr. Dan Cariveau.

ACTIVITY 2: Wild Bees Associated with Native Prairie
Description: Preliminary surveys of wild bees and associated flowering plants will be conducted on native prairie sites throughout the Minnesota Prairie Region. Survey findings will identify wild bee species associated with native prairies, as identified by the Minnesota Biological Survey, and will contribute to the comprehensive list of wild bees in Minnesota. Findings will be evaluated in terms of region, prairie classification, and spatial context. Survey techniques will be evaluated for effectiveness as a long-term monitoring protocol (see Activity 3).

Approach: Native prairie sites will be selected from Aspen Parklands, Red River Prairie and Minnesota River Prairie ecological sections. Bee trap transects will be run repeatedly at each site from April through October to maximize the diversity of bee species recorded. Survey protocol is similar to that proposed for the University of Minnesota's resurvey effort (refer to *Enhancing Pollinator Landscapes, ENRTF 146-F*), thus enabling comparison of bee fauna from other regions of the state. All *bees collected will be identified and entered into the bee database with associated habitat information. Voucher specimens will be prepared for each species at each site and submitted to the Insect Collection at the University of Minnesota. Associated floral diversity at the bee transects will be documented.

*Bees targeted include members of six bee families in the subgroup Anthophila, order Hymenoptera. Hymenoptera not targeted by this project include wasps, hornets, ants and sawflies. Individuals from these groups, as well as other insects and arachnids, that are captured during the survey will be collected and retained for a period of time for future investigations.

Summary Budget Information for Activity 2:

ENRTF Budget: $ 162,508
Amount Spent: $ 161,839
Balance: $ 669

Activity Completion Date: June 30, 2016

Outcome	Completion Date	Budget
1. Selection of up to 45 native prairie sites	July 2014	$ 6,000
2. Field surveys of bees and associated plant species	November 2014	$ 97,008
3. Protocol testing for long-term monitoring	November 2014	$ 5,500
4. Data entry, specimen preparation, and delivery of specimens to museum collections	April 2015	$ 33,000
5. Evaluation and refinement of survey methodology	April 2015	$ 5,500
6. Summarize findings, add to species list, and distribute to partners	June 2016	$ 5,500
7. DNR Direct and Necessary Cost	June 2016	$10,000

Project Status as of January 1, 2015

Procurement and preparation of survey equipment was initiated and preliminary surveys of selected sites were conducted from late summer through fall 2014 to test survey protocol.

Over 600 pan traps were constructed using inexpensive plastic bowls and PVC pipe. Several designs were considered to allow for adjustment of the pan traps to the height of surrounding flowering vegetation.

Preliminary field surveys were conducted at Roscoe Prairie, Otter Tail Prairie, and Sedan Brook Prairie Scientific and Natural Areas. It is noteworthy that a high density of blooming forbs at Roscoe Prairie seemed inversely proportional to the abundance of bees caught in the pan traps. This collection bias is consistent with similar observations from other bee researchers, who speculate that the pan traps are less visible or less attractive when there are many flowers in the vicinity. Specimen preparation and data management of captures are currently underway. Supplies and equipment to prepare and house bee specimens have been procured. North Dakota State University has agreed to store the non-bee specimens as bulk samples and an Eagle Scout is building vial racks to store the specimens.

Survey protocols, data forms and a field schedule are being developed and refined in preparation for 2015 bee surveys. Recommendations from other bee researchers, MBS entomologist and MBS plant ecologists/botanists have provided valuable input on survey design and diversity of native prairie plant communities. Final selection of native prairie survey sites, planned for early winter 2015, will draw from nearly 40 native prairie community types.

Project Status as of July 1, 2015

Native prairie survey sites were evaluated and site selection was finalized for eleven locations in the Lake Agassiz, Aspen Parklands and Red River Valley ecological sections in the north and eight locations in the North Central Glaciated Plains ecological section in the south portion of the Minnesota Prairie Region (see Attachment 3; refer to Activity 3 for a discussion of selection criteria). Site managers were notified, collecting permits were obtained, and field supplies were purchased. Transects were installed and GIS maps were created. Counties selected for native prairie transects were prioritized based upon the lack of species previously recorded, the amount of high-quality prairie habitat within the county, and distance from the field stations. Bee collecting with hand nets was conducted in counties without transects to fill in knowledge gaps about the distribution of bee species.

Seasonal staff were hired and trained. Lodging, vehicles and equipment were secured, prepared, and maintained. Survey protocols, field labels, data sheets, and scheduling tools were developed and refined. Data entry devices were purchased and an app was developed to facilitate electronic data entry in the field. This app is now in the second stage of beta testing.

Surveys were conducted along transects approximately every three weeks at all sites, resulting in an estimated 2,000 bee specimens. From May to July, staff spent 22 days in 28 counties hand netting over 760 bee specimens to augment county records. Voucher specimens were pinned and labelled at the field stations. Field surveys and specimen preparation is ongoing. Non-bee specimens were preserved in ethanol for long-term storage. As part of a special project, an Eagle Scout built 30 vial racks to hold these invertebrate specimens.

One specimen of the rare and declining yellow-banded bumble bee (*Bombus terricola*) was documented near Morris at Dolven WMA in Stevens County. We suspect this is a county record for the species, and also the first time this bee species has been documented visiting the plant genus *Symphoricarpos*. Equally notable is the absence of another declining species, the rusty patched bumble bee (*Bombus affinis*); to date, this project has not recorded any sightings of this species in Minnesota's Prairie Region. This project has also documented 15 county records of native plants from 8 counties, pending confirmation from experts (see Attachment 4).

Project Status as of February 11, 2016

Native prairies were surveyed using pan-trap transects at eleven sites in the Lake Agassiz Aspen Parklands and Red River Valley ecological sections in the north and eight sites in the North-Central Glaciated Plains ecological section in the south (see Attachment 3). Bee collecting with hand nets was conducted in counties without transects to fill in knowledge gaps about the distribution of bee species.

Seasonal staff and volunteers conducted field work and prepared specimens. Survey protocols, field labels, data sheets, and scheduling tools were continually refined. An app was tested to facilitate electronic data entry in the field. IT staff spent two days trouble-shooting the app in Yellow Medicine and Lac Qui Parle counties.

Surveys were conducted along transects approximately every three weeks at all sites (see schedule below), resulting in collection of 6,400 bee specimens. From May through October, staff hand netted over 1,400 bee specimens. Voucher specimens were pinned and labelled at the field stations. Specimen identification and databasing is ongoing. Non-bee specimens were preserved in 400+ vials of ethanol for long-term storage.

2015 Transect Dates for Pan Trap Surveys

SW Sites	NW Sites
May 26-27	May 26-27
June 15-17	June 15-17
July 13-15	July 19-21

August 14-16 & 24-26	August 24-26
September 9-11	September 11-13
October 10-11	October 10-11

Nine specimens of the Couse tadpole shrimp (*Lepidurus couesii*) were collected from boat launches at Roseau River WMA and Trangsrud Public Access Landing (Roseau County). Dr. Christopher Rogers from the Kansas Biological Survey confirmed their identification. These specimens are considered the second record of this genus in Minnesota, and a "News from the Field" blog shared this important find (refer to the Supplementary Materials).

This project has also documented 17 plant county records, which were confirmed by experts, vouchered at the UMN Herbarium, and added to the DNR's MNTaxa database (see Attachment 4).

Final Report Summary:
Survey equipment was procured and prepared. Over 900 pan traps were constructed using inexpensive plastic bowls and PVC pipe. Several designs were considered to allow for adjustment of the pan traps to the height of surrounding flowering vegetation. Survey protocols, data forms, field labels, and a field schedule were developed. Lodging, vehicles, and equipment were secured, prepared, and maintained. Seasonal staff were hired and trained. Data entry devices were purchased and an app was developed to facilitate electronic data entry in the field. MnIT staff spent two days trouble-shooting the app in Yellow Medicine and Lac Qui Parle counties. This app is now in the second stage of beta testing.

Preliminary field surveys were conducted from late summer through fall 2014 to test survey protocols. A high density of blooming forbs at Roscoe Prairie seemed inversely proportional to the abundance of bees caught in the pan traps. This collection bias is consistent with similar observations from other bee researchers, who speculate that the pan traps are less visible or less attractive when there are many flowers nearby.

Survey design and site selection was conducted with input from other bee researchers, MBS entomologists, and MBS plant ecologists/botanists. Counties selected for native prairie transects were prioritized based upon the lack of bee species previously recorded, the amount of high-quality prairie habitat within the county, and distance from the field stations. Native prairie survey sites were evaluated, and final site selection drew from nearly 40 native prairie community types. In 2015 and 2016, there were 19 and 36 high-quality native prairie sites, respectively (see Attachment 3).

Field surveys began once site managers were notified, collecting permits were obtained, transects were installed, and GIS maps were created. In counties without transect sites, bees were collected with hand nets to fill knowledge gaps about the distribution of bee species. From May through October 2015, staff hand-netted over 1,400 bee specimens. From May through June 2016, our project overlapped with other ENRTF projects -- Effects *of Grazing Versus Fire for Prairie Management* and *Data Driven Pollinator Conservation.* Bee data from all projects will be shared.

In 2015, native prairies were surveyed using pan-trap transects at eleven sites in the Lake Agassiz, Aspen Parklands, and Red River Valley ecological sections in the north and eight sites in the North-Central Glaciated Plains ecological section in the south. Seasonal staff conducted surveys along transects approximately every three weeks at all sites (see schedule below), resulting in collection of 6,400 bee specimens.

2015 - Transect Dates for Pan Trap Surveys

SW Sites	NW Sites
May 26-27	May 26-27

June 15-17	June 15-17
July 13-15	July 19-21
August 14-16 & 24-26	August 24-26
September 9-11	September 11-13
October 10-11	October 10-11

In 2016, native prairies were surveyed using pan-trap transects at 12 sites in the Lake Agassiz Aspen Parklands and Red River Valley ecological sections in the north and 24 sites in the North-Central Glaciated Plains ecological section in the south (see Attachment 3). Seasonal staff conducted surveys along transects approximately every three weeks at all sites (see schedule below), resulting in collection of over 3,800 bee specimens.

2016 - Transect Dates for Pan Trap Surveys

W Sites	Central Sites
May 18-21	May 21-22
June 6 – 9	June 7 - 8
June 27 - 30	July 1 – 2 (part of ENRTF project, M.L. 2016-03(b)

Specimen preparation and data management of captures is ongoing. Supplies and equipment to prepare and house bee specimens were procured. Seasonal staff and volunteers prepared voucher specimens at the field stations. Databasing was completed in winter 2015-2016. Specimens were prepared for long-term storage at the University of Minnesota Insect Collection. Final specimen identification is ongoing and non-bee specimens were preserved in vials of ethanol for long-term storage at North Dakota State University. An Eagle Scout built 30 vial racks to hold these non-bee specimens.

Several important records of bee species were documented during field surveys (see Attachment 4). One specimen of the rare and declining yellow banded bumble bee (*Bombus terricola*) was documented near Morris at Dolven WMA in Stevens County. This is a county record for the species and also the first time this bee has been recorded visiting snowberry plants, genus *Symphoricarpos*. Equally notable is the absence of another declining species, the rusty patched bumble bee (*Bombus affinis*); to date, this project has not recorded any sightings of this species in Minnesota's prairie region. A state record of *Nomia universitatis* was collected in Faribault County, pending confirmation by experts.

Many plant county records were also obtained during field surveys (see Attachment 4). In 2015, this project documented 17 county records of plants, which were confirmed by experts, vouchered at the UMN Herbarium, and added to the DNR's MNTaxa database. In 2016, an additional 10 plant county records were collected, pending confirmation from experts. Data was also sent to DNR experts about the location and blooming phenology of small white lady's slipper (*Cypripedium candidum*), an orchid listed as Special Concern in Minnesota. Locality data about *C. candidum* was also sent to land managers to protect it from trampling by conservation grazing.

Observations of other animals were recorded during field surveys. For example, the Couse tadpole shrimp (*Lepidurus couesii*) was collected from boat launches in Roseau County, remarkably documenting only the second record of this genus in the state. Spiders nesting in bee traps were identified by experts, revealing county records of the starbellied orbweaver (*Acanthepeira stellata*), slender crab spider (*Tibellus oblongus*), and a jumping spider (*Phiddipus clarus*). Bird observations included a sighting of American woodcock (*Scolopax minor*, a SGCN) in Redwood County and the first observation of a breeding hooded merganser (*Lophodytes cucullatus*) in Grant County. Rare mammal observations of Franklin's ground squirrel (*Spermophilus franklinii*) and moose (*Alces alces*) in northwestern Minnesota were reported to DNR experts.

ACTIVITY 3: Comparison of Wild Bee Fauna in Prairie-Grasslands

Description: The wild bee fauna and associated plant species will be compared among native prairie sites (surveyed in Activity 2) and restored prairie-grassland sites. The focus of these surveys is to identify mutually beneficial relationships between native or restored prairie-grasslands and bee pollinators. Other habitats present in the Prairie Region, such as agricultural fields, flower gardens and nurseries, will not be included in this project. Survey protocols will be refined to use for long-term monitoring of grassland management. Findings will form the basis for development of management recommendations to enhance diversity of prairie flora and associated pollinators.

Approach: Field surveys, specimen vouchering and data management will follow procedures described in Activity 2. Statistical comparisons of bee species richness and abundance and floral resource diversity will be performed and evaluated between native prairie and restored prairie-grassland sites. These findings, augmented by those from the University of Minnesota's floral resource assessment (refer to *Enhancing Pollinator Landscapes, ENRTF 146-F*), will inform best management practices in grassland habitats that promote wild bees.

Summary Budget Information for Activity 3:

ENRTF Budget: $ 115,000
Amount Spent: $ 115,000
Balance: $ 0

Activity Completion Date: June 30, 2016

Outcome	Completion Date	Budget
1. Refinement of survey and monitoring protocol and selection of up to 90 sites; 45 native prairie and 45 restored prairie-grassland	April 2015	$ 9,000
2. Field surveys of bees, associated plant species, and vegetation description	November 2015	$ 36,000
3. Data entry, specimen preparation, and delivery of specimens to museum collections	April 2016	$ 25,000
4. Results summarized and evaluated, species list updated	June 2016	$ 7,000
5. Second field season of surveys conducted	Continuing	$ 28,000
6. DNR Direct and Necessary Cost	June 2016	$ 10,000

Project Status as of January 1, 2015

Work is underway to refine selection criteria for paired comparisons between high-quality native prairie and restored/managed grasslands. Native prairie survey sites will be selected from the MNDNR Native Plant Community database, from native prairie plant communities with condition ranks of B or higher, and length sufficient to contain a bee pan-trap transect. Selection will be stratified by subsections for the prairie region. This will include the Aspen Parklands, Red River Prairie, Minnesota River Prairie, Coteau Moraines, and Inner Coteau subsections (MNDNR Ecological Classification System), and will be weighted by total acreage in each subsection. An ArcGIS tool was developed to randomly select sites while maintaining a minimum separation distance between sites of 6 miles. Once the native prairie community sites have been selected, restored/managed grassland sites will be identified for the paired comparisons.

One problem that has slowed final selection of the native prairie sites is that some known prairie communities of high quality do not have a condition rank and/or are contained within native plant community complexes and thus not selectable by the criteria described above. We are working with MBS plant ecologists with experience in the prairie region to identify these sites for inclusion.

Project Status as of July 1, 2015

Several iterations of the ArcGIS tool were run to select potential native prairie sites. After review by MBS prairie ecologists, it was decided that for the purposes of this project expert opinion and knowledge of the sites was the preferred way to select high-quality native prairie. Eight high-quality prairie sites were selected in the North Central Glaciated Plains ecological section and paired with a nearby grassland restoration site (Attachment 3). Efforts were made to maintain a minimum separation distance of six miles between high-quality prairie sites and their paired restoration to avoid sampling overlap for the flight ranges of bees.

As described in Activity 2, site managers were contacted and permits obtained. Transects were established and surveys conducted approximately every three weeks at these 16 sites. All specimens were pinned and labelled at the field stations. Final specimen processing is ongoing and non-bee specimens are preserved in ethanol for future study. Data analysis is scheduled for winter 2015-2016.

Project Status as of February 11, 2016

Restored grasslands were paired with native prairie sites and surveyed using pan-trap transects at eight sites in the North-Central Glaciated Plains ecological section. In July, an additional eight pan-trap transects were added to Wildlife Management Areas in the North-Central Glaciated Plains ecological section. Similarly, five transects were added to the Lake Agassiz Aspen Parklands and Red River Valley ecological sections. These were "county record" sites that aided bee collecting with hand nets to fill knowledge gaps about the distribution of bee species.

As described in Activity 2, surveys were conducted approximately every three weeks. All specimens were pinned and labelled at the field stations. Specimen identification and databasing is ongoing, and non-bee specimens are preserved in ethanol for future study. A plant ecologist evaluated the quality of prairie along all pan-trap transects. Data analysis is scheduled for winter 2016.

Final Report Summary:
Site selection began by developing an ArcGIS tool to randomly select sites, but review by MBS prairie ecologists revealed that expert opinion was the preferred method for the purposes of this project. Eight high-quality prairie sites were selected in the North Central Glaciated Plains ecological section and paired with a nearby grassland restoration site (Attachment 3). Efforts were made to avoid sampling overlap in the flight ranges of bees.

Additional sites were added in 2015 to fill knowledge gaps about the distribution of bee species. Eight pan-trap transects were added to wildlife management areas in the North-Central Glaciated Plains ecological section and five transects were added to the Lake Agassiz Aspen Parklands and Red River Valley ecological sections. A plant ecologist evaluated the quality of prairies and grasslands along all transects.

Field surveys were conducted as described in Activity 2. Site managers were contacted and permits obtained. Transects were established and surveys conducted approximately every three weeks in 2015. All specimens were pinned and labelled at the field stations. Databasing was completed in winter 2015-2016. Specimens were prepared for long-term storage at the University of Minnesota Insect Collection. Final specimen identification is ongoing, and non-bee specimens are preserved in ethanol for future study.

V. DISSEMINATION:
Description: Data collected from this project will be stored in the Minnesota Department of Natural Resources (MNDNR), Division of Ecological and Water Resources information system. This information will take the form of databases, GIS layers, maps, and web-based summaries. They will be linked to other databases within the MNDNR and will be shared with our partners working on separate bee and pollinator projects.

Publications, presentations and web-based products will be developed to provide information to a variety of audiences. A webpage on wild bees will be developed within the MNDNR's Minnesota Biological Survey website (http://www.dnr.state.mn.us/mbs/index.html). This webpage will include updates on project activities and findings, provide a state species list of bees in Minnesota, statewide distribution maps for each bee species, and species accounts that summarize natural history traits and habitat associations. The page will link to the MNDNR Nongame Wildlife Program and other external websites that feature bees.

Coordination and information exchange with other pollinator groups and projects will strengthen our knowledge of Minnesota's pollinators and identify additional needs for conservation and management. These collaborators include, but are not limited to, MNDNR Pollinator Habitat Project, University of Minnesota (UM) Bee Squad, Enhancing Pollinator Landscapes (UM, ENRTF 146-F), Minnesota Pollinator Partnership (Pheasants Forever, ENRTF 072-C), Protecting Bees by Understanding Systemic Insecticides (UM, ENRTF 151-F), Bee Discovery Center at the Minnesota Landscape Arboretum (ENRTF 073-C), Prairie Butterfly Conservation, Research and Breeding Program (MN Zoological Garden and MNDNR, ENRTF 017A).

Physical collections of bees will be prepared and deposited into the Insect Collection at the University of Minnesota; plant collections will be deposited into the J.F. Bell Museum of Natural History's Herbarium. Data associated with bee specimens will be stored in the MNDNR Observation Database and the UM Insect Collection's database, and will be available for inclusion in international databases.

Project Status as of January 1, 2015

Working with the MNDNR Natural Heritage Information System's data managers, a database module for bees was developed to accommodate bee specimen information. This database is being used to enter bee specimen data from the Insect Collection, University of Minnesota, and is available for use by other ENRTF-funded bee projects, other researchers and educators. Work is ongoing to develop a linked database for flowering plant data that will be collected in association with the bee surveys.

The goals and accomplishments of this project are presented in the MNDNR's *Native Bees of Minnesota's Grasslands* webpage (http://www.dnr.state.mn.us/mbs/grasslandbees.html) that was developed by the project's coordinator/bee specialist and MBS graphic/web-design specialist. They also developed, with input from the MNDNR Pollinator Team, the webpages on *Minnesota's Pollinators* (http://www.dnr.state.mn.us/pollinators/index.html) and *Minnesota Pollinator Resources* (http://www.dnr.state.mn.us/pollinator_resources/index.html). They collaborated with other MBS staff to produce a draft *Pollinator Resource Values for Upland & Wetland Prairies* (http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf). Planning is underway to post the state's list of wild bees and associated density map of species records (see Appendix 1, Attachment 1, and Attachment 5). The websites, species list and map will be updated regularly as new information is obtained.

The project's coordinator/bee specialist maintains contact with people on other bee and pollinator projects and collaborates on special projects, such as the Tallgrass Prairie Bee Identification workshop; is a member of multi-disciplinary teams addressing pollinator best management practices and prairie conservation; and has established a good working relationship with the Insect Collection at the University of Minnesota. This project has purchased needed supplies and equipment for permanent storage of bee specimens collected through this grant at the Insect Collection.

Bee specimen preparation and identification is ongoing. At this time, over 2,500 collected bee specimens are pinned, labeled and awaiting inclusion into the Insect Collection at the University of Minnesota. Data entry of bee specimens already housed by the collection continues. Volunteers have databased over 2,000 of the estimated 27,000 bee specimens in the collection.

The project's coordinator/bee specialist has responded to numerous inquiries about bees and requests to participate in workshops, make presentations, and provide information for news reports and articles (see below).

Bee workshops, symposia and educational programs:
Tallgrass Prairie Bee Identification Workshop (co-organized with bee specialists working under ENRTF-funded Enhancing Pollinator Landscapes project).
Minnesota Nursery and Landscape Association Pollinator Symposium
MNDNR Silviculture Program Annual Meeting
Pesticide Recertification Training
State Fair – MNDNR and MPCA stages
Project Earth

Presentations about bees:
Minneapolis Audubon Society
Community of Practice
Minneapolis Public Library
Golden Valley Historical Society
Minneapolis Pollinator Party
Big Brothers, Big Sisters Annual Picnic
Ebenezer Care Center's Mini State Fair

News interviews and reports about the project and bee conservation:
Minnesota Public Radio
WTIP North Shore Radio
St. Cloud Times
Outdoor News (2 articles)
Scientific and Natural Area newsletter
Concordia College newsletter

Project Status as of July 1, 2015
Bee specimen data continues to be added to databases. Thus far, volunteers have entered label information from 3,700 specimens previously housed at the University of Minnesota Insect Collection. Current fieldwork generated an additional 5,200 bee specimens that are pinned, labelled, and awaiting inclusion in the collection. Identification work is ongoing. Databases linking flowering plant data to field collections are in the second stage of beta testing.

Support continues for the MNDNR's *Native Bees of Minnesota's Grasslands* webpage (http://www.dnr.state.mn.us/mbs/grasslandbees.html) and its associated pages. New county record maps are being developed for 20 bumble bee species (see Attachment 1) and the draft *Pollinator Resource Values for Upland & Wetland Prairies* (http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf) is being distributed.

The project's coordinator/bee specialist maintains collaborations with other Minnesota pollinator projects and served as co-organizer of the successful 2015 Tallgrass Prairie Bee Identification Workshop. This five-day workshop welcomed 21 participants from 8 states, and reached 90 members of the public through three special events. The project coordinator contributed to finalizing the DNR's Operational Order 130: Pollinator Habitat and communicates regularly with those working on other ENRTF-funded bee projects. A positive working relationship has been established with the University of Minnesota Insect Museum and Herbarium and supplies and equipment have been procured for both through this grant.

The project's coordinator continues to respond to numerous inquiries about bees and requests to participate in workshops, give presentations, and provide information for news reports and articles (see below).

Workshops, symposia, and tools:
Tallgrass Prairie Bee Identification Workshop (co-organized with bee specialists working under ENRTF-funded *Enhancing Pollinator Landscapes* project)
Meet and Greet at Minnesota Zoo
Minnesota Department of Agriculture, Pollinator Consortium
Xerces Pollinator Habitat Assessment Tool

Presentations about bees:
University of Minnesota, Environmental Science and Society
University of Minnesota, Pollinator Protection in Managed Landscapes
MNDOT, Environmental Stewardship Conference
St. Paul Audubon Society, Warbler Weekend
Science Rocks! Event
MNDNR, Division of Wildlife Conference
Minnesota Landscape Arboretum, Pollinator Cubed
Minnesota Master Gardener Conference
Minneapolis Parks & Recreation, Pollinator Party

News interviews and reports about the project and bee conservation:
July/August 2015 Minnesota Conservation Volunteer, feature article: "A Bounty of Wild Bees"
ArcCollector Story Map of bumble bee declines
"News from the Field" blog entries

Technical Guidance (internal):
State Wildlife Action Plan, input on status of monarch butterflies and bumble bees
SNA permit review for bee research
DNR pollinator listserv

Technical Guidance (external partners):
Minnesota Department of Agriculture, State Fair seed packets and Pollinator Consortium planning
Monarch Joint Venture, helped obtain official partnership with MNDNR
Wisconsin DNR, provided information about honeybees and public lands

Project Status as of February 11, 2016
Bee specimen data continues to be added to databases. Thus far, staff and volunteers have entered label information from 6,400+ specimens previously housed at the University of Minnesota Insect Collection. Current fieldwork generated a total of ~7,900 bee specimens that are pinned, labelled, and awaiting inclusion in the collection, similar to an additional ~7,900 specimens from previous fieldwork. Identification work is ongoing. Databases and data flow are being configured to capture bee specimen data before entry into the DNR's Observation Database.

Work continues on the MNDNR's *Native Bees of Minnesota's Grasslands* webpage (http://www.dnr.state.mn.us/mbs/grasslandbees.html), county record maps for Minnesota's bumble bee species (see Attachment 1), and the draft *Pollinator Resource Values for Upland & Wetland Prairies* (http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf).

The project's coordinator/bee specialist collaborates with other Minnesota pollinator projects and communicates regularly with those working on other ENRTF-funded bee projects. Supplies and equipment continue to be secured for both the University of Minnesota Insect Museum and Herbarium.

The project's coordinator continues to respond to numerous inquiries about bees and requests to participate in workshops, give presentations, and provide information for news reports and articles (see below).

Workshops and Symposia:
Meet and Greet at University of Minnesota

Presentations about bees:
Kandiyohi County Master Gardeners
Town Hall Forum with Senator Kari Dziedzic, Representative Phyllis Kahn, and Representative Diane Loeffler
Golden Valley Rotary Club
DNR's Citizen Advisory Committee
Eagan Ecology Commission
Stearns History Museum
Stillwater Honey Bee Club
Science Rocks!, St. Cloud State University
Front Porch, DNR Roundtable
North Central Beekeepers Association
University of Minnesota, Conservation Biology Seminar
University of Minnesota, Environment Science and Society Class

News interviews and reports about the project and bee conservation:
Cook County News Herald, "U.S. Fish and Wildlife to Study Status of Four Midwest Wildlife Species," 10/3/15
Star Tribune, "Wild Bees Losing Out to Corn in Minnesota and Upper Midwest, Says U of Vermont Study," 12/21/15
Minnesota Conservation Volunteer, technical guidance on bee queens, December 2015
"News from the Field" blog entries

Technical Guidance (internal):
State Wildlife Action Plan, input on status of monarch butterflies and bumble bees
SNA permit review for bee research
DNR pollinator listserv

Technical Guidance (external partners):
Minnesota Department of Agriculture, Pollinator Summit planning
ENRTF-funded *Minnesota Native Bee Atlas*, project collaboration
USGS, coordinated site selection meeting between DNR and ENRTF-funded *Effects of Grazing Versus Fire for Prairie Management*
Hastings High School, provided instructions for building pan traps

Final Report Summary:
In collaboration with the MNDNR Natural Heritage Information System's data managers, a database module for bees was developed to accommodate bee specimen information. This database is being used to enter bee specimen data from the University of Minnesota Insect Collection and is available for use by other ENRTF-funded bee projects, other researchers, and educators. Work is ongoing to develop a linked database for flowering plant data that will be collected in association with the bee surveys.

The project coordinator/bee specialist (Crystal Boyd) and MBS web-design specialist, in collaboration with the MNDNR Pollinator Team and other MBS staff, developed several MNDNR webpages related to this project:

1. *Native Bees of Minnesota's Grasslands* webpage to present the goals and accomplishments of this project (http://www.dnr.state.mn.us/mbs/grasslandbees.html).
2. *Minnesota's Pollinators* webpage (http://www.dnr.state.mn.us/pollinators/index.html)
3. *Minnesota Pollinator Resources* webpage (http://www.dnr.state.mn.us/pollinator_resources/index.html).
4. *Pollinator Resource Values for Upland & Wetland Prairies* webpage and booklet (http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf).

These websites will be maintained and updated as new information is obtained. This includes posting updates to the state species list of bees (see Appendix 1) and county record maps for Minnesota's bumble bee species (see Attachment 2). The booklet *Pollinator Resource Values for Upland & Wetland Prairies* continues to be distributed.

The project coordinator/bee specialist collaborates with other Minnesota pollinator projects and communicates regularly with those working on other ENRTF-funded bee projects. The project coordinator co-organized the successful 2015 Tallgrass Prairie Bee Identification Workshop, which was a five-day workshop welcoming 21 participants from 8 states and reaching 90 members of the public through three special events. The project coordinator also contributed to finalizing the DNR's *Operational Order 130: Pollinator Habitat* and established a good working relationship with the University of Minnesota Insect Collection. Supplies and equipment continue to be secured for both the University of Minnesota Insect Collection and Herbarium to support permanent storage of bee specimens and plant county records.

Bee specimen data continues to be added to databases. Thus far, DNR staff and volunteers have entered label information from over 9,900 specimens previously housed at the University of Minnesota Insect Collection. In 2015, this project generated over 7,800 bee specimens that are pinned, labelled, and awaiting inclusion in the collection. An additional 7,900+ specimens from previous DNR bee surveys were incorporated. In 2016, this project generated an estimated 3,800 specimens that are currently being processed. Identification work is ongoing. Databases and data flow are being configured to capture bee specimen data before entry into the DNR's Observation Database.

The project coordinator responded to numerous inquiries about bees and over 120 requests to participate in workshops, give presentations, and provide information for news reports and articles. Of these requests, 64 were accepted and 56 were declined due to limited capacity. Activities are listed below.

<u>Workshops, symposia, educational programs, and tools</u>:

Tallgrass Prairie Bee Identification Workshop (co-organized with bee specialists working under ENRTF-funded *Enhancing Pollinator Landscapes* project)
Minnesota Nursery and Landscape Association Pollinator Symposium
MNDNR Silviculture Program Annual Meeting
Pesticide Recertification Training
State Fair – MNDNR and MPCA stages
Project Earth
ENRTF Pollinator Projects, Meet and Greets at DNR, Minnesota Zoo, and University of Minnesota
Minnesota Department of Agriculture, Pollinator Summit
Xerces Pollinator Habitat Assessment Tool
MNDNR Division of Ecological and Water Resources All-Staff Meeting

<u>Presentations about bees</u>:

Minneapolis Audubon Society
MNDNR Community of Practice
Minneapolis Public Library
Golden Valley Historical Society
Minneapolis Parks and Recreation, Pollinator Party, 2014 & 2015
Big Brothers, Big Sisters Annual Picnic
Ebenezer Care Center's Mini State Fair
University of Minnesota, Environmental Science and Society
University of Minnesota, Pollinator Protection in Managed Landscapes
MNDOT, Environmental Stewardship Conference
St. Paul Audubon Society, Warbler Weekend
Science Rocks! Event
MNDNR, Division of Wildlife Conference
Minnesota Landscape Arboretum, Pollinator Cubed
Minnesota Master Gardener Conference
Kandiyohi County Master Gardeners
Town Hall Forum with Senator Kari Dziedzic, Representative Phyllis Kahn, and Representative Diane Loeffler
Golden Valley Rotary Club
DNR's Citizen Advisory Committee
Eagan Ecology Commission
Stearns History Museum
Stillwater Honey Bee Club
St. Cloud State University, Science Rocks!
MNDNR Roundtable, Front Porch
North Central Beekeepers Association
University of Minnesota, Conservation Biology Seminar
University of Minnesota, Environment Science and Society Class
Town Hall Forum with Senators Scott Dibble and Patricia Torres Ray, Representatives Jim Davnie, Frank Hornstein, and Jean Wagenius, and Council Members Andrew Johnson and John Quincy
Audubon Society, Alexandria
League of Women Voters, White Bear Lake Area
St. Croix Riverway Speaker Series
Mount Zion Brotherhood
League of Women Voters, Park Rapids
MNDNR State Parks Annual Meeting

News interviews and reports about the project and bee conservation:
Minnesota Public Radio
WTIP North Shore Radio
St. Cloud Times
Outdoor News (2 articles)
Scientific and Natural Area newsletter
Concordia College newsletter
Minnesota Conservation Volunteer, feature article: "A Bounty of Wild Bees," July/August 2015
ArcCollector Story Map of bumble bee declines
"News from the Field" blog entries
Cook County News Herald, "U.S. Fish and Wildlife to Study Status of Four Midwest Wildlife Species," 10-3-15
Star Tribune, "Wild Bees Losing Out to Corn in Minnesota and Upper Midwest, Says U of Vermont Study," 12-21-15
Minnesota Conservation Volunteer, technical guidance on bee queens, December 2015

"News from the Field" blog entries
WJON St. Cloud, "Bees, Pollinator Populations Struggling Across Minnesota," 3-28-16
Burnsville Plant Sale Video, "Beautify Yards and Help the Environment by Planting Native Plants!" March 2016
The Wake Magazine, "When Dead Bugs Do the Legwork," 5-2-16

Technical Guidance (internal):
State Wildlife Action Plan, input on status of monarch butterflies and bumble bees
SNA permit review for bee research
DNR pollinator listserv

Technical Guidance (external partners):
Minnesota Department of Agriculture, State Fair seed packets and Pollinator Summit planning
Monarch Joint Venture, helped obtain official partnership with MNDNR
Wisconsin DNR, provided information about honeybees and public lands
ENRTF-funded *Minnesota Native Bee Atlas*, project collaboration
USGS, coordinated site selection meeting between DNR and ENRTF-funded *Effects of Grazing Versus Fire for Prairie Management*
Hastings High School, provided instructions for building pan traps
Updated MNDNR Native Plant Suppliers webpage

VI. PROJECT BUDGET SUMMARY:

A. ENRTF Budget Overview:

Budget Category	$ Amount	Explanation
Personnel:	$250,126	1 project coordinator/entomologist at 100% FTE for 2 years; 1 zoology data manager at 30% FTE for 1 year; 1 graphics/web design specialist at 10% FTE for 2 years; 1 seasonal entomologist at 60% FTE for 1.5 years; 2 seasonal botanists at 30% for 1.5 years
Professional/Technical/Service Contracts:	$0	Contractual agreements with technical experts for statistical guidance, database development and vegetation analysis.
Equipment/Tools/Supplies:	$32,008	Field equipment and supplies to be used for data recording, bee collection, specimen preparation; cell phone rental for field coordination and safety.
Travel Expenses in MN:	$55,000	Mileage and seasonal lease of MNDNR fleet vehicles, lodging and meals to visit state repositories with Minnesota bee specimens and to conduct field surveys.
Other: Travel Expenses outside MN:	$ 3,992	Mileage, lodging, meals to Midwest collections with Minnesota bee specimens. Important records of bees collected from Minnesota reside in collections held by Midwest institutions in Wisconsin, Iowa, North Dakota, South Dakota, and Illinois. It is critical to the objective of this project -- *to compile specimen data on Minnesota bees* -- that the project

		coordinator be allowed to visit these institutions to record these data.
*DNR Direct & Necessary Cost	$28,874	Direct and necessary costs: HR Support (~$6,257); Safety Support (~$1,475); Financial Support (~4,777); Communications Support (~1,236); IT Support (~$13,970); Planning Support (~$829); and Procurement Support (~$235) necessary to accomplishing funded programs/projects.
TOTAL ENRTF BUDGET:	**$ 370,000**	

***Direct and Necessary** expenses include both Department Support Services (Human Resources [~$6,257], Safety Support [~$1,475], Financial Support [~$4,777], Communications Support [~$1,236], IT Support [~$13,970], Planning Support [~$829], and Procurement Support [~$235] and Division Support Services. Department Support Services are described in the agency Service Level Agreement, and is billed internally to divisions based on rates that have been developed for each area of service. These services are directly related to and necessary for the appropriation. Department leadership services (Commissioner's Office and Regional Directors) are not assessed. Division Support Services include costs associated with Division business offices and clerical support. Those elements of individual projects that put little or no demand on support services such as large single-source contracts, large land acquisitions, and funds that are passed-through to other entities are not assessed Direct and Necessary costs for those activities.

Calculations for this project are as follows:

Funding request before D&N = $341,221
Total Direct & Necessary = $28,779
Total Project Costs - $369,999
Sum of FTE-Year Units = 4.3
Sum of User ID Units = 5

Explanation of Use of Classified Staff: Any classified staff paid through this project (1) will be a technical expert needed to incorporate incoming data into existing information systems, or (2) will delay, eliminate or complete work normally performed by this position.

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: Approximately 4.3 FTEs over the 2-year period of this project.

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: None.

B. Other Funds:

Source of Funds	$ Amount Proposed	$ Amount Spent	Use of Other Funds
Non-state			
	$	$	
State			
RIM Critical/Heritage Enhancement	$ 24,000	$22,303/$3,591	Project manager salary
TOTAL OTHER FUNDS:	**$ 24,000**	**$ 25,894**	

VII. PROJECT STRATEGY:

A. Project Partners: This request does not include funding for the following partners: land managers and owners of survey sites, including the MNDNR divisions of Ecological and Water Resources, Fish and Wildlife, Parks and Trails, U.S Fish and Wildlife Service, The Nature Conservancy, counties and private landowners; institutions supporting the project, containing Minnesota bee specimens and/or serving as repositories for specimens collected by this project, including American Museum of Natural History, University of Minnesota's Insect Collection and J. F. Bell Museum of Natural History, Science Museum of Minnesota. This request complements the project addressing pollinators submitted by Dr. Marla Spivak and Dr. Clarence Lehman (*Enhancing Pollinator Landscapes, ENRTF 146-F*).

B. Project Impact and Long-term Strategy: The duration of this project is insufficient to account for the yearly fluctuations of insect populations. Similarly, this timeframe will produce results that can stand alone or act as the beginning phase of a long-term monitoring scheme. Continuation of the prairie-grassland monitoring component would enable differences between sites to be statistically significant. Additionally, extending the bee survey to the forested and forest-transition regions would add to our knowledge of the state's bee fauna.

C. Spending History: N/A

VIII. ACQUISITION/RESTORATION LIST: N/A

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

X. ACQUISITION/RESTORATION REQUIREMENTS WORKSHEET: N/A

XI. RESEARCH ADDENDUM: N/A

XII. REPORTING REQUIREMENTS:
Periodic work plan status update reports will be submitted no later than January 2015, July 2015, and January 2016. A final report and associated products will be submitted between June 30 and August 15, 2016.

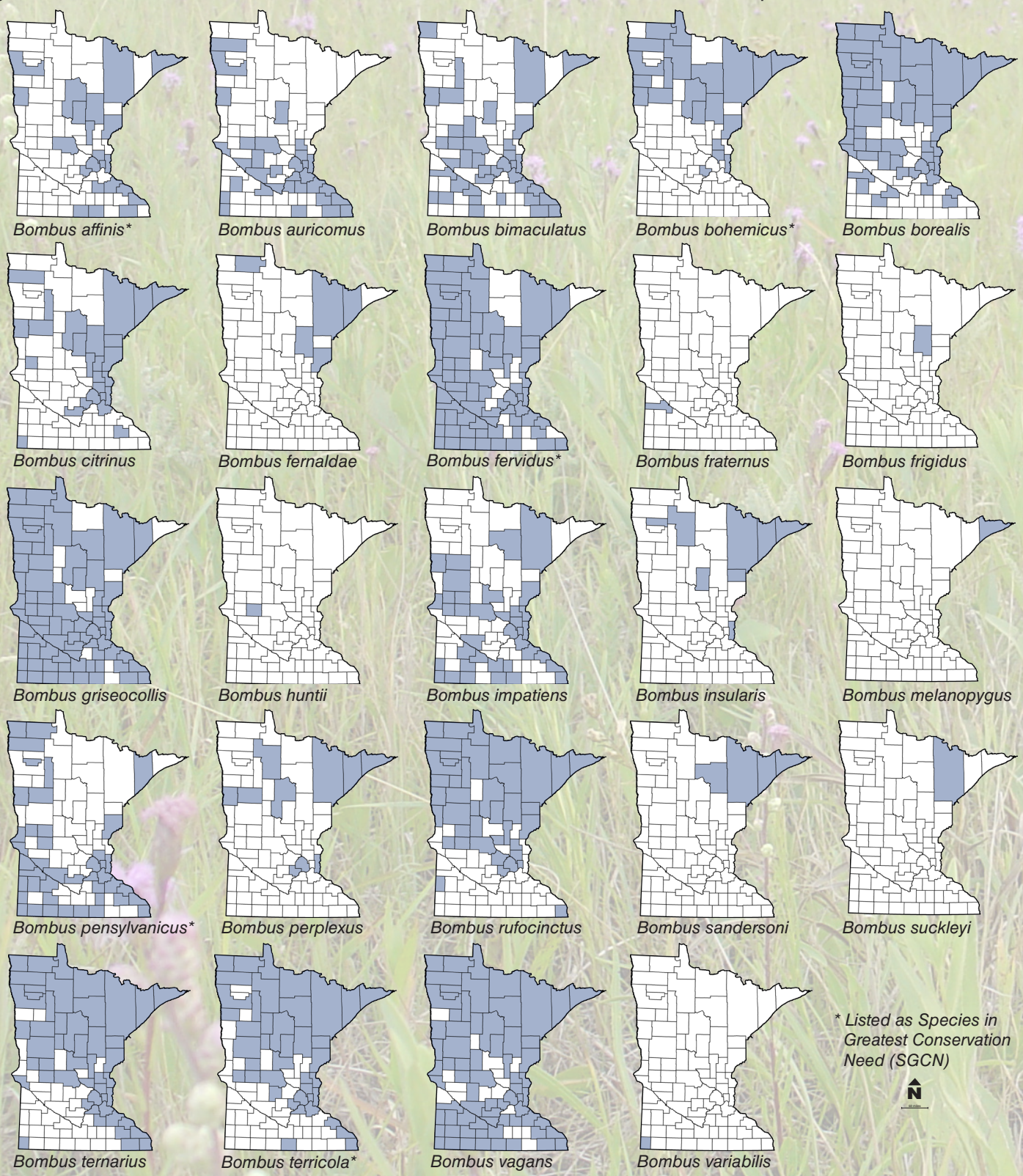
Final Attachment A: Budget Detail for M.L. 2014 Environment and Natural Resources Trust Fund Projects

Project Title: Wild Bee Pollinator Surveys in Prairie-Grassland Habitats
Legal Citation: M.L. 2014, Chp. 226, Sec. 2, Subd. 05i
Project Manager: Gerda Nordquist
Organization: MNDNR
M.L. 2014 ENRTF Appropriation: $ 370,000
Project Length and Completion Date: 2 years, June 30, 2016
Date of Final Report: September 14, 2016

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	TOTAL BUDGET	TOTAL BALANCE
BUDGET ITEM	**Species List of Wild Bees in Minnesota**			**Wild Bees Associated with Native Prairie**			**Comparison of Wild Bee Fauna in Prairie-Grasslands**				
Personnel (Wages and Benefits)	$70,126	$70,126	$0	$90,000	$90,000	$0	$90,000	$90,000	$0	$250,126	$0
1 Project Coordinator: $108,126 (70% salary, 30% benefits); 100% FTE for 2 years		$62,030			$22,189			$21,696			
1 Zoology Data Manager: $17,000 (70% salary, 30% benefits); 30% FTE for 1 year		$2,801			$3,802			$3,315			
1 Graphics/Web Design Specialist: $17,000 (50% salary, 50% benefits); 10% for 2 years		$5,295			$5,140			$4,505			
1 Entomologist: $34,000 (85% salary, 15% benefits); 50% for 1.5 years					$12,583			$12,553			
2 Botanist: $53,000 (75% salary, 25% benefits); 30% for 1.5 yrs					$46,286			$47,931			
Professional/Technical/Service Contracts											
TBD (competitive bid): statistical guidance, project											
TBD (competitive bid): vegetational analysis											
Equipment/Tools/Supplies											
Field survey equipment and supplies, including but not limited to: bee traps, trap solution, GPS units, cameras, batteries, kill jars, chemicals, collection bags, clipboards, field forms, pencils, cell phone rental, field vests, gloves, insect repellent, sunscreen	$500	$500	$0	$20,008	$20,008	$0	$5,000	$5,000	$0	$25,508	$0
Specimen preparation equipment and supplies, including but not limited to: pins, pinning boards, storage boxes, archival paper, vials, preservative, freezer	$500	$500	$0	$1,500	$1,500	$0	$4,000	$4,000	$0	$6,000	$0
Data management: external drives	$500	$0	$500							$500	$500
Travel expenses in Minnesota											
Mileage, seasonal lease of MNDNR fleet vehicles, lodging and meals while conducting field surveys or visiting state specimen repositories	$10,000	$10,000	$0	$39,000	$38,331	$669	$6,000	$6,000	$0	$55,000	$669
Other											
Travel expenses outside Minnesota. Mileage, lodging, meals and incidental expenses to visit Midwest specimen repositories.	$3,992	$3,992	$0							$3,992	$0
DNR Direct & Necessary Cost	$6,874	$6,874	$0	$12,000	$12,000	$0	$10,000	$10,000	$0	$28,874	$0
COLUMN TOTAL	**$92,492**	**$91,992**	**$500**	**$162,508**	**$161,839**	**$669**	**$115,000**	**$115,000**	**$0**	**$370,000**	**$1,169**

Attachment 1. Preliminary County Records of Minnesota Bumble Bees

In 2009, experts estimated that Minnesota had 12 to 13 species of bumble bees (*Bombus* sp). Thanks to this project in collaboration with others, we now know that Minnesota has at least 24 species of bumble bees.



* *Listed as Species in Greatest Conservation Need (SGCN)*

Partial funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative–Citizen Commission on Minnesota Resources (LCCMR).

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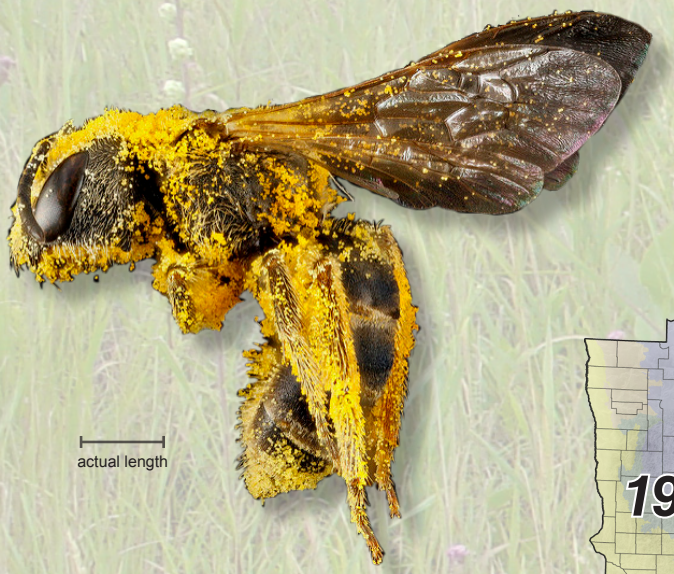
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

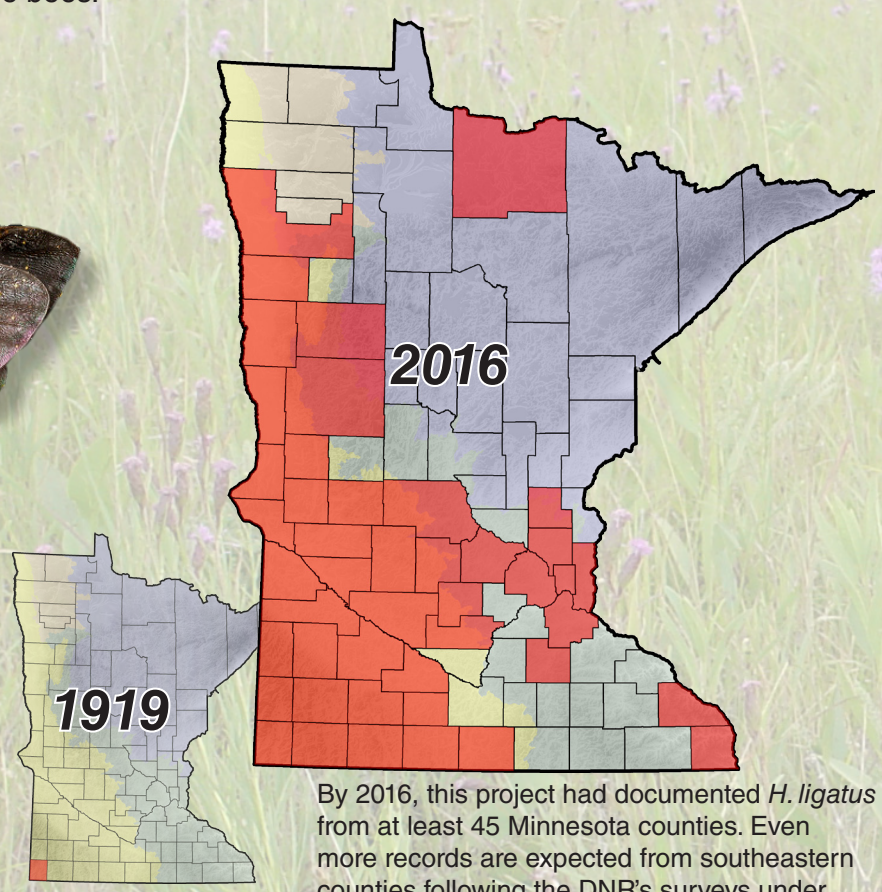
September, 2016

Attachment 2. This project has dramatically increased knowledge about Minnesota's native bees.

This sweat bee, *Halictus ligatus*, is just one example of how this project has greatly expanded baseline knowledge about the distribution of native bees.

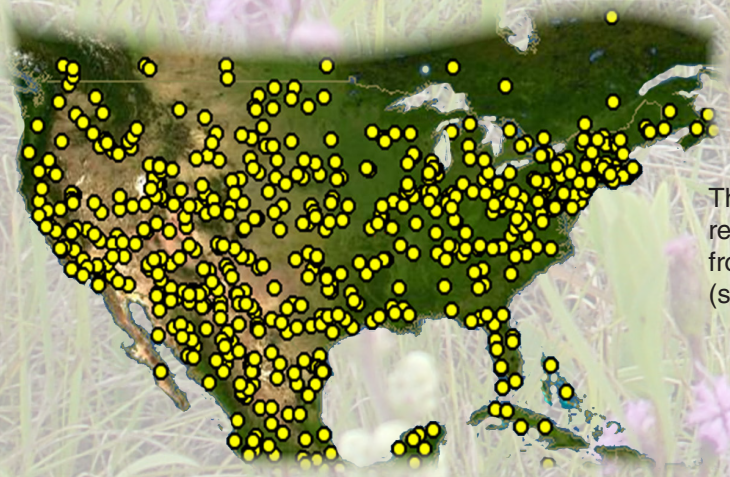


This common sweat bee, *Halictus ligatus,* (shown here dusted with pollen) has been under-surveyd for more than a century.



Frederic Washburn reported *H. ligatus* from only Rock County in his 1919 publication *The Hymenoptera of Minnesota.*

By 2016, this project had documented *H. ligatus* from at least 45 Minnesota counties. Even more records are expected from southeastern counties following the DNR's surveys under the ENRTF project M.L. 2016-03(b) *Native Bee Surveys in Minnesota Prairie and Forest Habitats.*



This bee is abundant across North America, but even recently was under-reported from Minnesota. This map from 2016 shows only 1 record from MN. (source: www.DiscoverLife.org)

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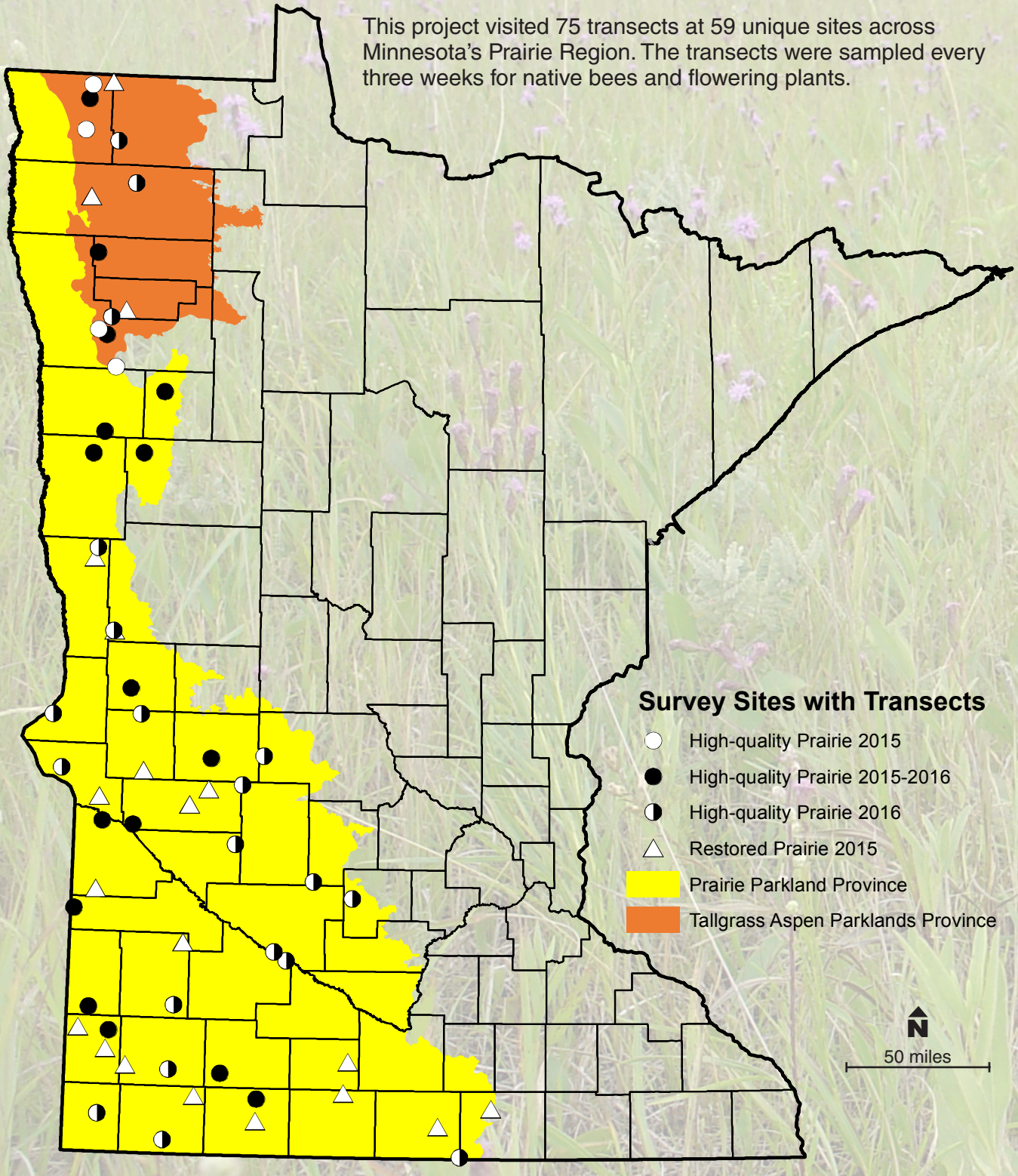
Partial funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative–Citizen Commission on Minnesota Resources (LCCMR).

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Attachment 3. Project Site Map

This project visited 75 transects at 59 unique sites across Minnesota's Prairie Region. The transects were sampled every three weeks for native bees and flowering plants.



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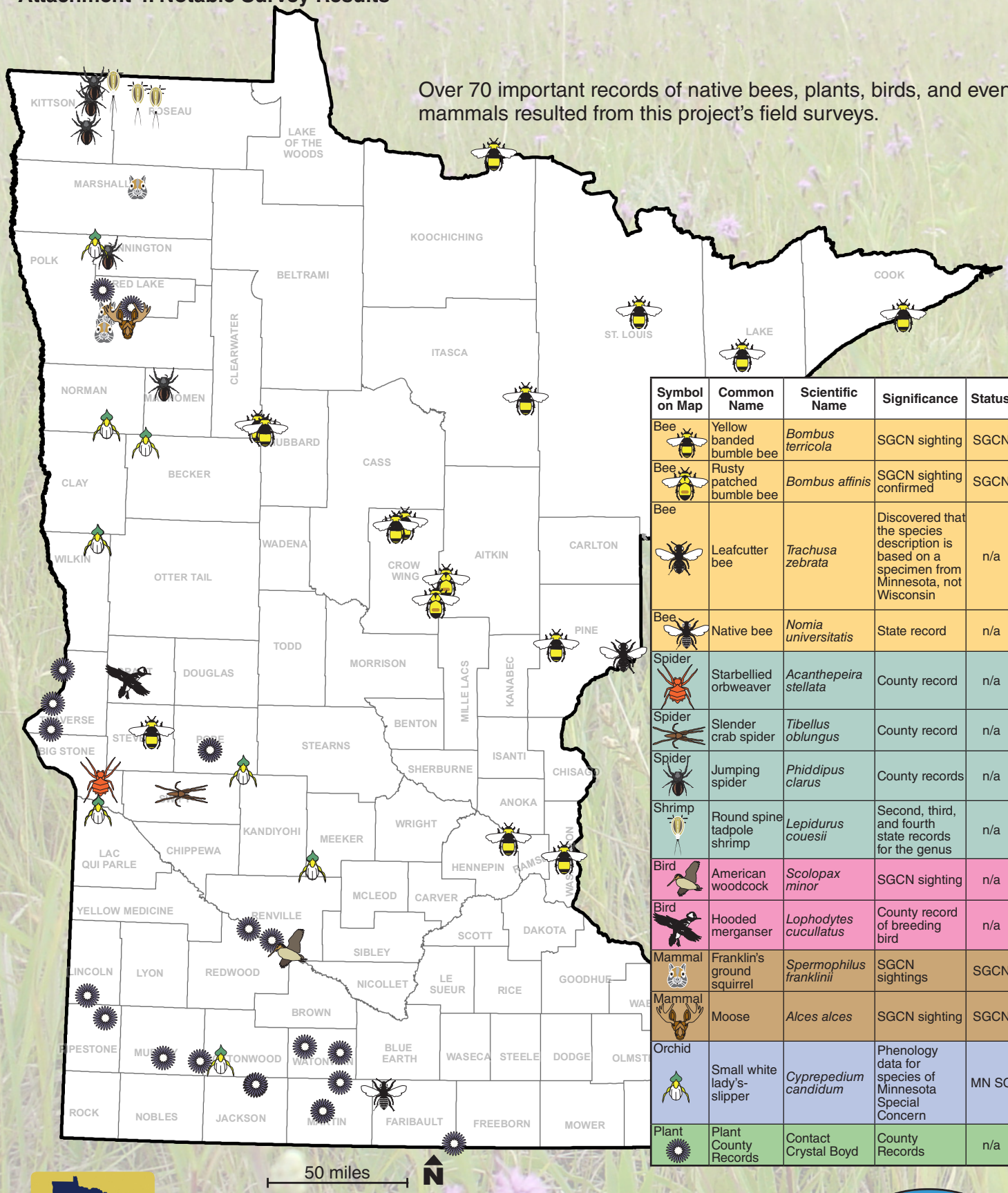
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Attachment 4. Notable Survey Results

Over 70 important records of native bees, plants, birds, and even mammals resulted from this project's field surveys.



Symbol on Map	Common Name	Scientific Name	Significance	Status
Bee	Yellow banded bumble bee	*Bombus terricola*	SGCN sighting	SGCN
Bee	Rusty patched bumble bee	*Bombus affinis*	SGCN sighting confirmed	SGCN
Bee	Leafcutter bee	*Trachusa zebrata*	Discovered that the species description is based on a specimen from Minnesota, not Wisconsin	n/a
Bee	Native bee	*Nomia universitatis*	State record	n/a
Spider	Starbellied orbweaver	*Acanthepeira stellata*	County record	n/a
Spider	Slender crab spider	*Tibellus oblungus*	County record	n/a
Spider	Jumping spider	*Phiddipus clarus*	County records	n/a
Shrimp	Round spine tadpole shrimp	*Lepidurus couesii*	Second, third, and fourth state records for the genus	n/a
Bird	American woodcock	*Scolopax minor*	SGCN sighting	n/a
Bird	Hooded merganser	*Lophodytes cucullatus*	County record of breeding bird	n/a
Mammal	Franklin's ground squirrel	*Spermophilus franklinii*	SGCN sightings	SGCN
Mammal	Moose	*Alces alces*	SGCN sighting	SGCN
Orchid	Small white lady's-slipper	*Cyprepedium candidum*	Phenology data for species of Minnesota Special Concern	MN SC
Plant	Plant County Records	Contact Crystal Boyd	County Records	n/a

Partial funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative–Citizen Commission on Minnesota Resources (LCCMR).

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

MNDNR

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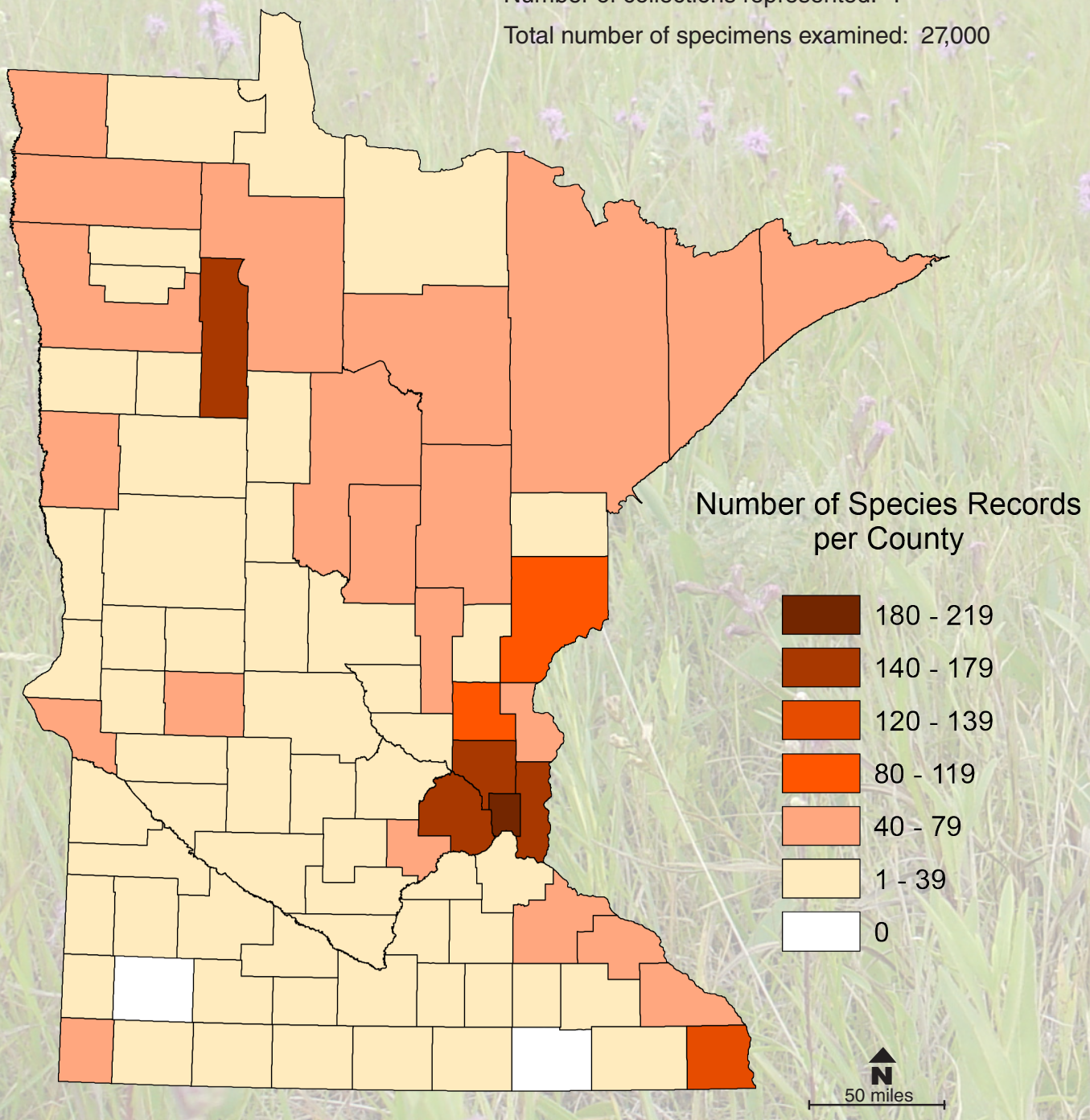
Attachment 5. Number of bee species per county, based on museum specimens as of January 1, 2015.

Number of collections represented: 1

Total number of specimens examined: 27,000



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Partial funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative–Citizen Commission on Minnesota Resources (LCCMR).

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Appendix 1. Preliminary State Species List of Minnesota Bees

Only 66 bee species were reported for Minnesota when Frederic Washburn published *The Hymenoptera of Minnesota* in 1919.

Through this project, the state species list of Minnesota bees now stands at 418 species. An additional 29 problematic species are listed in Appendix 2.

Please note: This is a preliminary list. Species are expected to be added or removed as surveys are completed and specimen identifications are confirmed.

In compiling this list, the project coordinator/bee specialist (Crystal Boyd) consulted 11 museum collections and 16 additional sources, including personal collections, student theses, informal reports, published literature, and recent survey data from collaborators.

The list was made possible through fieldwork and databasing efforts of MNDNR staff and volunteers. Joel Gardner with the ENRTF project *Enhancing Pollinator Landscape* also contributed to databasing and identifying museum specimens. A special thanks to the numerous collection managers who provided access to historical specimens. In particular, data was collected from large collections of Minnesota bees at the University of Minnesota Insect Collection, the American Museum of Natural History, and the Illinois Natural History Survey.

All data on flight season, nesting, sociality, and host plants/bees was compiled by John Ascher and simplified by MNDNR.

Flight Season: Numbers indicate months when a species is known to fly across its entire range. This data is not specific to Minnesota. For example, Minnesota has a shorter flight season than more southern states, and bees do not fly prior to April. Brackets indicate atypical months.

Nest: Categories include Burrow, Cavity, Hive, Pithy Stems, Soil, and Wood. Some bees parasitize other bee species, and their host's nesting habits are listed in brackets.

Sociality: Categories include Solitary, Communal, Subsocial, Eusocial, and Parasite.

Plant [or Insect] Host: Some bees—including species called oligoleges—collect pollen from only certain plant taxa, which are listed here. Some bees parasitize other bee species, and their host taxa are listed in brackets.

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ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

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Appendix 1. Preliminary List of Minnesota Bees

Scientific Name		Flight Season	Nest [parasitic]	Sociality	Plant [or Insect] Host	
					Family	*Genus*
Plasterer, Yellow-faced Bees -- Family Colletidae						
Colletes	*aberrans*	6-8	Soil	Solitary		
Colletes	*albescens*					
Colletes	*americanus*					
Colletes	*andrewsi*					
Colletes	*brevicornis*	3-6	Soil	Solitary		
Colletes	*compactus*					
Colletes	*consors*	4-8	Soil	Solitary		
Colletes	*hyalinus*	4-10	Soil	Solitary		
Colletes	*impunctatus*	6-7	Soil	Solitary		
Colletes	*inaequalis*	3-7 [8-9]	Soil	Solitary		
Colletes	*kincaidii*	6-9	Soil	Solitary		
Colletes	*latitarsis*	3-9	Soil	Solitary	Solanaceae	*Physalis*
Colletes	*nudus*					
Colletes	*phaceliae*	6-9	Soil	Solitary		
Colletes	*robertsonii*	6-8	Soil	Solitary		
Colletes	*rufocinctus*	8-9	Soil	Solitary		
Colletes	*simulans*	1, 5-11	Soil	Solitary	Asteraceae	
Colletes	*solidaginis*	7-9	Soil	Solitary		
Colletes	*speculiferus*	4-11	Soil	Solitary		
Colletes	*susannae*	7-8	Soil	Solitary		
Colletes	*willlistoni*					
Colletes	*wilmattae*	6-9	Soil	Solitary		
Hylaeus	*affinis*	4-10	Cavity	Solitary		
Hylaeus	*annulatus*	4-10	Cavity	Solitary		
Hylaeus	*basalis*	5-8	Cavity	Solitary	Rosaceae	
Hylaeus	*fedorica*	6-7	Cavity	Solitary		
Hylaeus	*floridanus*	4-10	Cavity	Solitary		
Hylaeus	*illinoisensis*					
Hylaeus	*leptocephalus*					
Hylaeus	*mesillae*	4-10	Cavity	Solitary		
Hylaeus	*modestus*	5-9	Cavity	Solitary		
Hylaeus	*rudbeckiae*	5-10	Cavity	Solitary		
Hylaeus	*saniculae*	6-8	Cavity	Solitary		
Hylaeus	*sparsus*					
Hylaeus	*verticalis*	4-8	Cavity	Solitary		
Mining Bees -- Family Andrenidae						
Andrena	*algida*					
Andrena	*aliciae*	7-9	Soil	Solitary	Asteraceae	
Andrena	*alleghaniensis*	4-7	Soil	Solitary		
Andrena	*andrenoides*	3-8	Soil	Solitary	Salicaceae	*Salix*
Andrena	*asteris*	8-10	Soil	Solitary	Asteraceae	

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ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Appendix 1. Preliminary List of Minnesota Bees

Andrena	*barbilabris*	3-7 [8-9]	Soil	Solitary		
Andrena	*bisalicis*	2-9	Soil	Solitary		
Andrena	*bradleyi*	3-9	Soil	Solitary	Ericaceae	
Andrena	*brevipalpis*	5-10	Soil	Solitary		
Andrena	*canadensis*	8-10	Soil	Solitary	Asteraceae	
Andrena	*carlini*	3-7 [8]	Soil	Solitary		
Andrena	*carolina*	4-7	Soil	Solitary	Ericaceae	*Vaccinium*
Andrena	*ceanothi*	5-6	Soil	Solitary		
Andrena	*chromotricha*	7-9	Soil	Solitary	Asteraceae	
Andrena	*clarkella*	3-8	Soil	Solitary	Salicaceae	*Salix*
Andrena	*commoda*	4-7	Soil	Solitary		
Andrena	*cragini*	5-6	Soil	Solitary		*Amorpha*
Andrena	*crataegi*	3-8	Soil	Solitary		
Andrena	*cressonii*	3-8	Soil	Solitary		
Andrena	*distans*					
Andrena	*dunningi*	2-7 [8]	Soil	Solitary		
Andrena	*erigeniae*					
Andrena	*erythrogaster*	2-7	Soil	Solitary	Salicaceae	*Salix*
Andrena	*erythronii*	3-6	Soil	Solitary		*Erythronium*
Andrena	*forbesii*	4-6	Soil	Solitary		
Andrena	*frigida*	2-7	Soil	Solitary	Salicaceae	*Salix*
Andrena	*geranii*	4-7	Soil	Solitary		
Andrena	*helianthi*	7-9	Soil	Solitary	Asteraceae	
Andrena	*helianthiformis*					
Andrena	*hippotes*	4-6	Soil	Solitary		
Andrena	*hirticincta*	8-10	Soil	Solitary	Asteraceae	
Andrena	*illinoiensis*	3-7	Soil	Solitary		
Andrena	*imitatrix*	3-7	Soil	Solitary		
Andrena	*integra*	5-8	Soil	Solitary	Cornaceae	*Cornus (Svida)*
Andrena	*krigiana*	3-7	Soil	Solitary	Asteraceae	
Andrena	*lupinorum*	5-8	Soil	Solitary		
Andrena	*macoupinensis*					
Andrena	*mandibularis*	3-7	Soil	Solitary		
Andrena	*mariae*	4-7	Soil	Solitary	Salicaceae	*Salix*
Andrena	*melanochroa*	3-7	Soil	Solitary	Rosaceae	
Andrena	*milwaukeensis*	3-8	Soil	Solitary		
Andrena	*miranda*	5-8	Soil	Solitary		
Andrena	*miserabilis*	1-7 [8-9]	Soil	Solitary		
Andrena	*nasonii*	3-7	Soil	Solitary		
Andrena	*nigrae*	3-7	Soil	Solitary		
Andrena	*nigrihirta*	3-8	Soil	Solitary		
Andrena	*nivalis*	2-8	Soil	Solitary		
Andrena	*nubecula*	7-10	Soil	Solitary	Asteraceae	

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Appendix 1. Preliminary List of Minnesota Bees

Andrena	*nuda*					
Andrena	*peckhami*	9	Soil	Solitary	Asteraceae	
Andrena	*perplexa*					
Andrena	*persimulata*	4-7	Soil	Solitary	Cornaceae	*Cornus (Svida)*
Andrena	*placata*	7-9	Soil	Solitary	Asteraceae	
Andrena	*platyparia*	5-7	Soil	Solitary	Cornaceae	*Cornus (Svida)*
Andrena	*polemonii*					
Andrena	*quintilis*	4-7	Soil	Solitary		
Andrena	*regularis*	4-7	Soil	Solitary		
Andrena	*robertsonii*	4-8	Soil	Solitary		
Andrena	*robervalensis*					
Andrena	*rudbeckiae*	6-8	Soil	Solitary	Asteraceae	
Andrena	*rufosignata*	4-8	Soil	Solitary		
Andrena	*rugosa*	3-6	Soil	Solitary		
Andrena	*runcinatae*	7-10	Soil	Solitary	Asteraceae	
Andrena	*salictaria*	3-6	Soil	Solitary	Salicaceae	*Salix*
Andrena	*sigmundi*	5-7	Soil	Solitary	Salicaceae	*Salix*
Andrena	*simplex*	7-9	Soil	Solitary	Asteraceae	
Andrena	*spiraeana*	6-8	Soil	Solitary		
Andrena	*thaspii*	4-8	Soil	Solitary		
Andrena	*tridens*	3-7	Soil	Solitary		
Andrena	*vicina*	3-7 [8-9]	Soil	Solitary		
Andrena	*virginiana*	6-8	Soil	Solitary		
Andrena	*wellesleyana*	3-7	Soil	Solitary	Salicaceae	*Salix*
Andrena	*wheeleri*	4-7	Soil	Solitary		
Andrena	*wilkella*	4-9	Soil	Solitary		
Andrena	*w-scripta*	2-9 [10]	Soil	Solitary		
Andrena	*ziziae*	4-6 [7, 9]	Soil	Solitary		
Andrena	*wilmattae*	5-7	Soil	Solitary		
Calliopsis	*andreniformis*	4-10	Soil	Solitary	esp. Fabaceae	
Calliopsis	*coloradensis*	6-10	Soil	Solitary	Asteraceae	
Calliopsis	*nebraskensis*	6-9	Soil	Solitary	Verbenaceae	*Verbena*
Perdita	*albipennis*	6-9	Soil	Solitary	Asteraceae	*Helianthus*
Perdita	*bequaerti*	7-10	Soil	Solitary	Asteraceae	
Perdita	*bruneri*					
Perdita	*halictoides*					
Perdita	*maculigera*	3-7	Soil	Solitary	Salicaceae	*Salix*
Perdita	*octomaculata*	7-10	Soil	Solitary	Asteraceae	
Perdita	*perpallida*	7-8	Soil	Solitary		*Petalostemon*
Perdita	*swenki*	7-9	Soil	Solitary	Asteraceae	
Protandrena	*bancrofti*					
Pseudopanurgus	*aestivalis*	8-9	Soil	Solitary	Asteraceae	
Pseudopanurgus	*albitarsis*					

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Appendix 1. Preliminary List of Minnesota Bees

Pseudopanurgus	*andrenoides*	8-10	Soil	Solitary	Asteraceae	
Pseudopanurgus	*labrosus*	7-9	Soil	Solitary	Asteraceae	
Pseudopanurgus	*parvus*					
Pseudopanurgus	*pauper*	7	Soil	Solitary	Rhamnaceae	*Ceanothus*
Pseudopanurgus	*simulans*		Soil	Solitary	Asteraceae	
Sweat Bees -- Family Halictidae						
Agapostemon	*sericeus*	4-10	Soil	Solitary, Communal		
Agapostemon	*splendens*	4-8	Soil	Solitary, Communal		
Agapostemon	*texanus*	4-9	Soil	Solitary, Communal		
Agapostemon	*virescens*	5-10	Soil	Solitary, Communal		
Augochlora	*pura*	4-10	Wood	Solitary		
Augochlorella	*aurata*	4-10	Soil	Eusocial		
Augochlorella	*persimilis*	3-9	Soil	Eusocial		
Augochloropsis	*metallica*	3-11	Soil	Solitary		
Augochloropsis	*sumptuosa*					
Dieunomia	*heteropoda*	6-10	Soil	Solitary, Communal	Asteraceae	*Helianthus*
Dieunomia	*triangulifera*	8-10	Soil	Solitary, Communal		
Dufourea	*marginata*	6-9	Soil	Solitary	Asteraceae	
Dufourea	*monardae*	7-8	Soil	Solitary	Lamiaceae	*Monarda*
Dufourea	*novaeangliae*					
Halictus	*confusus*	4-10	Soil	Eusocial		
Halictus	*ligatus*	1-12	Soil	Eusocial		
Halictus	*parallelus*	3-8	Soil	Eusocial		
Halictus	*rubicundus*	3-9	Soil	Eusocial		
Lasioglossum	*acuminatum*	4-10	Soil	Solitary, Communal		
Lasioglossum	*admirandum*	3-9	Soil	Eusocial		
Lasioglossum	*albipenne*	5-9	Soil	Eusocial		
Lasioglossum	*anomalum*	5-9	Soil	Eusocial		
Lasioglossum	*athabascense*	4-10	Soil	Solitary, Communal		
Lasioglossum	*birkmanni*	4-9	Soil	Solitary		
Lasioglossum	*bruneri*					
Lasioglossum	*callidum*	3-10	Soil	Eusocial		
Lasioglossum	*cinctipes*	3-9	Soil	Eusocial		
Lasioglossum	*coeruleum*	3-10	Wood	Eusocial		
Lasioglossum	*comagenense*	6-7	Soil	Eusocial		
Lasioglossum	*coriaceum*					
Lasioglossum	*coriaceum*	3-10	Soil	Solitary, Communal		
Lasioglossum	*cressonii*	3-10	Wood	Eusocial		
Lasioglossum	*dreisbachi*	5-8	Soil	Eusocial		
Lasioglossum	*ellisiae*		Soil	Eusocial		
Lasioglossum	*ephialtum*	6-9	Soil	Eusocial		
Lasioglossum	*foveolatum*					
Lasioglossum	*foxii*	4-9	Soil	Solitary		

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Lasioglossum	*hartii*	5-8	Soil	Eusocial		
Lasioglossum	*heterognathum*	4-9	Soil	Eusocial		
Lasioglossum	*imitatum*	4-10	Soil	Eusocial		
Lasioglossum	*inconditum*		Soil			
Lasioglossum	*laevissimum*	3-10	Soil	Eusocial		
Lasioglossum	*leucocomum*	5-8	Soil	Eusocial		
Lasioglossum	*leucozonium*	5-10	Soil	Solitary, Communal		
Lasioglossum	*lineatulum*	4-10	Soil	Eusocial		
Lasioglossum	*lustrans*					
Lasioglossum	*macoupinense*	6-7	Soil	Solitary		
Lasioglossum	*nelumbonis*	3-11	Soil	Solitary	Nymphaeales	
Lasioglossum	*nigroviride*					
Lasioglossum	*nymphaearum*	4-10	Soil	Eusocial		
Lasioglossum	*oblongum*	3-10	Wood	Eusocial		
Lasioglossum	*obscurum*	4-10	Soil	Eusocial		
Lasioglossum	*paradmirandum*	4-9	Soil	Eusocial		
Lasioglossum	*paraforbesii*	4-10	Soil	Solitary, Communal		
Lasioglossum	*pectinatum*					
Lasioglossum	*pectorale*	3-11	Soil	Solitary		
Lasioglossum	*perpunctatum*	4-9	Soil	Eusocial		
Lasioglossum	*pictum*	4-9	Soil	Eusocial		
Lasioglossum	*planatum*					
Lasioglossum	*platyparium*	10-11	[Soil]	Parasite	[Halictidae]	*[Lasioglossum]*
Lasioglossum	*pruinosum*	3-10	Soil	Eusocial		
Lasioglossum	*quebecense*	3-9	Soil			
Lasioglossum	*semicaeruleum*	8	Soil	Eusocial		
Lasioglossum	*subversans*					
Lasioglossum	*succinipenne*		Soil	Eusocial		
Lasioglossum	*swenki*		Soil	Solitary		
Lasioglossum	*testaceum*	7	Soil	Eusocial		
Lasioglossum	*texanum*	4-12	Soil	Solitary, Communal	Onagraceae	*Oenothera*
Lasioglossum	*truncatum*	3-10	Soil	Eusocial		
Lasioglossum	*versans*	4-10	Soil	Eusocial		
Lasioglossum	*versatum*	4-11	Soil	Eusocial		
Lasioglossum	*vierecki*	4-9	Soil	Eusocial		
Lasioglossum	*zephyrum*	3-10	Soil	Eusocial		
Lasioglossum	*zonulum*	4-10	Soil	Solitary, Communal		
Nomia	*melanderi*					
Nomia	*nortoni*					
Sphecodes	*atlantis*	5-9	[Soil]	Parasite		
Sphecodes	*banksii*	4-9	[Soil]	Parasite		
Sphecodes	*confertus*	3-8	[Soil]	Parasite		
Sphecodes	*coronus*	6-9	[Soil]	Parasite		

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Sphecodes	*cressonii*	1, 4-9	[Soil]	Parasite		
Sphecodes	*davisii*	5-10	[Soil]	Parasite		
Sphecodes	*dichrous*	4-9	[Soil]	Parasite		
Sphecodes	*fattigi*	4-8	[Soil]	Parasite		
Sphecodes	*galerus*					
Sphecodes	*heraclei*					
Sphecodes	*illinoensis*	5-10	[Soil]	Parasite		
Sphecodes	*johnsonii*					
Sphecodes	*levis*	5-8	[Soil]	Parasite		
Sphecodes	*mandibularis*	5-8	[Soil]	Parasite		
Sphecodes	*minor*					
Sphecodes	*pimpinellae*	5-9	[Soil]	Parasite		
Sphecodes	*prosphorus*	5-9	[Soil]	Parasite		
Sphecodes	*ranunculi*	4-7	[Soil]	Parasite		
Sphecodes	*solonis*	5-8	[Soil]	Parasite		
Melittid Bees -- Family Melittidae						
Macropis	*ciliata*					
Macropis	*nuda*	6-8	Soil	Solitary	Primulaceae	*Lysimachia*
Macropis	*patellata*					
Macropis	*steironematis*	6-7	Soil	Solitary	Primulaceae	*Lysimachia*
Leaf-cutter, Mason Bees -- Family Megachilidae						
Anthidium	*manicatum*	6-10	Cavity	Solitary		
Anthidium	*oblongatum*	6-10	Cavity	Solitary		
Anthidium	*psoraleae*	7	Cavity	Solitary		
Anthidium	*tenuiflorae*					
Ashmeadiella	*bucconis*					
Coelioxys	*alternata*	6-10	[Cavity]	Parasite		
Coelioxys	*banksi*	4-9	[Cavity]	Parasite		
Coelioxys	*bisoncornua*	7-9	[Cavity]	Parasite		
Coelioxys	*funeraria*	5-9	[Cavity]	Parasite		
Coelioxys	*immaculata*					
Coelioxys	*modesta*					
Coelioxys	*moesta*	5-9	[Cavity]	Parasite		
Coelioxys	*octodentata*	5-10	[Cavity]	Parasite		
Coelioxys	*porterae*	6-9	[Cavity]	Parasite		
Coelioxys	*rufitarsis*	4-10	[Cavity]	Parasite		
Coelioxys	*sayi*	3-10	[Cavity]	Parasite		
Coelioxys	*sodalis*	4-9	[Cavity]	Parasite		
Coelioxys	*texana*	3-11	[Cavity]	Parasite		
Dianthidium	*simile*	7-9	Cavity	Solitary		
Heriades	*carinata*	4-9	Cavity	Solitary		
Heriades	*leavitti*					
Heriades	*variolosa*	4-9	Cavity	Solitary		

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Hoplitis	*albifrons*	5-8	Pithy stems	Solitary		
Hoplitis	*pilosifrons*	4-7	Pithy stems	Solitary		
Hoplitis	*producta*	4-7	Pithy stems	Solitary		
Hoplitis	*spoliata*	4-8	Pithy stems	Solitary		
Hoplitis	*truncata*	4-8	Pithy stems	Solitary		
Megachile	*addenda*					
Megachile	*brevis*	3-12	Cavity	Solitary		
Megachile	*campanulae*	2-11	Cavity	Solitary		
Megachile	*centuncularis*	5-9	Cavity	Solitary		
Megachile	*dakotensis*	7-8	Ground?	Solitary		
Megachile	*fortis*	7-8		Solitary		
Megachile	*frigida*	6-9	Cavity	Solitary		
Megachile	*gemula*	4-8	Cavity	Solitary		
Megachile	*inermis*	6-9	Cavity	Solitary		
Megachile	*lapponica*	6-8	Cavity	Solitary		
Megachile	*latimanus*	5-10	Soil	Solitary		
Megachile	*melanophaea*	5-8	Soil	Solitary		
Megachile	*mendica*	5-10	Cavity	Solitary		
Megachile	*montivaga*	4-9	Cavity	Solitary		
Megachile	*nivalis*					
Megachile	*parallela*					
Megachile	*perihirta*					
Megachile	*pugnata*	6-9	Cavity	Solitary	Asteraceae	
Megachile	*relativa*	5-10	Cavity	Solitary		
Megachile	*rotundata*	6-9	Cavity	Solitary		
Megachile	*sculpturalis*					
Megachile	*texana*	6-8	Cavity	Solitary		
Osmia	*albiventris*	5-7	Cavity	Solitary		
Osmia	*atriventris*	4-7	Cavity	Solitary		
Osmia	*bucephala*	4-6	Cavity	Solitary		
Osmia	*caerulescens*	3-8	Cavity	Solitary		
Osmia	*collinsiae*	4-6	Cavity	Solitary		
Osmia	*conjuncta*	4-7	Cavity	Solitary		
Osmia	*distincta*	5-6	Cavity	Solitary		
Osmia	*felti*	6	Cavity	Solitary		
Osmia	*lignaria*					
Osmia	*nigriventris*		Cavity	Solitary		
Osmia	*proxima*					
Osmia	*pumila*	4-7	Cavity	Solitary		
Osmia	*sculleni*		Cavity	Solitary		
Osmia	*simillima*	5-8	Cavity	Solitary		
Osmia	*subarctica*					
Osmia	*tersula*	5-7	Cavity	Solitary		

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Osmia	*virga*	4-7	Cavity	Solitary	Ericaceae	
Paranthidium	*jugatorium*	7-9	Soil	Solitary		
Stelis	*coarctatus*	6-8	[Cavity]	Parasite	[Megachilidae]	
Stelis	*foederalis*	5-7	[Cavity]	Parasite	[Megachilidae]	
Stelis	*labiata*					
Stelis	*lateralis*	3-7	[Cavity]	Parasite	[Megachilidae]	
Stelis	*nitida*					
Stelis	*subemarginata*					
Trachusa	*zebrata*					
Cuckoo, Digger, Bumble, Honey Bees -- Family Apidae						
Anthophora	*bomboides*	3-8	Burrow	Solitary		
Anthophora	*terminalis*	5-9	Wood	Solitary		
Anthophora	*walshii*	7-8	Soil	Solitary		
Apis	*mellifera*	1-12	Hive	Eusocial		
Bombus	*affinis*	4-10	Hive	Eusocial		
Bombus	*ashtoni*	5-10	[Hive]	Parasite	[Apidae]	*[Bombus]*
Bombus	*bimaculatus*	2-9	Hive	Eusocial		
Bombus	*borealis*	5-10	Hive	Eusocial		
Bombus	*citrinus*	5-10	[Hive]	Parasite	[Apidae]	*[Bombus]*
Bombus	*fernaldae*					
Bombus	*fervidus*	4-10	Hive	Eusocial		
Bombus	*fraternus*					
Bombus	*frigidus*					
Bombus	*griseocollis*	2-10	Hive	Eusocial		
Bombus	*huntii*					
Bombus	*impatiens*	1-11	Hive	Eusocial		
Bombus	*insularis*	3-10	[Hive]	Parasite	[Apidae]	*[Bombus]*
Bombus	*melanopygus*					
Bombus	*pensylvanicus*	4-10	Hive	Eusocial		
Bombus	*perplexus*	4-10	Hive	Eusocial		
Bombus	*rufocinctus*	2-10	Hive	Eusocial		
Bombus	*sandersoni*	4-10	Hive	Eusocial		
Bombus	*suckleyi*					
Bombus	*ternarius*	4-10	Hive	Eusocial		
Bombus	*terricola*	4-10	Hive	Eusocial		
Bombus	*vagans*	5-10	Hive	Eusocial		
Bombus	*variabilis*					
Ceratina	*calcarata*	3-10	Pithy stems	Subsocial		
Ceratina	*mikmaqi*					
Epeolus	*autumnalis*	7-10 [6]	[Soil]	Parasite	[Colletidae]	*[Colletes]*
Epeolus	*bifasciatus*	2-9	[Soil]	Parasite	[Colletidae]	*[Colletes]*
Epeolus	*interruptus*					
Epeolus	*lectoides*					

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Epeolus	*minimus*					
Epeolus	*scutellaris*	6-10	[Soil]	Parasite	[Colletidae]	*[Colletes]*
Eucera	*atriventris*	3-8	Soil	Solitary		
Eucera	*belfragei*					
Eucera	*dubitata*	3-6	Soil	Solitary		
Eucera	*hamata*	4-8	Soil	Solitary		
Eucera	*rosae*					
Holcopasites	*calliopsidis*	5-10	[Soil]	Parasite	[Andrenidae]	
Melecta	*separata*					
Melissodes	*agilis*	5-11	Soil	Solitary	Asteraceae	
Melissodes	*bidentis*	7-8	Soil	Solitary	Asteraceae	
Melissodes	*bimaculatus*	2-10	Soil	Solitary		
Melissodes	*boltoniae*	7-11	Soil	Solitary	Asteraceae	
Melissodes	*communis*	3-9	Soil	Solitary		
Melissodes	*confusus*	8	Soil	Solitary	Asteraceae	
Melissodes	*coreopsis*	6-10	Soil	Solitary	Asteraceae	
Melissodes	*denticulatus*	5-10	Soil	Solitary	Asteraceae	
Melissodes	*dentiventris*					
Melissodes	*desponsus*	6-10	Soil	Solitary	Asteraceae	*Cirsium*
Melissodes	*druriellus*	5-11	Soil	Solitary	Asteraceae	
Melissodes	*gelida*					
Melissodes	*grindeliae*		Soil	Solitary	Asteraceae	
Melissodes	*illatus*	7-9	Soil	Solitary	Asteraceae	
Melissodes	*menuachus*	7-10	Soil	Solitary	Asteraceae	
Melissodes	*niveus*	7-10	Soil	Solitary	Asteraceae	
Melissodes	*rivalis*	5-10	Soil	Solitary	Asteraceae	*Cirsium*
Melissodes	*subagilis*			Solitary	Asteraceae	
Melissodes	*subillatus*	6-9	Soil	Solitary	Asteraceae	
Melissodes	*tinctus*	8-12	Soil	Solitary	Asteraceae	
Melissodes	*trinodis*	7-10	Soil	Solitary	Asteraceae	
Melissodes	*wheeleri*	4-10	Soil	Solitary	Asteraceae	
Nomada	*aquilarum*	7-8	[Soil]	Parasite		
Nomada	*articulata*	5-7	[Soil]	Parasite	[Halictidae]	*[Agapostemon]*
Nomada	*australis*	4-6	[Soil]	Parasite	[Halictidae]	*[Agapostemon]*
Nomada	*banksi*					
Nomada	*bella*	3-4	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*besseyi*	7-9 [4]	[Soil]	Parasite		
Nomada	*bethunei*					
Nomada	*cressonii*	4-7	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*cuneata*	6 [10]	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*depressa*	4-7	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*erigeronis*	5	[Soil]	Parasite		
Nomada	*fervida*	6-8	[Soil]	Parasite	[Halictidae]	*[Agapostemon]*

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Nomada	*florilega*					
Nomada	*gracilis*	4-6	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*illinoensis*	4-6	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*imbricata*	4-6	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*lehighensis*	4	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*lepida*	5-7	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*louisianae*	5	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*luteoloides*	4-7	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*maculata*	4-6	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*obliterata*	5-6	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*ovata*	5-6	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*perplexa*	6-7	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*pygmaea*	4-6 [8]	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*rubi*		[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*rubicunda*	5-7	[Soil]	Parasite		
Nomada	*sayi*	4-7	[Soil]	Parasite	[Andrenidae]	*[Andrena]*
Nomada	*vegana*					
Nomada	*vincta*	7-9	[Soil]	Parasite		
Peponapis	*pruinosa*					
Svastra	*obliqua*	4-11	Soil	Solitary		
Triepeolus	*concavus*	5-10	[Soil]	Parasite	[Apidae]	*[Svastra]*
Triepeolus	*cressonii*	6-10	[Soil]	Parasite		
Triepeolus	*distinctus*	5-10	[Soil]	Parasite	[Halictidae]	*[Dieunomia]*
Triepeolus	*donatus*	7-10	[Soil]	Parasite		
Triepeolus	*helianthi*	6-10	[Soil]	Parasite	[Apidae]	*[Melissodes]*
Triepeolus	*lunatus*	3-10	[Soil]	Parasite		
Triepeolus	*obliteratus*	7-10	[Soil]	Parasite		
Triepeolus	*pectoralis*	5, 7-11	[Soil]	Parasite		
Triepeolus	*rhododontus*	8	[Soil]	Parasite		
Triepeolus	*simplex*	7-8	[Soil]	Parasite	[Apidae?]	*[Svastra?]*
Xenoglossa	*kansensis*	6-9	Soil	Solitary	[Cucurbitaceae]	*[Cucurbita]*
Xenoglossa	*strenua*					
Xeromelecta	*interrupta*		[Soil]	Parasite	[Apidae]	

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Appendix 2. List of Problematic Bee Records in Minnesota

	Scientific Name
Plasterer, Yellow-faced Bees Family Colletidae	*Colletes mandibularis*
	Colletes validus
Mining Bees Family Andrenidae	*Andrena pruni*
	Perdita albipennis palidipennis
	Pseudopanurgus perlaevis
	Pseudopanurgus piercei
	Pseudopanurgus solidaginis
Sweat Bees Family Halictidae	*Agapostemon femoratus*
	Augochlorella gratiosa
	Lasioglossum cattellae
	Lasioglossum cephalotes
	Lasioglossum forbesii
	Lasioglossum nymphale
	Lasioglossum pilosum
	Lasioglossum tegulare
	Lasioglossum viridatum
	Sphecodes carolinus
	Sphecodes clematidis
	Sphecodes shawi
	Sphecodes stygius
Leaf-cutter, Mason Bees Family Megachilidae	*Stelis vernalis*
Cuckoo, Digger, Bumble, Honey Bees Family Apidae	*Bombus pascuorum*
	Ceratina dupla
	Epeolus banksi
	Eucera speciosa
	Nomada graenicheri
	Nomada luteola
	Nomada tiftonensis
	Triepeolus remigatus

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Supplement A. Media Coverage

1. 2014
    a. St. Cloud Times
    b. Minnesota Public Radio
    c. Outdoor News
    d. Concordia Magazine
    e. The Lake Detroiter
    f. WTIP, North Shore Community Radio
    g. St. Cloud Times
2. 2015
    a. Minnesota Conservation Volunteer
    b. News from the Field blog (3 posts)
    c. Star Tribune
3. 2016
    a. WJON, St. Cloud News Radio
    b. Fox9 News
    c. The Wake Magazine
    d. YouTube videos

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State bee research takes aim at Quarry Park

St. Cloud Times
Ann Wessel, awessel@stcloudtimes.com 8:41 p.m. CDT July 5, 2014

Native bees aren't as flashy or fuzzy as honeybees. Some of them look more like flies. No one knows the number of species in Minnesota — or if they're in trouble. Surveys will establish a baseline.

(Photo: Jason Wachter, jwachter@stcloudtimes.com)

Story Highlights

- Minnesota DNR bee researcher Crystal Boyd expects surveys may turn up 400 species of native bees
- Native bees are getting attention because of concerns with honeybees, which pollinate crops

- Native bees are less easily managed, as they tend to be solitary nesters
- What researchers learn about honeybees could translate to native bees and vice versa

WAITE PARK Crystal Boyd strained four bees, three flies and one leafhopper from a yellow pan trap, the third of 12 in a transect topping a granite outcrop in Quarry Park Scientific & Natural Area.

She popped everything into a labeled, zip-top plastic bag, which will share space in her home freezer with her husband's chocolate Popsicles until the field season ends. Then she'll process the bees; identify, label and enter them in a database; and send them off to the University of Minnesota Insect Collection.

The aim is to discover what lives where — data that could inform small-scale farmers looking for alternative pollinators and land managers considering wildflowers' genetic diversity.

Boyd, a Minnesota Department of Natural Resources bee researcher working with the Minnesota Biological Survey, thinks she may ID as many as 400 native bee species.

Minnesota DNR reseracher Crystal Boyd is collecting samples at Quarry Park in St. Cloud. St. Cloud Times

In June, she wrapped up an SNA project that took her to 12 sites, many of them southwestern Minnesota prairies. During the two-year effort that launched July 1, she'll work on that state species list, visit insect museum collections and complete more surveys. The last attempt to establish a baseline for state species, made in 1919, went unfinished after the researcher died. At the time, insects weren't high on the list.

"We need to know what's out there," said Elaine Evans, who is earning her doctorate in entomology from the University of Minnesota. "The survey is the first step to assess the health of our pollinator population in Minnesota."

Evans spoke from the University of Minnesota's Bee Lab, where the focus is on bee health. Most of that research centers on honeybees; hers centers on native bees — in particular, on how landscape affects the biodiversity of bees in North Dakota.

At Quarry Park SNA, some of the bees that turned up in the shallow plastic cups painted white, blue or yellow inside to resemble flowers looked more like flies and nothing like honeybees. Boyd said people often are surprised to learn honeybees aren't native. They came here with European settlers who wanted effective pollinators.

What researchers learn about the problems affecting one may help the other.

"Honeybees are like cattle. We know a lot about how to manage cattle and what to do when cows get sick. And native bees are like moose. We don't know as much about what to do when moose get sick or how to manage moose," Boyd said.

Still, native bees aren't as flashy as moose or other large, hairy animals.

"The only reason they're getting attention is because honeybees are in trouble so people are looking at alternatives," said Heather Holm, Minnetonka-based landscape designer and "Pollinators of Native Plants" author.

Some bumblebees have been used to pollinate crops in Western states. Harnessing bumblebees and other native species for that purpose is largely ineffective. They don't nest in colonies, and they don't fly far. Holm said the maximum range is usually about a mile — not far enough to reach the center of many fields.

Smaller, organic operations might plant flowers and maintain nesting habitat to attract native bees.

While adept at pollinating crops, honeybees might not be as effective at pollinating wildflowers. Some plants don't meet honeybees' nutritional needs. Some are pollinated only by certain bees. Deep-throated flowers, for example, might require a bumblebee's long tongue. Flowers such as Dutchman's breeches may require a bumblebee's strength to pry it open.

"Native bees are really important pollinators, too," Evans said. "Over 80 percent of plants and flowering plants are dependent on animals for pollination. Most of those are bees."

Holm said native bees help to ensure cross-pollination and the sort of genetic diversity that makes plants resilient to disease or other environmental stressors.

Scientific & Natural Areas were chosen as study subjects because they tend to contain the best examples of native plants. Boyd said she expected to enter at least a few county records — the first time a species is documented in a county — because so little past research has centered on counties outside Hennepin and Ramsey.

Boyd used topographical maps to pinpoint where to set the traps, aka bee baskets, within Quarry Park SNA, which shares a boundary line with Quarry Park & Nature Preserve. Armed with a long-handled kitchen sieve, she returned 24 hours later to see what turned up.

Flowers including yarrow, spiderwort, harebells and goat's beard grew in the cracks and around the edges of the bald granite dome. Getting there required a muddy walk through a face-slapping buckthorn thicket. Boyd moved effortlessly through the tangle.

The final tally included about 20 bees, 27 flies, four leafhoppers, three butterflies and two dragonflies.

She may send some of the leafhoppers to the University of Colorado Museum of Natural History. Rove beetles may wind up at The Field Museum in Chicago, weevils at Kutztown University in Pennsylvania and mites at Ohio State University.

Meanwhile, Minnesota continues its focus on native bees. Six pollinator projects funded by the Legislative-Citizen Commission on Minnesota Resources started in 2014; five more applied for funding starting in 2015.

For those projects that involve native bees, the survey will be the starting point.

"It's really hard to know how things are doing when we don't even know all of what's here," Evans said.

"We need to know who's out there."

Beguiling blooms

Heather Holm, a landscape designer and author of "Pollinators of Native Plants," suggests starting with the following plants to attract pollinators throughout the season:

• Bee balm (choose lavender instead of red, which attracts hummingbirds but not bees).

• Stiff goldenrod (for late-summer blooms that don't overtake a space).

• Butterfly milkweed (in sandier soil) or swamp milkweed (for heavier soil).

• Golden Alexanders (for early blooms).

• Coneflowers, asters, penstemon and black-eyed Susans (for their flat, open surface that provides diversity in shape).

Researchers to conduct first survey of Minnesota's native bees

Environment Dan Gunderson · Fergus Falls, Minn. · Aug 4, 2014

Plastic cups are painted and filled with soapy water to attract and trap bees at Otter Tail Prairie Scientific and Natural Area near Fergus Falls. Dan Gunderson/MPR News

Listen Story audio 3min 48sec

A few miles west of Fergus Falls, dew on the prairie grass sparkles in the morning sun, as Crystal Boyd, an entomologist for the state Department of Natural Resources walks into the Otter Tail Prairie Science and Natural Area.

Among the yellow and purple prairie flowers is a row of 12 plastic cups suspended on poles about the same height as the plants — an ideal setting for researchers who need to capture bees.

For years, scientists have studied honeybees to assess the connection between their declining population and the use of pesticides, declining habitat and disease. But until recently, they paid little attention to Minnesota's native bees.

This summer DNR researchers are traveling the length of western Minnesota to conduct the first population survey of native bees. That's where the cups come in. They are filled with soapy water to trap insects, which Boyd said is an unfortunately necessary technique, as the only way to count insect populations is to kill them.

"These cups are painted with a UV florescent paint and the bees are attracted to the yellows, the blues and the whites," said Boyd, who is leading the statewide bee survey. "Those are their favorite colors."

Researchers will collect the insects from each cup to identify them later. Big fuzzy bumble bees are easy. But many native bees are the size of a grain of rice and live inside plants and Boyd will need a microscope to identify them.

Minnesota has a list of native bees, but it was written in 1919 and is missing many of the state's more than 350 different species of native bees.

DNR entomologist Crystal Boyd collects the insects trapped in a cup of soapy water on the Otter Tail Prairie Scenic and Natural Area. Dan Gunderson/MPR News

The research project, funded by a $370,000 grant from the Environment and Natural Resources Trust Fund through state lottery proceeds, will allow scientists to create a new list over the next two years.

Although historically researchers have found it difficult to obtain funding for bee research, that's changing because of growing public interest in pollinating insects, Boyd said. Typically the focus is on honeybees because of their importance to many crops. But native bees are busy too.

"Our native bees are incredibly important pollinators," she said. "They're supporting our prairie ecosystem, creating habitat and food for wildlife. They're pollinating plants that prevent soil erosion, that buffer waterways, that store carbon. They were pollinating plants in Minnesota before honeybees even arrived."

Among the plants that depend on bumblebees for pollination are the tomato plants in many backyards.

Researchers think at least three of 18 bumblebee species — the most studied of native bee species — are in trouble. But they have far more questions than answers.

"It's really hard to say what native bee populations are doing in Minnesota right now," Boyd said. "Bumblebees are a little easier. They're easier to see [and] more people have collected them so we have more data. Anything smaller than a bumblebee, we really don't know."

The bee survey will continue through October as researchers visit 90 sites every two weeks to make sure they capture bees that are active during different times of the summer.

A collection of insects taken from 24 traps on the Otter Tail Prairie Scenic and Natural Area July 30th 2014. Dan Gunderson/MPR News

They also will analyze the historical record found in insect collections at institutions like the University of Minnesota to get a better idea of past bee diversity in the state.

So far, Boyd is finding fewer bees than she expected. She suspects a cold wet spring might have reduced bee numbers.

Her research is only a first step in learning about native bees. Scientists may need up to 20 years of population data to establish trends.

Although this year's will provide a snapshot of bee diversity in the state, it won't tell scientists if native bees are in decline.

"It would help us to see if species are moving in or disappearing from Minnesota," Boyd said. "If we don't track what we have we don't know if we're gaining new bees or losing what we have."

New generation of pesticides contaminating wetlands and eliminating pollinators?

August 25, 2014

by Nick Ronning Contributing Writer

Neonicotinoids. Say what? The problem with chemical names is that only scientists think they make sense, but luckily, when broken down by syllables, normal humans can usually figure out how say the word.

Breaking it down, neonicotinoid means: neo = new; nicotin = nicotine; oid = similar to, but not the same. It's a relatively new breed of nerve poison insecticide that resembles nicotine, chemically speaking. Like nicotine, in small doses neonicotinoids stimulate an insect's nervous system, but in high doses, they over-stimulate the nerves, leading to paralysis and death.

This class of pesticides includes specific chemicals that are equally fun to sound out, including: acetamiprid, clothianidin, nitenpryam, nithiazine, thiacloprid, thiamethoxam, and the most widely used insecticide in the world, imidicloprid. Collectively, they are often referred to as neonics (knee-oh-nix).

First introduced to the United States in 1994 by Bayer, neonics are now used by the major pesticide companies in everything from home and garden products to agricultural seed treatments and sprays. Neonics are water soluble so that plants can absorb them. A systemic type of pesticide, they are present in all parts of the plants, affecting any insect that feeds on the plant, including the pollen and nectar.

The heavy hitters in ag chemicals say that neonics are harmless to humans and fall within Environmental Protection Agency regulations for all classes of toxicity and aquatic persistence. Many scientists and environmental activists aren't so sure neonics are harmless beyond their intended use.

University of Saskatchewan biologist Christy Morrissey recently published research showing contamination of prairie wetlands due to leaching of neonics. Morrissey's research studied hundreds of wetlands at various times of the year and showed 80 to 90 percent were contaminated. Some had three to four times the concentration of neonics tolerable to insects.

Thus far, it appears neonics have high persistence rates in prairie soils, and due to their water-soluble nature, they run off into wetlands during snow melt and rain. Soil and wetland persistence of neonics hasn't been determined, but it is expected to be months to years. That wetlands have shown high concentrations after ice-out and prior to spring planting spells trouble for waterfowl that feed on wetland invertebrates during the breeding season.

Despite being relatively new on the market, according to a recently published government study in Iowa, use of neonics has tripled over the past decade. Morrisey estimated almost half the cropland in prairie Canada – tens of millions of acres – was treated with neonics. If the Center for Food Safety's estimates are accurate and over 99 percent of corn and more than 75 percent of soybeans are treated with neonics, the United States land area treated with neonics would be staggering as well.

There are several possibilities as to how neonics may harm insect and wildlife populations.

One is by interrupting the food web. If neonics are contaminating wetlands at a high rate during the spring and summer, it's likely they could eliminate the invertebrates depended upon by breeding waterfowl and their offspring. Seed-eating birds may reach toxic levels after consuming neonic-treated seeds in crop fields.

Also under scrutiny is the possibility neonics play a role in the collapse of pollinator colonies. Given neonics are present in all parts of the plant, bees and butterflies feeding on the pollen and nectar may succumb to the pesticide, even if indirectly.

Neonics may not kill bees outright, but DNR pollinator specialist Crystal Boyd said, "There is solid evidence of sub-lethal effects on bees. It may disrupt their ability to find their way back to the hive or cause them to forget how to forage."

Neonics can be applied as sprays, which are prone to wind drift, but there is evidence that even the dust resulting from air-seeded corn may drift to adjacent plants visited by bees. Several colony collapses have coincided with corn seeding.

In December 2013, the European Union issued a 2-year moratorium on neonics to further study their impacts. So far, efforts to restrict neonics in the United States, including federal legislation and a lawsuit against the EPA, have failed. However, the national wildlife refuge system recently announced neonics will be phased out and prohibited beginning in January 2016.

As research continues, look for neonics to become a hot topic in agricultural and environmental circles. The phrase "silent spring" and comparisons to DDT are ramping up and will be hitting the mainstream before year's end.

Concordia Magazine

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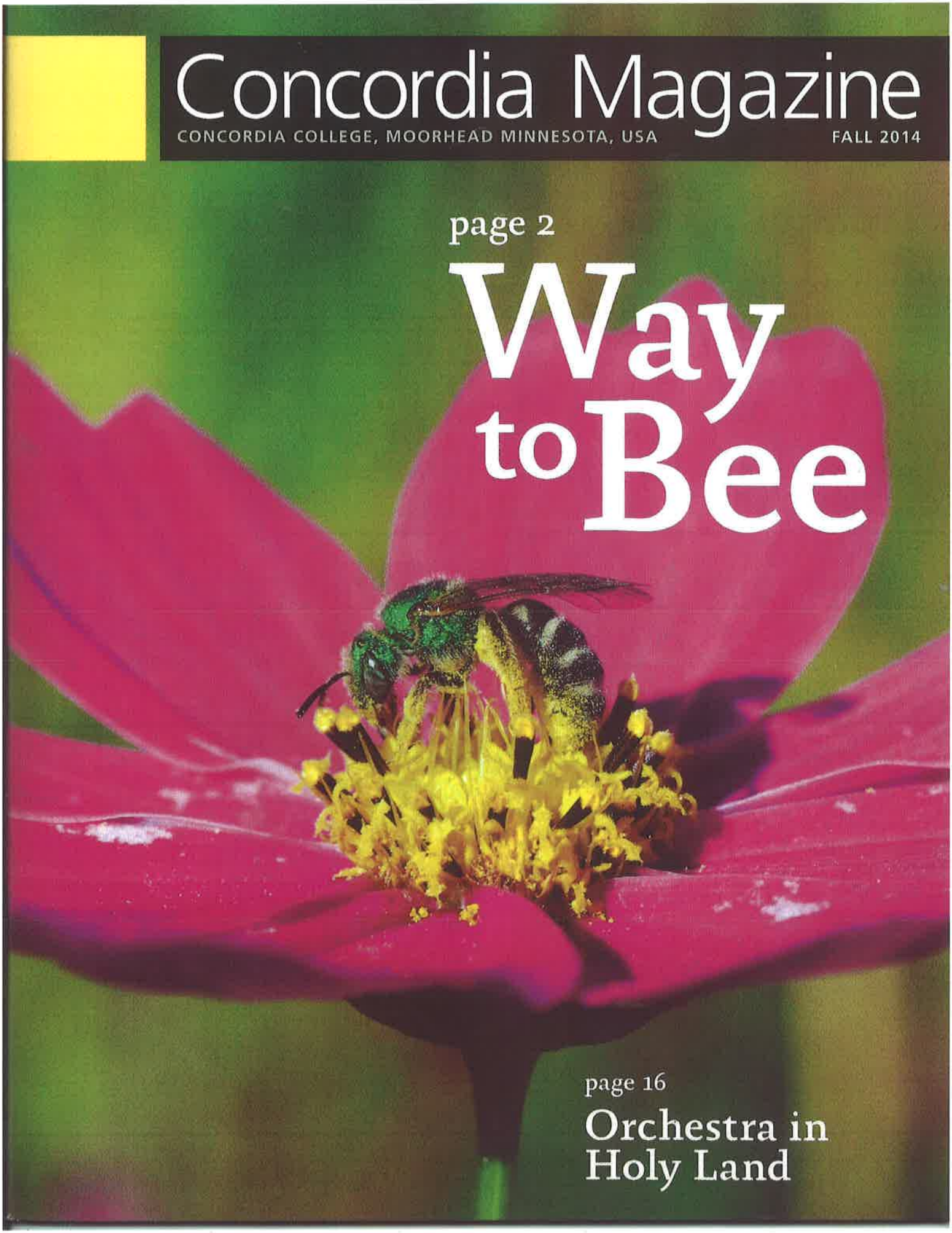

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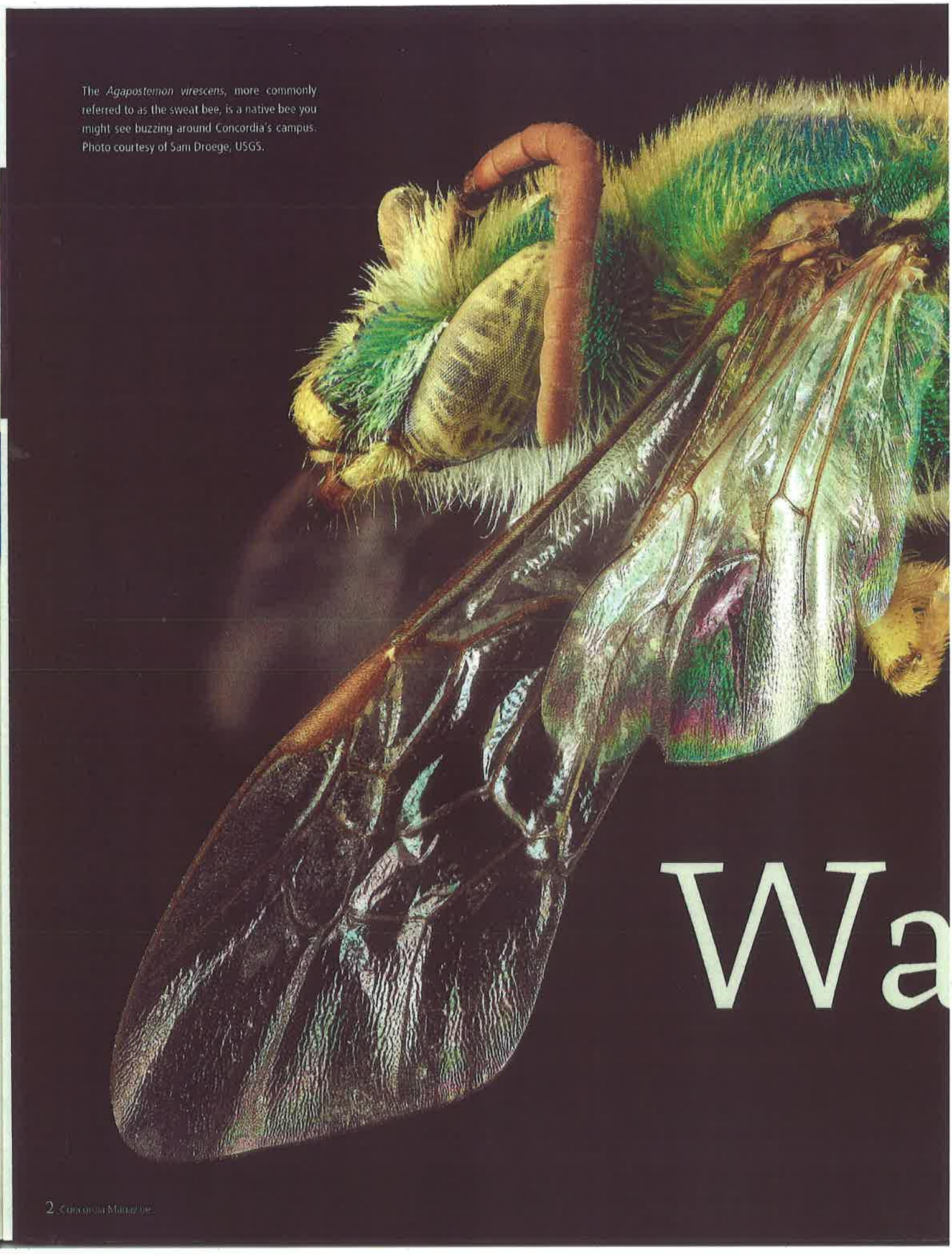
Orchestra in Holy Land



The *Agapostemon virescens*, more commonly referred to as the sweat bee, is a native bee you might see buzzing around Concordia's campus. Photo courtesy of Sam Droege, USGS.

Wa

y to Bee

By Aubrey Schield

As honeybees disappear, an answer to the pollination question may be closer than we think. Concordia researchers are among those investigating the secrets of native bees.

THE sun is already beating down on Concordia's Long Lake Field Station near Detroit Lakes, Minn., drying the prairie grasslands of their morning layer of dew. Wildflowers spring from the yellow-green backdrop in a multitude of colors: waist-high thistles with enticing purple flowers, golden sunflowers and brilliant fuchsia blooms.

It's 10:45 a.m. on a weekday and, for three student researchers, the lab looks a little different than it does for most.

Throughout the summer, **Jens Hulden** '16, Moorhead, **Jon Tetlie** '15, St. Paul, Minn., and **Scott Opatril** '17, Glyndon, Minn., assisted **Dr. D. Bryan Bishop**, associate professor of biology, with his three-year research project on native bees.

Their mission was simple: collect and identify as many bees as possible.

The reason for their research, however, was anything but simple. Bishop's project came about as a reaction to the pollinator crisis. In 2006, beekeepers began seeing a 40 percent loss in their honeybee colonies annually. Bishop says normal loss for a season is only 10 percent.

Scientists have dubbed the phenomenon "colony collapse disorder" or CCD.

"The strange thing about CCD is that all the bees disappear," Bishop says. "We still don't really understand what's going on."

If you take a look back in history, you may be surprised to learn that honeybees are not native to North America. The species we have here was brought over from Europe in the 17th century. The insects quickly became celebrities in pollination because they lend themselves so well to domestication and mass pollination.

In recent years, more and more people have started paying attention to CCD because of its impact on crop production. It's commonly said that honeybees pollinate one-third of the food we eat. These insects are responsible for everything from almonds to raspberries to your favorite Häagen-Dazs ice cream flavor.

Native bees pollinate too, but tend to get overshadowed by the widely recognized black and yellow striped honeybee. With honeybee colonies dying out, scientists are asking: What is the current state of our native bees and how do they impact pollination?

Those are the questions researchers like Bishop are trying to answer.

In 1919, an entomologist named Frederic L. Washburn set out to compile a list of Minnesota's native bee species. Unfortunately, Washburn died before the list was completed. Now, almost 100 years later, we still don't have an updated, comprehensive list of the state's native bees.

Enter Bishop.

When he started researching native bees, Bishop knew students would be interested in the work, as well as benefit from a practical research experience.

"I'm an educator," he says. "I like sharing information."

Since his work began, Bishop has spent many days with his students out in the field collecting and studying bees. Hulden says he learned a lot from Bishop when he accompanied them in the field.

"We learned even more just by talking to Dr. Bishop," he says.

The project sampled three different sites: one at Concordia's Long Lake Field Station, one at Bluestem Prairie Scientific and Natural Area, and the third at associate professor of art Dr. Peter Schultz's Longspur Prairie, a restored prairie near Ulen, Minn.

All in a Day's Work

At Long Lake, Hulden, Tetlie and Opatril have a long day ahead of them.

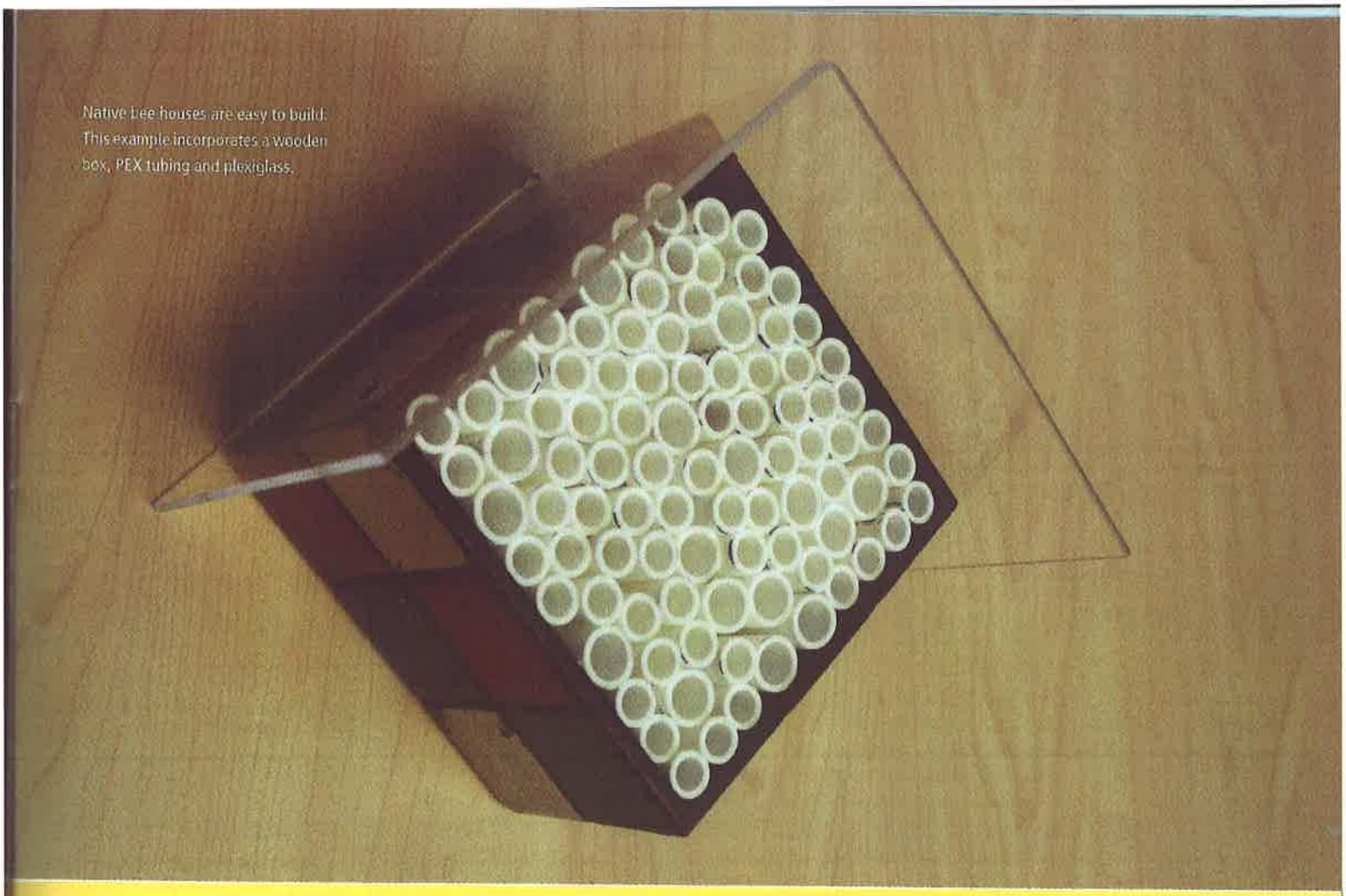
The team collects bees using two methods: net and bowl capture. In the morning, they walk in a single file line through the prairie grasses, setting out bee bowls, plastic condiment cups painted in fluorescent blues, yellows and whites.

The paint reflects ultraviolet light, mimicking a real flower and attracting the bees. Each bowl is filled with soapy water, which traps the bee when it flies in.

Every 10 meters, Hulden places a bee bowl along an imaginary diagonal line bisecting a rectangular plot of land. Opatril follows behind, filling each bowl with soapy water.

Later in the afternoon, they will walk the same diagonal lines again, picking up each bowl and storing its contents in plastic bags and a solution of water and isopropyl alcohol.

They will bring their nets along with them when they revisit the bowls in hopes of catching more bees. Walking through the thick prairie grass, Hulden swoops the net forward in a graceful, sideways S. The tail of the net flips into its center, barring any escape for the bee he has just caught.



Native bee houses are easy to build. This example incorporates a wooden box, PEX tubing and plexiglass.

What You Can Do

1. Build native bee houses.
They come in many shapes, sizes and designs. It's up to your imagination. *Helpful tips: ConcordiaCollege.edu/beehouse*

2. Skip the mulch.
Native bees often live in holes within soil or wood. Leaving gardens mulch-free gives bees access to natural habitat in the dirt.

3. Plant wildflowers.
They're beautiful and they give pollinators sustenance. It's a win-win.

4. Avoid pesticides.
Pesticides don't discriminate between pesky nuisances and innocent pollinators like native bees.

Tetlie also carries an old pickle jar, which contains a concentrated amount of ethyl acetate. The kill jars, as they are colloquially referred to, smell strongly of nail polish remover.

Periodically, Tetlie unscrews the kill jar's lid, having spotted a specimen pollinating a flower. He moves in a fluid motion toward the bloom, the bee resting precariously on its pedals. In one swift attack, Tetlie claps the jar around the bee, sparing the flower and capturing the insect.

When the student researchers return to the lab, they wash, dry and mount the bees captured that day.

After drying a bee with a blow dryer turned on the lowest setting, Hulden hands the bee off to Tetlie, who pins it to a piece of plastic foam and identifies it. Hulden comments that the bees are surprisingly strong. A fresh insect is actually very hard to break; their bodies are flexible and not as fragile as you might think.

Hulden enjoys researching bees with Bishop because his work is contributing to the shared knowledge of native bees.

"I think it's really cool because it matters so much," he says.

A Secret World

Wooden boxes sit lined up on the black tables in the lab. The glass tops reveal rows upon rows of bee species. From a distance, most look as small and insignificant as a fly or a gnat.

But close up, a diverse world of colors, shapes and sizes is revealed.

Native bees can range in size from a mere centimeter to the width of three fingers put together. Around the world, native bees turn up in all colors of the spectrum: translucent blues and greens, brilliant purples, stark white and black.

The shapes of native bee species are even more varied. Some have round bodies with wide legs. Others are skinny, the sections of their body pieced together at the narrowest of junctions.

It seems the closer you get the more magnificent they become.

This was the third summer that Bishop included students in his research. Though the students' contributions are very helpful, the task of discovering Minnesota's more than 430 estimated species of native bees requires the collaboration of many researchers.

Bishop enjoys working with other researchers to tackle the project of making a species list.

This past summer the Minnesota Department of Natural Resources began a statewide study of native bees. Crystal Boyd, a DNR bee researcher, is heading the project.

Boyd's project aims to update the state species list from the severely outdated 1919 list of Minnesota native bee species.

"There's a big gap there," she says, "a century worth of information."

Boyd's project is also a survey of Minnesota native bees. By studying the different species, she hopes to answer questions about their behavior and activity when it comes to pollination.

Boyd visited Concordia's campus this fall to take a peek at Bishop's collection of specimens. This collaboration is integral to understanding more about native bees in Minnesota.

Bishop, Boyd and other researchers have already drawn some conclusions about native bees as they have tried to identify what species are here and create a baseline for researchers in the future.

In many ways, native bees are more efficient pollinators than honeybees, Bishop says. Unlike honeybees, they do not take breaks, but work nonstop because they do not store up nectar for food. In other words, they don't make honey. They need to constantly pollinate in order to survive.

"Native bees are beautiful and amazing creatures," Boyd says. "They are workhorses."

Each species of native bee seems to be somewhat specialized. If a honeybee is a standard hammer, one species of native bee might be a sledgehammer; another might be a rubber mallet; each specifically designed for one particular type of work or one particular flower.

The Alfalfa leafcutter bee, for example, specializes in pollinating alfalfa. Bishop says leafcutters are responsible for the pollination of at least 90 percent of alfalfa in Minnesota.

In addition to pollinating plants that we consume, native bees are often responsible for wildflower pollination, which provides beautiful landscapes and healthy ecosystems.

That's why researchers are so adamant about learning their secrets.

"If honeybees are going to die out," Hulden says, "then we need the native bees' help."

Jon Tetrie '15 carries a bug net and kill jar as he walks through the Bluestem Research Area in hopes of catching a specimen.

Become an Advocate

Researchers are not the only ones helping the bees. Average people, like you and me, are taking note of the crisis and getting involved.

Noreen Thomas has devoted her family farm to helping bee populations along.

Doubting Thomas Farms rests in the midst of corn and soybean fields just outside of Kragnes, a small Minnesota town north of Moorhead.

The 1,200-acre farm has been in her husband's family since 1878, passed on through five generations. Earlier this year, Thomas received a grant through the Minnesota Department of Agriculture for a three-year project designed to build habitat for native bees while adding value to a small acreage of land.

Bishop has helped Thomas implement her project by sharing his expertise regarding bee habitat. He has made the trek out to Doubting Thomas Farms several times to set up native bee houses, honeybee boxes, as well as to monitor the species present, working alongside Thomas as the project's entomologist.

Thomas, a former employee of the tea manufacturer Celestial Seasonings, had the idea to incorporate tea plantings into the habitat. If successful, the design Thomas has developed will be a win-win for native bees and farmers.

"A lot of the time, research is not applicable on farms," she says. "That's why this grant is so important."

By planting chamomile, red clover, lavender and other teas, Thomas hopes to attract pollinators and yield a valuable crop at the same time. In the half-mile-long plot of land, she has also planted wildflowers and annuals.

She worries that people won't take notice of the challenges facing bees until it's too late.

"Some people won't get it until their apple tree doesn't fruit," she says.

Although Thomas has been able to create something of a native bee sanctuary, that level of devotion isn't realistic for everyone. Fortunately, there are many things everyone can do to help native and honeybees.

"Leaving some area for habitat is just so simple," Thomas says.

Many advocacy groups are working in response to CCD and the pollinator crisis. From urban rooftop bee habitats to statewide native bee surveys and research, more people are taking notice of the plight of our bees.

Boyd says one simple answer to the crisis asks people to consider native bees and become interested in them. The next time you see what looks like a tiny, green fly or hear a faint buzz in your ear, think about pollinators and all they do for our environment and way of life.

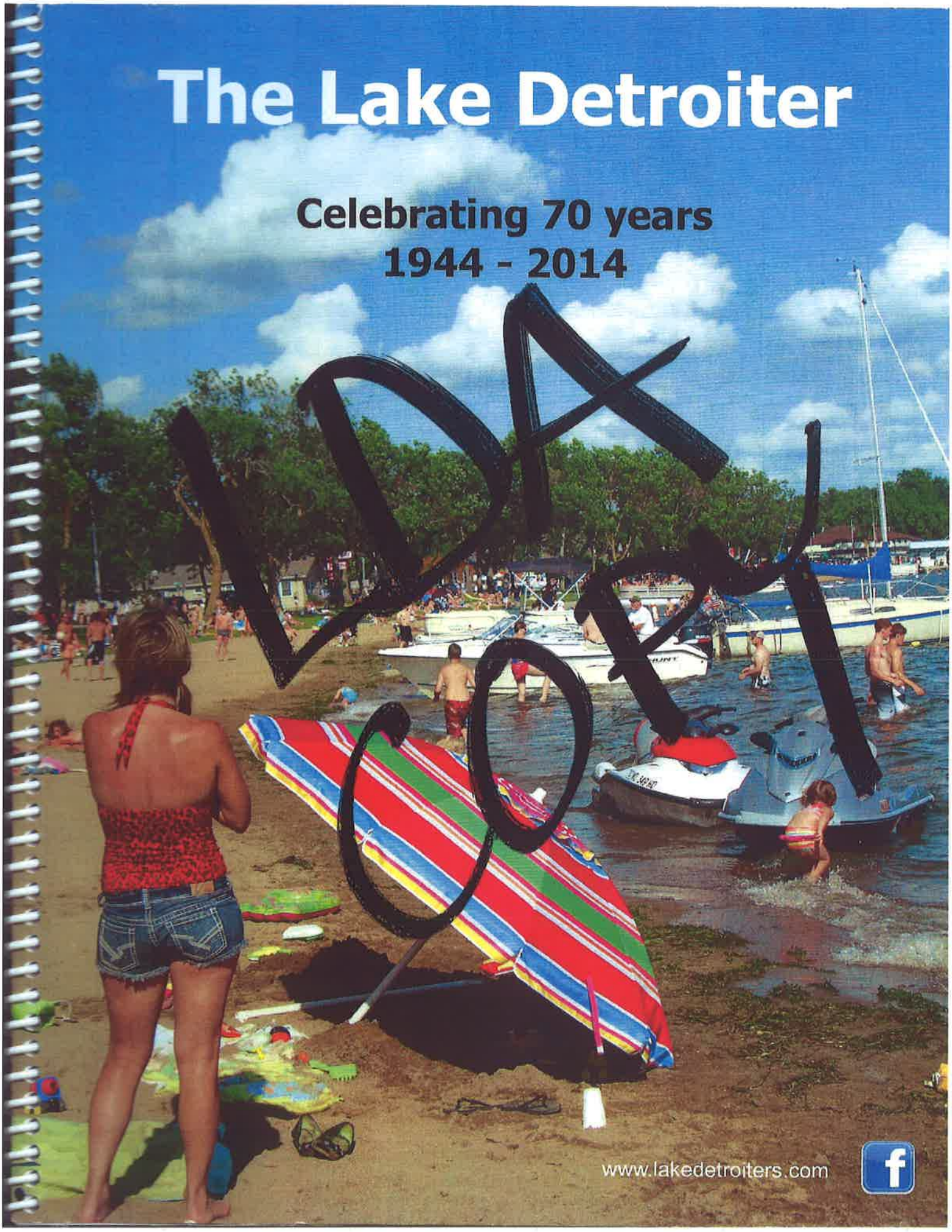
"Look carefully at bees," she says. "You'll get blown away." ■

Photo above: Brianne Lee '16

Aubrey Schield '15, Orono, Minn., studies multimedia journalism.

The Lake Detroiter

Celebrating 70 years
1944 - 2014



IMPORTANCE of BEES and OTHER POLLINATORS

What is a Pollinator? Pollinators are an important part of all ecosystems, including Minnesota's lakeshore habitats. Pollinators include insects such as bees, butterflies, moths, flies, beetles, and many more. These small animals play a large role in sustaining plant populations that stabilize soil, store carbon, purify runoff, and beautify the landscape. It is an animal that causes plants to make fruit or seeds. They do this by moving pollen from one part of the flower of a plant to another part. This pollen then fertilizes the plant. Only fertilized plants can make fruit and/or seeds, and without them, the plants cannot reproduce.

Why Do We Care? These hard-working animals help pollinate over 75% of our flowering plants, and nearly 75% of our crops. Often we may not notice the hummingbirds, bats, bees, beetles, butterflies, and flies that carry pollen from one plant to another as they collect nectar. Examples of crops that are pollinated include apples, strawberries, and squash. Having enough pollinators during bloom is essential to produce a sustainable crop. Proper pollination increases fruit size at yield, hastens maturity, and produces a more symmetrical fruit shape. Without the assistance of pollinators, most plants cannot produce fruits and seeds. The fruits and seeds of flowering plants are an important food source for people and wildlife.

What is New Regarding Pollinators in Minnesota? 2014 was a good legislative year in MN for protecting bees and other pollinators from systemic insecticides in garden plants. The legislation says, "A person may not label or advertise an annual plant, bedding plant, or other plant, plant material, or nursery stock as beneficial to pollinators if the annual plant, bedding plant, plant material, or nursery stock has been treated with and has a detectable level of systemic insecticide." This new legislation will encourage limited insecticide use on flowering plants. Systemic insecticides are ingested by bees and other pollinators when they gather nectar or pollen from treated plants. Minnesota research shows pollinators need a habitat free of chemicals and pesticides can be particularly dangerous to bees. Bumblebees are among the most efficient pollinators present in Minnesota and their population seems to be declining.

So what can we do? It's a good time to consider planting flowering trees, shrubs and other plants that are attractive to bees, butterflies and other pollinators. Beautify yards with landscape diversity and feed and protect pollinators, all at the same time. Botanists and entomologists say even a few square yards of native flowering plants in a yard, garden, or vacant lot can make a difference. You can support pollinators by taking a few simple steps on your own property. Here are some suggestions:

- Include diverse flowering plants along your shoreline. Pollinators seek nectar, pollen, and/or nesting sites throughout the season, so a variety of plants will provide continuous food and shelter.
- Plant at least three species that bloom in each season. This helps pollinators to find resources in spring, summer, and fall.
- Select native or heirloom varieties of plants because they offer easy access to pollen and nectar. Hybrid varieties might not be accessible to pollinators.
- Keep shrubs and trees on your property. Bees rely on willows early in the spring, and 30% of bee species nest in beetle tunnels in dead, standing trees.
- Leave bare patches of soil because 70% of bee species nest underground.
- Avoid using insecticides (which are designed to kill insects—including pollinators like bees and butterflies). When buying plants or seeds, ask the staff at your nursery if they were treated with neonicotinoids. These "neonics" are harmful to pollinators.

BEES and OTHER POLLINATORS (con't)

Pollinators require both nectar and pollen for their life cycles. Planting trees, shrubs, and flowers that **bloom** from April/May until frost will allow for a consistent food supply for bees and other pollinators. Gold-**enrod** and asters blooming in September are gold mines for pollinators looking for high-energy food before **winter**.

Native species to use in landscaping for pollinators:

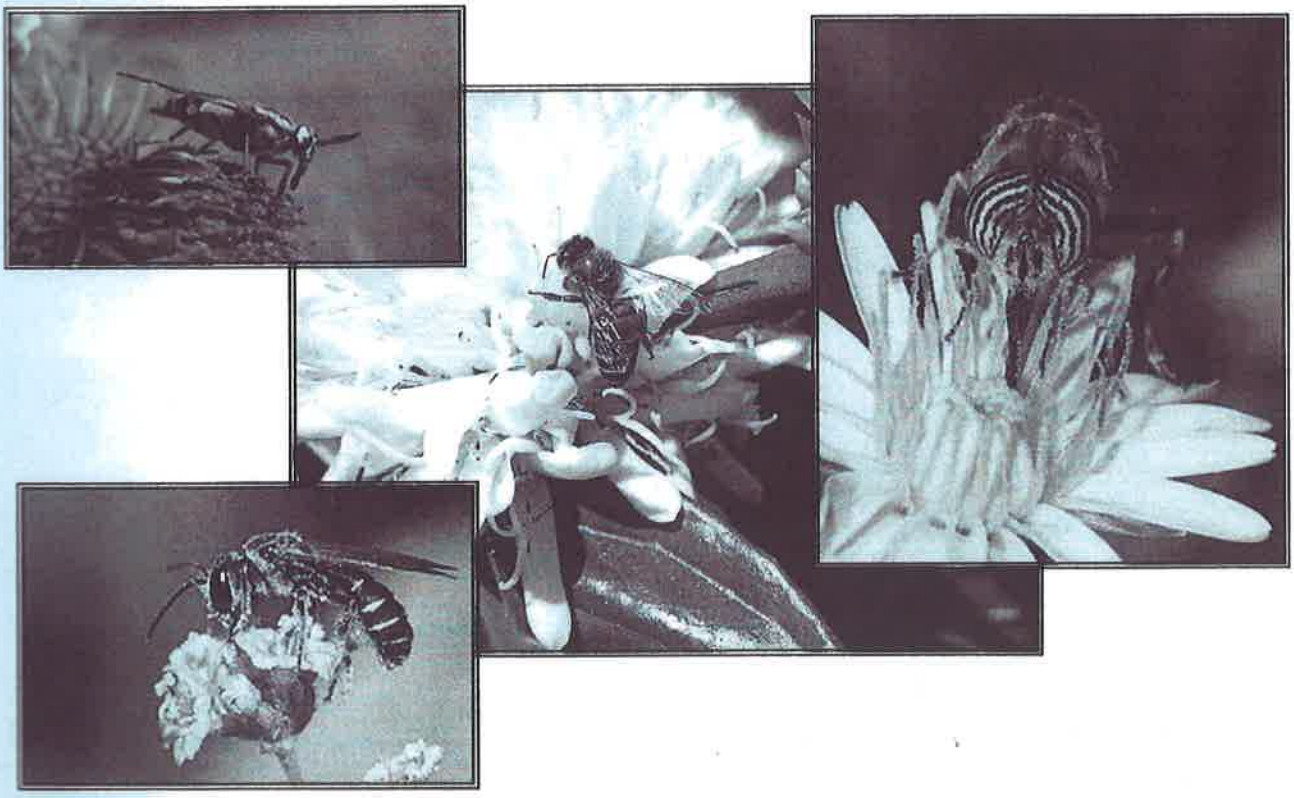
Spring Blooming Plants: Pussy willow , Juneberry, Spiderwort, Plums and cherries, Wild roses
Summer Blooming Plants: Prairie clover, Swamp Milkweed, Lavender, Beardtongue, Catnip
Fall Blooming Plants: Aster, Sneezeweed, Goldenrod, Sunflower, Catnip

Sunflower - A striking, cheerful flower, easily grown from seed. A great plant for fascinating and growing "little gardeners". Sunflowers attract numerous species of native bees. Be sure to avoid pollenless varieties, when planting for pollinators.

Catnip (catmint) - An adaptable perennial that grows well in cold climates; gorgeous drifts of china blue give the look of lavender, but unfortunately not the fragrance. However it will attract not only bees, but hummingbirds and butterflies. Rabbits don't care for the gray foliage and pungent scent.

Swamp Milkweed - Swamp milkweed can be easily distinguished from other milkweeds with pink flowers by its long narrow leaves and it's 2 to 3-inch convex flower that clusters at the top of the plant. . It grows easily in a home garden with average to moist soil. It can nearly exploding in heavy clay soil. Butterflies love it, and not just the Monarchs. Bees love it, too

Contributor: Crystal Boyd
MN Biological Survey Inspect Specialist
MN Department of Natural Resources



WTIP NORTH SHORE COMMUNITY RADIO 90.7 FM

Bee researcher documents native species

Bumble bee

Local News *Environmental Stewardship* - Tue, 10/07/2014 - 9:19am

Attachment	Size
CrystalBoyd_NativeBees_100714.mp3	17.59 MB
Crysta_lBoyd_Bees_tag.mp3	9.9 MB

There are at least 35 species of native bees living in Cook County and most of them winter either under ground or in cavities. WTIPs Jay Andersen spoke with DNR bee researcher Crystal Boyd.

This feature was funded in part by the Coastal Zone Management Act of 1972, as amended, by the NOAA's Office of Ocean and Coastal Resource Management, in conjunction with Minnesota's Lake Superior Coastal Program. The statements, findings, conclusions, and recommendations are those of WTIP and do not necessarily reflect the views of NOAA's Office of Ocean and Coastal resource Management, Minnesota Department of Natural Resources or Minnesota's Lake Superior Coastal Program.

Let these 2014 outdoor experiences launch your new year

Ann Wessel, awessel@stcloudtimes.com 10:27 p.m. CST December 27, 2014

2014 roundup: A competitive musher in the grueling John Beargrease Sled Dog Marathon. A bike-riding band of volunteers. A long-runing pelican banding effort. A bee researcher. An archaeology class.

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(Photo: Jason Wachter, jwachter@stcloudtimes.com)

Story Highlights

- St. Cloud musher Mike Bestgen is preparing for the Beargrease. You can get involved, too.
- Scientists band pelicans. You can view them from a safe distance, starting in about March.
- Single-track trail building is slow work. You can speed things up by joining the MORC volunteers.
- Bee research involves field work plus hours of documentation and verification.

Our Woods & Waters found adventure in the John Beargrease Sled Dog Marathon, dedication in a pelican-banding effort at Lac Qui Parle Wildlife Management Area, reclamation on Bertram Chain of Lakes' rebuilt single-track trails, ground-level science in bee research and glimpses of history at an archaeological dig within Charles A. Lindbergh State Park.

Find out what's happened since and how you can get involved. Or at least follow along.

Sled dog marathon

Vicious and Blanche are back in training as St. Cloud musher Mike Bestgen plots a strategy for the John Beargrease Sled Dog Marathon's mid-distance race.

Last year, the car salesman from Miller Chevrolet in Rogers placed sixth in the 150-mile Duluth-to-Tofte route that parallels the North Shore of Lake Superior.

With his eye on a first-place finish this season, he's got 20 Alaskan huskies in training — seven of them 1-year-olds, some of them potential replacements for lead dogs Vicious and Blanche when they start to slow down.

"They'll follow as fast as the leaders go," Bestgen said. "You have to evaluate each dog, because even though they can be siblings, they can be different sizes. The mental toughness of a dog can make a big difference, and when you start to run a lot of miles, some will handle it better than others."

Bestgen's changed the vitamins in the nutritional mix, and supplemented beef with chicken and beaver meat. He's training at a faster pace. He's dropped an early season race that took a toll on the dogs last season. His season will start Saturday with the Gunflint Mail Run Sled Dog Race.

Meanwhile, most of Bestgen's training has been behind a four-wheeler. He's logged more training time — 754 miles logged in 53 hookups, compared with 679 miles and 46 hookups at the same time last year. But the lack of snow means he's only been on a sled three times. The drawback: Pulling a 2,000-pound four-wheeler vs. a 250-pound sled in competition will affect dogs' muscle memory.

As of Tuesday, 18 mushers had registered for the full 400-mile marathon; 26 had registered for the mid-distance.

"We're really starting to draw mushers from all over the country, all over the Midwest, to come back to the race," said Jason Vincent, Beargrease media director.

The race reorganized last year with new leadership and sponsors.

The $45,000 purse includes $10,000 for the first-place marathon finisher and $4,000 for the first-place mid-distance finisher.

GET INVOLVED: Running the Beargrease takes 700-plus volunteers working indoors and out. It's possible to sign up days before the race. The biggest need: About 200 road crossing guards. Spectators find the best vantage points and opportunities to get up close with the dogs at the checkpoints.

WHAT TO WATCH: Another win would put defending marathon champion Nathan Schroeder of Chisholm at three Beargrease wins, tying the record held by Jamie Nelson of Togo, who's also registered.

DETAILS: The 31st running of the race starts 1 p.m. Jan. 25 at Duluth East High School. The three-day, 400-mile marathon continues to Devils Track before it heads back south. The race is billed as the most challenging in the Lower 48. See www.beargrease.com.

Pelican monitoring

Volunteers led by Jeff DiMatteo banded 364 pelicans at Lac Qui Parle Wildlife Management Area this July, continuing the work of the late Al Grewe, a St. Cloud State University biology professor who started monitoring the colony in 1972.

The colony, which peaked at 19,400 breeding pairs in 2006, was documented in 1968. More than 55,000 pelicans have been banded at the site since 1972.

John Wollenberg, assistant manager at the WMA, found 67 leg bands when he conducted carcass counts on Eight-Acre Island later in the summer. Those came from pelican chicks that died. Wollenberg estimated this season's survival rate at one-half chick per nest.

This season attracted about 10,500 nesting pairs to the islands in Marsh Lake, down about 1,000 compared with last year. The decline wasn't considered alarming. Nor was the carcass count of 650 pelicans found on Eight-Acre Island. From the known count of 763 pelican carcass on Eight-Acre Island and part of Big Island, Wollenberg extrapolated the total count at 1,100 birds.

To compare, the first year West Nile virus swept through the WMA, it killed 1,200 birds on Eight-Acre Island and 1,500 on Big Island. West Nile remains a primary pelican killer.

Disease, predators and exposure are the usual factors. Last year's pelican, gull and cormorant carcass count totaled about 1,800.

GET INVOLVED: Don't. Nesting birds can be spooked into vacating a site. Getting up close doesn't help. Flooding, coyotes and skunks already have prompted pelicans to abandon a peninsula and some islands. This year, Wollenberg said a lot of the young moved from Eight-Acre Island to Big Island once they could swim.

"With this predator stuff going on, the declining number of pelicans doesn't need any extra disturbance from bird-watchers," Wollenberg said.

RESPONSIBLE VIEWING: The best and least disruptive places to see pelicans is from any of the dams in the Marsh Lake vicinity, including at Lac Qui Parle State Park.

"Basically anywhere there's a dam, you can see these birds," Wollenberg said. They can fly as far as 50 miles to feed on crawfish, salamanders and other critters.

Spring migration brings the first pelicans back in March — usually when the lake is still frozen. By April, their numbers increase from dozens to thousands. The earliest nests have appeared in early April, the latest chicks emerge in July.

Mountain bike trails

Bertram Chain of Lakes opened another mile of new single-track mountain bike trail this summer, augmenting a 700-foot stretch that was finished in the spring and bringing the 720-acre Wright County park near Monticello a step closer to redesigning all 12-14 miles of trails.

Led by Minnesota Off-Road Cyclists volunteers, the park is slowly transforming from a rutted maze that once hosted motorcycle scrambles to a sustainable trail network built to curb erosion. Existing trails remain open during the changeover, which will take a few years.

Hiring a contractor to cut in the 1-mile trail cost $6,400, according to Jay Thompson, MORC president and trail volunteer. Once the contractor finished in June, volunteers moved in with hand tools. Cutting the roots and finishing the trail took the balance of the summer.

"There's some nice views," Thompson said of the resulting stretch, which allows views of the lake as it follows the side hill.

While the county hasn't taken a visitor count, Thompson said he and other volunteers have noticed more bikers and parked cars. On an average weeknight, 20 riders will cruise by.

"We hope to continue on more of the same. We hope to build at least a new mile next year if not more," Thompson said. "Between the extra mile and the fact that this trail has been maintained for two summers now, the numbers are increasing."

Long-range plans call for ball fields, RV sites and canoe camping. The redesigned mountain bike route is expected to draw from a 50-mile radius.

"We are just constantly hoping to increase traffic," Thompson said.

GET INVOLVED: Join in weekly work sessions during the summer. Learn more at www.morcmtb.org.

(Photo: Jason Wachter, jwachter@stcloudtimes.com)

Minding bees' business

Crystal Boyd spent much of the summer devising a better bee trap.

The result: a three-legged contraption made of PVC pipe that can be pounded into the ground and adjusted depending upon the height of surrounding plants. A ring holds the blue, yellow or white pan traps. To pollinators, the chosen colors resemble flowers.

The aim: Find the most efficient way to collect pollinators. Those specimens will augment county records in creating a state species list. That baseline will serve as a starting point for scientists trying to figure out what, if any, shifts in the pollinators' population are taking place.

The last funding cycle brought Boyd to Quarry Park Scientific & Natural Area, where she collected 56 insects.

A Minnesota Department of Natural Resources bee researcher with the Minnesota Biological Survey, Boyd works on projects funded by the Environment and Natural Resources Trust Fund, administered by the Legislative-Citizen Commission of Minnesota Resources.

Between field work and museum visits, she's creating a state species list.

"There should be nearly 400 bee species in Minnesota," Boyd said.

Boyd has started sifting through University of Minnesota Insect Collection, which contains 27,000 specimens. She's been to North Dakota State University and the University of Minnesota-Duluth. Since July 1, shes spent 197 hours examining museum specimens and 122 hours processing field collections.

This winter, she'll visit South Dakota State University, Iowa State, the University of Wisconsin-Madison and Chicago's Field Museum of Natural History. She confirms or provides an ID, captures label data such as where and when it was collected, and then links it to a spreadsheet with a unique number.

"Sometimes I show up and it's just a box of bees," Boyd said. In that case, she starts by sorting to family, genus and species.

GET INVOLVED: One place to track what's happening with bee research is through The Xerces Society, www.xerces.org.

Archaeological dig

The St. Cloud State University archaeology students who worked the site of a Methodist-Episcopal mission occupied 1839-41 in Charles A. Lindbergh State Park took their summer findings — about 2,500 pieces — back to the lab for processing this fall.

After cleaning the items, usually with a soft toothbrush and a pail of water, students picked a class of artifacts to analyze.

The 40 glass seed beads likely used in embroidery. The 20 nails in different sizes and shapes. Quite a lot of European-made ceramics, most of it tableware. Native American pottery. Lots of fat rock quartz, more than 1,800 pieces, from the nearby river outcrops. Some higher-quality tool-making materials such as cherts, which came from other states. Glass, most of it window glass, only one piece from a bottle.

Small clues emerged from the collection.

Rob Mann, the assistant anthropology professor who led the field school, said the glass finds indicate two things.

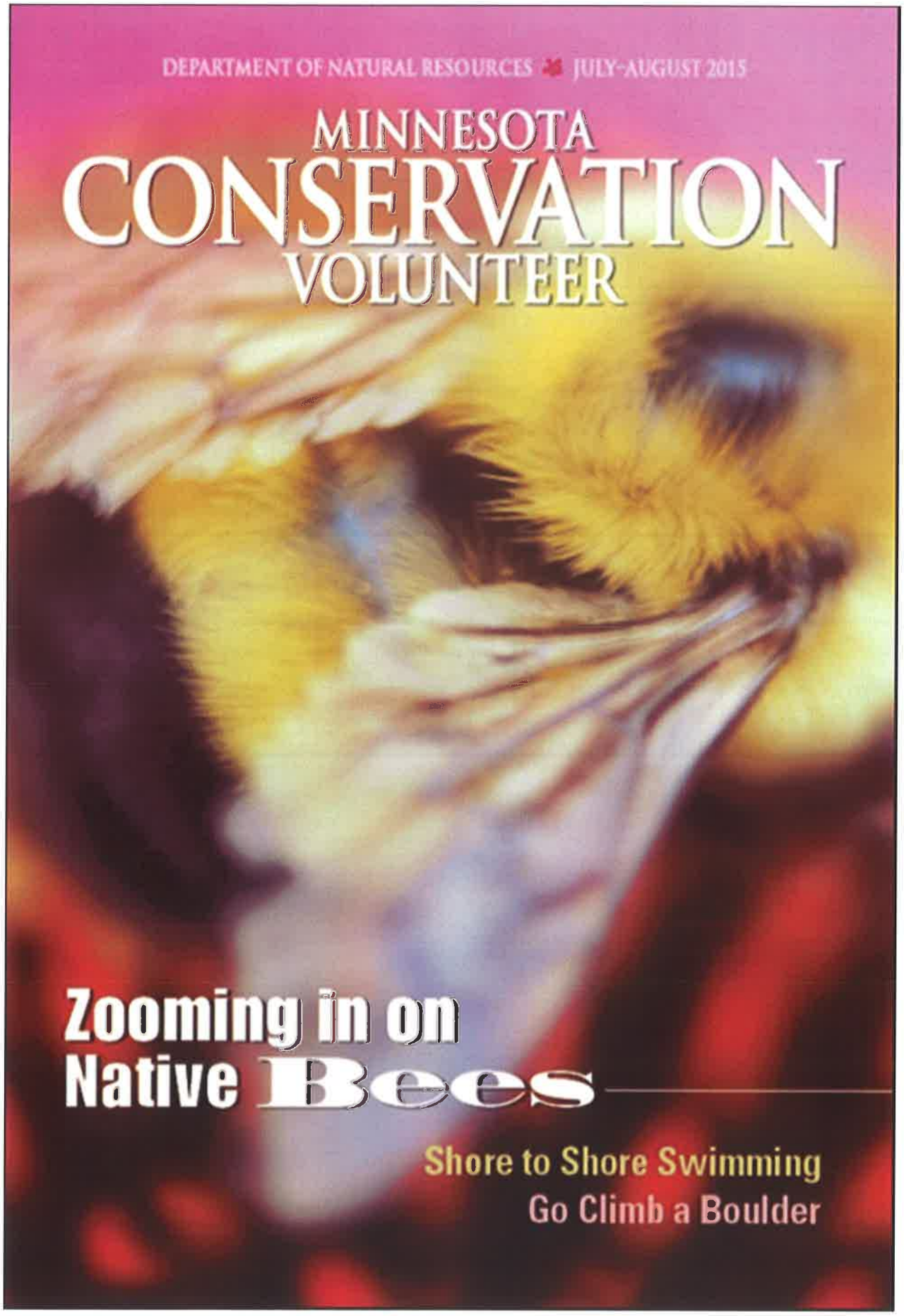
The missionaries likely discouraged drinking. And they probably hauled the window glass with them.

"It suggests that they had windows in the structure. Not all buildings on the frontier would have had glass windows. It speaks to their desire to bring the latest and best technology to the frontier with them," Mann said.

The bigger picture remains elusive, including the layout and how far the missionaries invited by Ojibwe Chief Hole-in-the-Day advanced their efforts to start a school, church and living space.

"I think that's what I enjoy, is you never know what the next hole in the ground is going to hold," Mann said.

FOLLOWING PROGRESS: Students who worked on the site will be among the presenters at the Council for Minnesota Archaeology conference Feb. 13-14 at St. Cloud State University.


DEPARTMENT OF NATURAL RESOURCES
JULY-AUGUST 2015
MINNESOTA
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Zooming in on
Native Bees
Shore to Shore Swimming
Go Climb a Boulder

A Bounty of Wild Bees

By Crystal Boyd

Researchers are learning more about these **energetic pollinators** and their role in prairie and grassland conservation.

THE PRAIRIE LEAPT in riotous colors as a gentle breeze rustled the wildflowers. Purple leadplant bowed and yellow coreopsis bent as I surveyed for bees. It was July 2014, and I was visiting Roscoe Prairie Scientific and Natural Area in Stearns County. This high-quality site potentially hosted great bee diversity, and the clear, sunny sky was warming bees to flight. Swish! I flicked my net at a bumblebee that zipped between the flowers.

As I transferred the bee into a jar, I wondered if Frederic Washburn had enjoyed similar landscapes. Washburn worked as an entomologist in the early 1900s, and he published Minnesota's

BILL JOHNSON

A metallic-green sweat bee in the genus Agapostemon *searches for nectar on purple-stemmed angelica.*

The author uses brightly colored cups filled with soapy water to trap bees at survey sites around the state.

first state species list of bees in 1919. Unfortunately, his records are incomplete, and he included only six of Minnesota's 87 counties.

In 2014—almost a century later—the DNR's Minnesota Biological Survey successfully applied for a research grant to update the state species list of bees and survey these pollinators on prairies and grasslands. Less than 2 percent of Minnesota's native prairie remains. Without bees, these prairie patches might be increasingly dominated by grasses or other wind-pollinated plants. Bees are often the most efficient pollinators, partly because their branched body hairs transport pollen among flowers. Many prairie forbs would struggle to reproduce without the bees that are vital go-betweens. To protect such plants and their pollinators, scientists must first learn which bee species live in Minnesota.

With funding from the Environment and Natural Resources Trust Fund, as recommended by the Legislative-Citizen Commission on Minnesota Resources and approved by the Legislature, this two-year project began July 1, 2014. DNR entomologists inventoried museum specimens in the Twin Cities, Duluth, Fargo, Madison, and Chicago. This work has already raised Washburn's report of 66 species to today's tally of 350 to 400 native species.

By comparing diversity and abundance at different prairie sites, the DNR is gathering information that could help land managers protect pollinators. We might discover that prairie restorations host bee species that are missing from native prairies, or vice versa. This information would help land managers evaluate the flowering plants and nesting habitat at their sites. The surveys will also help standardize monitoring techniques that could be used year after year to track changes in native bee populations.

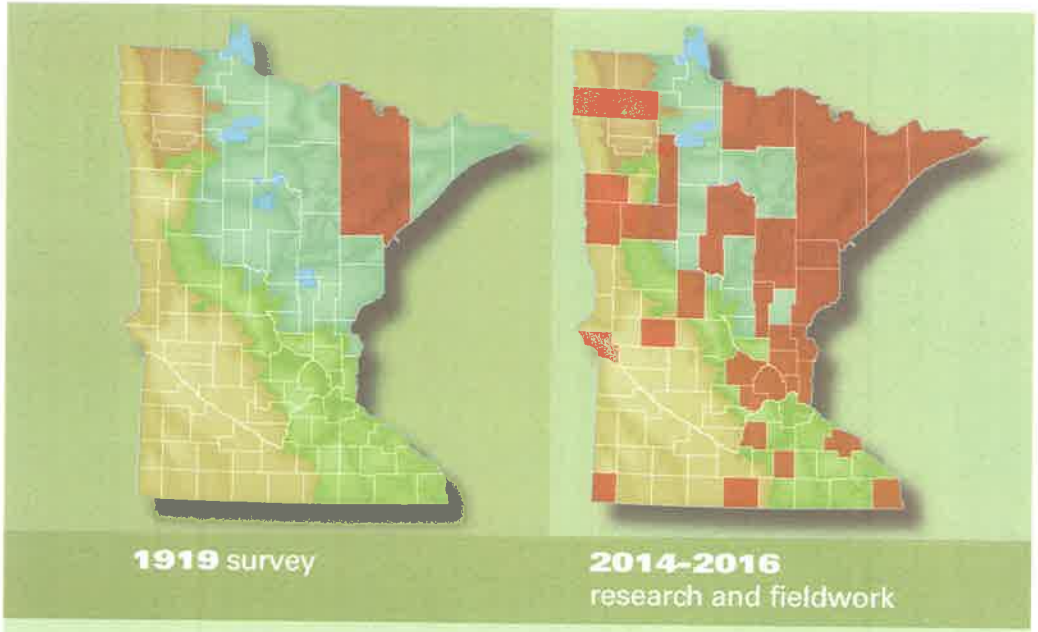
This summer, two entomologists and two botanists are surveying Minnesota's prairie region. One team, based out of Granite Falls, looks for bees on a southern route that includes Des Moines River

FIELD SURVEY PHOTOS BY DEBORAH ROSE, DNR

At Sedan Brook Prairie Scientific and Natural Area in Stearns County, the contents of a pan trap are strained. The bees are then bagged, labeled, and stored in a freezer for later identification. Though the traps kill bees, research has shown that this method does not affect bee populations.

SNA, Glacial Lakes State Park, and 14 other sites. The second team, stationed near Thief River Falls, follows identical protocols at 12 more sites. Their northern route winds through Caribou Wildlife Management Area, Helliksen Prairie Waterfowl Production Area, and other places.

The researchers set out bee bowls once a month at each site. The bowls are painted bright yellow, blue, and white to attract pollinators, and they're filled with soapy water that catches inquisitive bees. After the bowls have been out for 24 hours, the entomologists return to collect the specimens. Research shows that collecting bees this way does not negatively affect their populations. The bees are placed in an ice-filled cooler and later stored in a freezer in the lab. These specimens can remain frozen for weeks or months until they're pinned, labeled, and sent to the University of Minnesota Insect Collection. Each specimen is a valuable data point that provides clues about the lives of bees.



Collecting Records

When Minnesota's bee species were last listed by Frederic Washburn in 1919, the sweat bee *Halictus rubicundus* was recorded only in St. Louis County (left). Ongoing research and fieldwork to update the state's list of bee species (right) has discovered this species is far more widespread. A county record is the first time a species is reported from a county. DNR field researchers recently turned up what was thought to be the first record of the golden northern bumblebee (*Bombus fervidus*) in Stearns County. However, further investigation revealed preserved specimens of *Bombus fervidus* at the University of Minnesota Insect Collection. This is why, in addition to fieldwork, Minnesota Biological Survey researchers visit museums, read records, and search databases. The future state species list of bees will help people to compare past and present bee records with ease.

All Kinds of Bees

Despite often being overlooked, all native bees play a large role in our ecosystem. In addition to supporting native plant communities, native bees pollinate food crops including apples, blueberries, cranberries, and much more. By pollinating plants, they also create shelter and food for wildlife. Bee-pollinated plants produce seeds, nuts, and berries that fuel many bird species. Bees also pollinate plants that prevent soil erosion and store carbon. For their small size, bees have powerful impacts on our landscapes.

In addition to the European honeybee (*Apis mellifera*), Minnesota has many groups of diverse native bees. Different species emerge throughout the season, and Minnesota's bees typically fly from mid-April to mid-October. They can be found everywhere from gardens and orchards to state parks and wildlife management areas.

You might be amazed by a rainbow of diversity if you look closely while bees are sipping nectar. Watch patches of blooms for large, fuzzy

Bees at Risk

Minnesota has at least 20 bumblebee species, including six (below) that researchers think are declining.

BOMBUS BOHEMICUS AND BOMBUS PENSYLVANICUS SPECIMENS COURTESY OF UNIVERSITY OF MINNESOTA INSECT COLLECTION; PHOTOGRAPHY BY DEBORAH ROSE, DNR. ALL OTHERS COURTESY OF SAM DROEGE, USGS BEE INVENTORY AND MONITORING LAB.

Augochlora pura

Hylaeus modestus

Melissodes bimaculata

Agapostemon virescens

Megachile brevis

Osmia pumila

Close-up images of native bees offer a glimpse into the amazing diversity of the 350 to 400 bee species found in the state. About 70 percent of wild bees nest in the ground. Prairies with dry, sandy soil allow for easy excavation of tunnels and nest chambers. Many bee species forage on a variety of flowering plants. Bees find important nesting and foraging habitat at prairies such as, from top left, Twin Valley Prairie Scientific and Natural Area, The Nature Conservancy's Sheepberry Fen, and Lake Bronson State Park. Conserving prairie lands helps ensure the diversity of all bee species.

LANDSCAPE PHOTOGRAPHS TOP LEFT TO RIGHT: GARY ALAN NELSON, RICHARD HAMILTON SMITH, GARY ALAN NELSON. *HYLAEUS MODESTUS* AND *MELISSODES BIMACULATA* SPECIMENS COURTESY OF UNIVERSITY OF MINNESOTA INSECT COLLECTION. *HYLAEUS MODESTUS* AND *MELISSODES BIMACULATA* PHOTOS BY DEBORAH ROSE, DNR. ALL OTHER BEE SPECIMENS AND PHOTOS COURTESY OF SAM DROEGE, USGS BEE INVENTORY AND MONITORING LAB.

Yellow coneflower blooms at Myre-Big Island State Park, providing habitat for native bees amid the largely agricultural landscape of Freeborn County.

GARY ALAN NELSON

bumblebees and check colorful flowers for small carpenter bees (*Ceratina* spp.), which are about the size of a grain of rice. Keep your eyes open this summer for yellow-faced bees (*Hylaeus* spp.), metallic blue bees (*Osmia* spp.), brilliantly green bees (*Augochlora pura*), and black-and-white bees (*Melissodes bimaculata*). These are some of our flashiest species.

Minnesota has at least 20 species of bumblebees (*Bombus* spp.), including six species that researchers think are declining. These bumblebees and other pollinators face many complex challenges. Their food sources may disappear when invasive plants outcompete native flowers. Herbicides may remove milkweeds, dandelions, and other plants that provide pollen or nectar. Insecticides, including chemicals known as neonicotinoids, can directly threaten pollinator health. Parasites and pathogens stress bees, and habitat loss removes places where they forage or nest.

Social or Solitary?

Native bees have diverse nesting strategies. About 70 percent of bee species nest un-

Boost for Bees

You can support pollinators. Gardeners should provide at least three species of blooming plants during spring, summer, and fall to give pollinators reliable food sources. Make sure to ask at your local garden center if the plants were treated with neonicotinoids, which can harm pollinator health. Plant native species whenever possible because they often have more pollen and nectar than cultivars do.

You can also provide nesting spots for cavity-nesting bees. These solitary species usually hesitate to sting people. Unlike social honeybees, which have thousands of bees per hive, solitary species rely only on themselves to maintain their nest, so trying to sting you is risky behavior because they might be injured or killed. Of course, solitary bees will sting if provoked or trapped between your clothing and your skin. People who are allergic to bee stings should take the same precautions they use whenever they enjoy the outdoors.

Leave vegetation such as raspberry canes and hollow grasses standing through the winter in case cavity-nesting bees are developing inside. When spring arrives, you can put out a simple nesting block for cavity-nesting bees, and gentle local bees will move in.

If you want to put up a nesting block, it's easy to buy one at a garden center or build your own following instructions from the nonprofit Xerces Society at *ow.ly/MkvtD*. Make sure to clean or replace your nesting block every other year so it won't harbor diseases or parasites.

For more information, go to *www.mda.state.mn.us/protecting/bmps/pollinators.aspx*.

NEST BLOCK COURTESY OF MATTHEW SHEPHERD, THE XERCES SOCIETY

About 30 percent of native bees make their nests in cavities, such as hollow stems or old beetle tunnels found in logs or dead trees. A backyard nesting block can provide additional habitat for these solitary bee species.

derground. Some bumblebee queens, for example, fly close to the ground in spring, searching for an abandoned rodent burrow where they can build a nest. Other species dig a tunnel into the ground and excavate passages that end in small cells. The adult female collects pollen and shapes it into a ball for each cell. She usually lays one egg on the pollen ball and closes the cell. Most bees have an annual life cycle in which the egg matures to a prepupa and rests through the winter. The next spring or summer, it transforms into an adult and emerges. Then the cycle begins again.

All bees fall on a spectrum of sociality. Honeybees, for example, are a highly social species. They work together to build a hive and tend the young, with overlapping generations of workers. Bumblebees are also social and have a queen. Despite popular perception, however, only a small percentage of Minnesota's bee species are as social as honeybees and bumblebees.

Some species are not quite social and not quite solitary. These are known as communal species. One example is a shiny green sweat bee (*Agapostemon virescens*), which is common on prairies at Lac qui Parle WMA. It's one of the bees I encountered most frequently during pilot surveys in 2013. These bees live underground and share a common entrance tunnel. Once inside, each adult female builds and provisions her own nest. It's similar to single mothers sharing an elevator but maintaining their own apartment and carrying home their own groceries. Adult females take turns guarding the nest entrance, so bee researchers think they gain an extra level of protection against parasites.

Other species are solitary nesters. Leafcutter bees (*Megachile* spp.) employ a life strategy in which a single adult female starts a nest and provides pollen for her young. She dies before her offspring hatch.

While some solitary bee species live underground, others live in cavities. About 30 percent of bee species are cavity nesters. To start a nest, these bees find a pre-existing space such as a crack in a concrete wall or an abandoned beetle tunnel in dead wood. Some species line each cell with leaves, petals, or other materials. Some species line their nests with plant resins or leaf hairs. Other cavity nesters live in hollow plant stems. Yellow-faced bees and small carpenter bees may nest inside raspberry canes, sumac branches, or tall grasses.

Back on the Prairie

At Roscoe Prairie SNA, I held the bumblebee in its jar toward the light. A shiny, triangular patch on the hind leg told me this was a female. Her small size indicated that she was a worker, out collecting pollen for her siblings in the nest. I looked more closely to see her color pattern—I counted one, two, three, four yellow stripes on her abdomen and one black bar between her wings. These marks meant she was a golden northern bumblebee, *Bombus fervidus*. I quickly checked Washburn's state species list from 1919 and smiled. This was a new county record.

Colletes aberrans, a species of plasterer bee, gathers pollen from purple prairie clover. This bee feeds primarily on plants in the Dalea genus.

BILL JOHNSON

"News from the Field" blog about rare aquatic invertebrate.

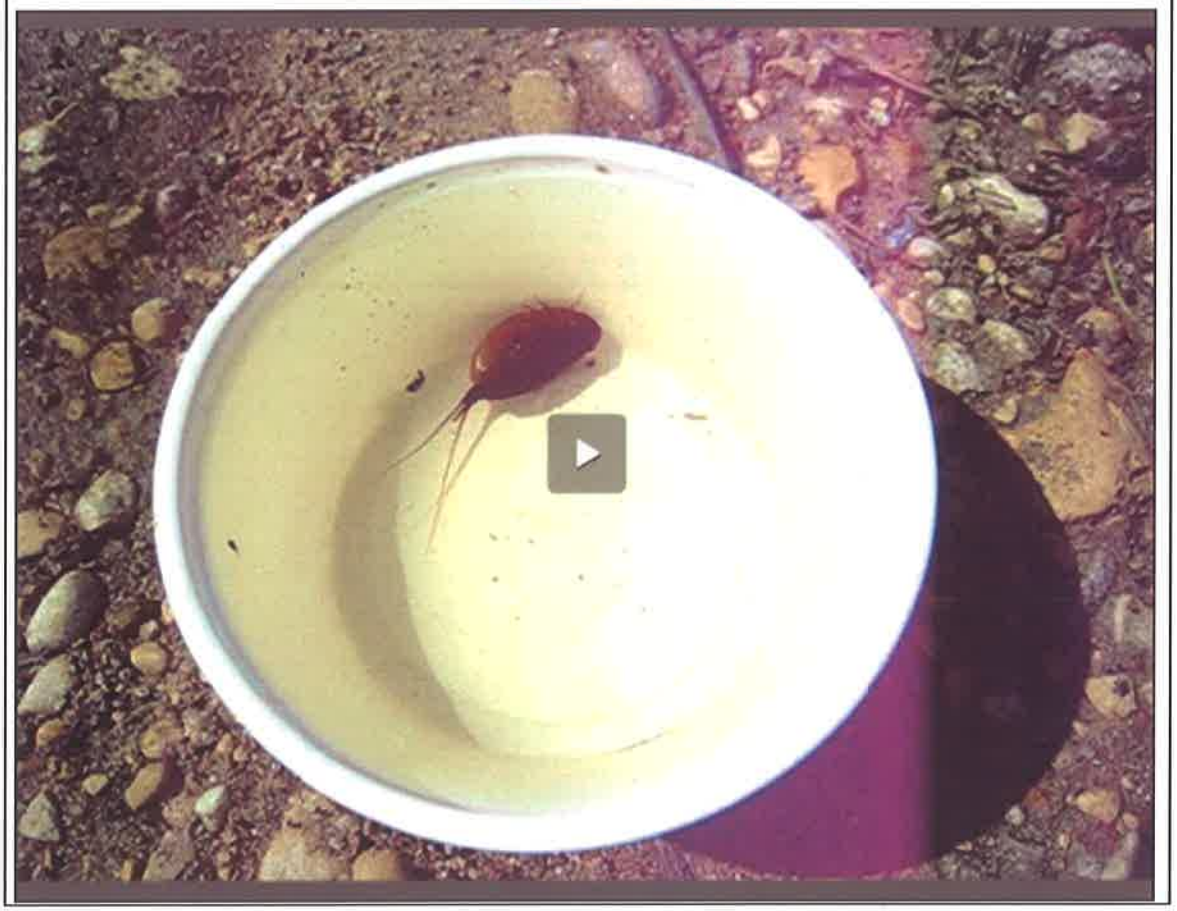
Crystal Boyd,
Entomologist

June 17-18. Roseau County. *"I was searching for native bees at **Roseau River WMA** when I noticed dark, oval blobs scanning the concrete pad at the boat launch. I thought they were tadpoles-until a closer look revealed something much rarer!*

*These were tadpole shrimp (*Lepidurus *sp.), or aquatic invertebrates that look like small horseshoe crabs. The specimens are county records for Roseau County and possibly the first specimens reported in Minnesota since 1972! I'm working with Dr. Christopher Rogers from the **Kansas Biological Survey** to identify the species."*

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

click on images to enlarge



"News from the Field" blog about Lac Qui Parle Wildlife Management Area.

Andy Kranz, Botanist

June 2015. *"The Minnesota Biological Survey has undertaken a new project to survey **native bees in prairie-grassland habitats**. Earlier this month, we visited an exceptional dry prairie remnant within **Lac Qui Parle Wildlife Management Area** (WMA) in the Upper Minnesota River Valley. The vegetation here grows thinly on sandy slopes. Above these slopes the remnant gives way to level ground where the introduction of cool-season grasses has greatly diminished the former plant diversity. Below, riparian vegetation borders a small stream.*

Our purpose here was to brush up on specimen collection techniques. Each of us practiced netting a bee and transferring it to a vial before releasing it. Our project includes the study of plants as well as bees, and we each prepared a plant specimen for the plant press. Since this visit we have been using these techniques to document new county records of wild bee and plant species.

*The first thing that stands out botanically in the prairie is the profusion of white and large-flowered beardtongues in bloom (*Penstemon albidus *and* P. grandiflorus*). Massive queen bumblebees are equally obvious, and we spotted a few of the season's first worker bees as well (*Bombus griseocollis*).*

click on images to enlarge

*The grasses at Lac Qui Parle WMA are diverse, with abundant side oats grama (*Bouteloua curtipendula*), little bluestem (*Schizachyrium scoparium*), and porcupine grass (*Hesperostipa comata*), as well as junegrass (*Koeleria macrantha*), hairy grama (*Bouteloua hirsuta*) and plains oval sedge (*Carex brevior*).*

*Forbs at this site include northern bedstraw (*Galium boreale*), Lambert's locoweed (*Oxytropis lambertii*), sage wormwood (*Artemisia frigida*), field sagewort (*Artemisia campestris *ssp.* caudata*), bracted spiderwort (*Tradescantia bracteata*), green milkweed (*Asclepias viridiflora*), narrow-leaved puccoon (*Lithospermum incisum*), and a variety of goldenrod species (*Solidago *spp.*). We could have spent more time studying a variety of diminutive plants that are easy to overlook, such as rough false pennyroyal (*Hedeoma hispida*)."*

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

"News from the Field" blog about Morton Outcrops SNA.

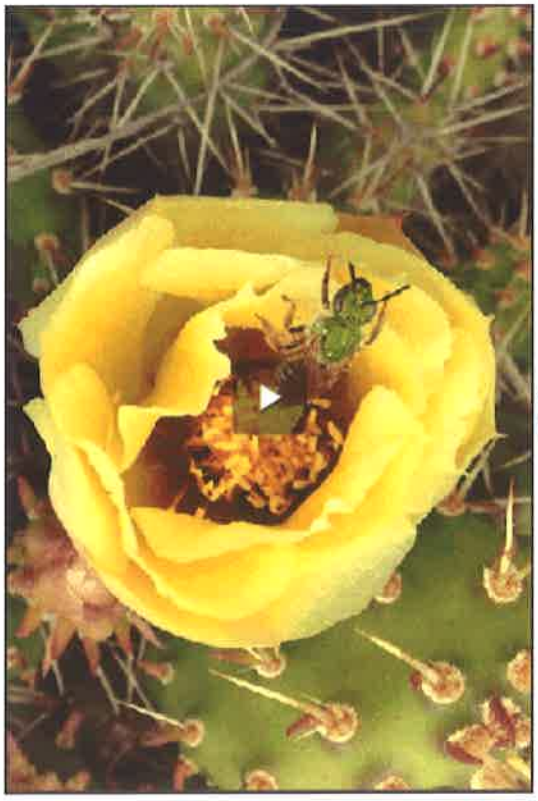
Karin Jokela, Entomologist

June 23, 2015: "*I spent the day visiting natural areas in Renville County as part of the Minnesota Biological Survey's* ***Wild Bee Surveys****. The most interesting site of the day was* ***Morton Outcrops SNA****, a relatively small bedrock knob located along the Minnesota River that hosts a vast diversity of forbs and insects. Some of the most popular flowers for pollinators that day included butterflyweed (*Asclepias tuberosa*), meadowsweet (*Spirea alba*), and my favorite: brittle prickly pear (*Opuntia fragilis*). After collecting several different bees from this stunning and seemingly exotic cactus flower, I decided to video the foraging behavior of a common sweat bee:* Agapostemon virescens.

click on images to enlarge

On this visit, it appears that the bee was diving deep into the flower to reach its nectar. Despite her brief efforts to clean the pollen grains from her face, many grains still clung to her fuzzy body, and she likely transported some of them to another prickly pear flower.

If the pollen grains (male gametes) landed on the flower stigma (female reproductive structure), then fertilization probably occurred. And that is the win-win story of pollination: the bee gathered nourishing nectar, and the cactus was cross-fertilized!



Agapostemon virescens on brittle prickly pear cactus (*Opuntia fragilis*).

Other fun encounters during my visit included hairstreak butterflies, a deer fawn, and a nighthawk nestling."

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR).

Wild bees losing out to corn in Minnesota and Upper Midwest, says U of Vermont study

Wild pollinators declined across 23 percent of the country, study found.
By Josephine Marcotty Star Tribune
December 22, 2015 — 5:59am

Johanna James-Heinz, AP The photo provided by amateur Illinois bee spotter Johanna James-Heinz, shows a rusty-patched bumblebee, on Aug. 14, 2008, in Peoria, Ill. It is one of four types of bumblebees researchers say is in trouble. (AP Photo/Johanna James-Heinz)

It's not just honeybees that are in trouble. Wild bees are disappearing from much of the nation's farmland — especially in Minnesota and much of the Upper Midwest.

Overall, wild bees declined across nearly one-fourth of the country between 2008 and 2013. But some areas are now so inhospitable to wild bees that the nation's crops, including soybeans in western Minnesota, are probably not getting the pollination they need for peak production, researchers at the University of Vermont found in the first nationwide study to map the abundance of wild bees.

"Those farmers are going to be looking at inconsistent yields," said Taylor Ricketts, a professor at the University of Vermont, and one of the lead researchers on the study.

Wild bees provide $3 billion worth of pollination services to the nation's food system. Some crops, like almonds, blueberries and other fruits, are totally reliant on either domesticated honeybees that are trucked at a high cost, or wild insects that live around the fields. The researchers found that 39 percent of the croplands that need insects face a threatening mismatch between rising demand for pollination and a dwindling supply of wild bees.

In all, there are 139 counties with an imbalance, including Roseau and Otter Tail counties in Minnesota.

Hot spots are areas of the country growing the crops that need insects the most — central California, northwest Washington, Michigan and a vast stretch from western Minnesota through Iowa and the Dakotas. Minnesota alone accounted for nearly 13 percent of the overall decline, said Insu Koh, another author and researcher at the University of Vermont.

Where wild bees are in most trouble

Source: University of Vermont. Map by C.J. Sinner

In Minnesota, apple trees and soybeans, which need both wind and insects for peak production, are the primary crops that need pollinators.

Ricketts said that the decline is driven by the conversion of natural land into intensely managed row crops. In 11 key states where the study showed bees in precipitous decline, the amount of land tilled for corn spiked 200 percent in five years, the researchers found.

In California, global demand for nuts has created vast monocultures of orchards. In Minnesota and the rest of the Corn Belt, the federal biofuels mandate that drives ethanol production has eaten up millions of acres of prairies and pastures, he said.

"It reinforces what others have found," he said. "Corn is on the rise, and bees are declining."

The researchers used federal data to track changes between 2008 and 2013 on 45 different types of landscapes — including prairies, wetlands, forests and cropland. They then used detailed estimates from more than a dozen scientists to score how hospitable each type of land is for bees. Prairies, for example, provide ample nesting grounds and plenty of flowers for food. Cornfields, in contrast, provide no food or nesting sites, and insects are vulnerable to pesticides.

In all, they estimated that wild bees have declined on 23 percent of landscape, and 60 percent of that drop occurred in just 11 states, including Minnesota and the Dakotas.

Minnesota surveys bees

The Minnesota Department of Natural Resources is conducting a survey of the 400 wild bees that are native to the state, but the results are not in yet, said Crystal Boyd, a DNR entomologist. Still, the University of Vermont study fits with what's she's seeing on the landscape, she said. For example, surveyors have found only one yellow banded bumblebee, which is a species that should be pretty common, she said.

"It emphasizes the need for long-term monitoring to get a handle on population trends," she said.

Ricketts said that the research was designed to help figure out where conservation funds should be focused to protect and revive struggling insect populations.

"It's not really a mystery how to help pollinators." he said. "They need flowers, nesting sites, undisturbed soils and trees. And they need not to be poisoned by chemicals."

Earlier this year the White House released a pollinator protection plan that calls for bringing back 7 million acres of land as pollinator habitat.

Minnesota has enacted numerous conservation projects with pollinators in mind, including on the 450 square miles of land managed by the Board of Soil and Water Resources, millions spent on research and land protection from lottery and legacy funds, and the state's long-term plan to restore native prairie along the western edge of the state.

AM1240 WJON NEWS • TALK • SPORTS

Bee, Pollinator Populations Struggling Across Minnesota

By Dan DeBaun March 28, 2016 3:49 PM

Joe Raedle, Getty Images

ST. CLOUD – A United Nations report released earlier this month says many species of bees, butterflies and other pollinators are shrinking towards extinction.

Pollinator populations are also struggling across the state, including the forested areas of Central Minnesota.

Crystal Boyd is studying bees in Minnesota for the Department of Natural Resources, she says St. Cloud is part of a forested biome in the state and has a variety of pollinators.

"You've got a great selection of bees, butterflies, moths and even flies and beetles can be pollinators. So you've got a big diversity up there."

Tim Fenlason in Sartell is a beekeeper with the Tri County Beekeepers Group. (Alex Svejkovsky, WJON)

St. Cloud and Central Minnesota have different types of bees compared to the prairie biomes in the more southern and southwestern parts of the state. Boyd says bees that live in forested areas can be quite different compared to other species in Minnesota.

"Our bees are very different between the regions. What's interesting about the forest is that they're often working along the edges. They're on those open really nice patches of flowers along the edges of forests."

Pollinators are vital for the environment in that they provide food, habitat and pollination for countless species and plants. **The DNR says** almost 90 percent of the world's flowering plant species rely on animal pollinators. According to the University of Minnesota Bee Lab, pollinators have a $20 billion economic impact on North America alone.

However, their populations are struggling. According to the U.N. report, 20,000 or so species of pollinators are crucial towards billions of dollars worth of crops every year. Yet two out of five species of invertebrate pollinators like bees and butterflies, are on a path to extinction.

Boyd confirms that pollinators are struggling in Minnesota and across the country. She says their main challenges are habitat loss, diseases like parasites or pathogens and pesticide use.

"If you release a chemical that's designed to kill an insect, it doesn't know the difference between a good bug or a bad bug, it just kills bugs."

The last attempt to catalog the entire state species list for bees was in 1919. Boyd is finishing a complete list of Minnesota bee species after years of research. A few years back she visited Central Minnesota and collected species at Quarry Park.

"It has these nice rock outcrops and open spaces surrounded by forests. I wanted to check it out because it's a rare area that could have interesting insects. I did a preliminary study and found lots of sweat bees and honey bees there."

If homeowners are looking to help native populations, Boyd says you can benefit pollinators by planting local native wildflowers in your

yard or garden and keep them free of pesticides. For more on how to create a pollinator-friendly garden, **visit the DNR Pollinator website by clicking here.**

-This story was written with information from the Associated Press-

You can see more on Boyd's work by watching a video from the DNR below:

Subscribe to AM 1240 WJON on

Honey bees disappearing at 'alarming' rates

The decreasing population of bees could spell trouble for food and plants.
By: Iris Perez

Posted: May 18 2016 10:14PM CDT

Updated: May 18 2016 10:21PM CDT

ST. PAUL, Minn. (KMSP) - Many see them as pests, but honey bees play a vital role in our ecosystem. Unfortunately, they're disappearing at an alarming rate across the country, which could have grave consequences if the trend continues.

Jeff Danky, beekeeper and owner of Minnesota honey producer Minnetonka Gold, says the amount of bees in our environment is an issue that touches everyone.

"It affects what's on your plate for dinner," said Danky.

Honey bees disappearing at 'alarming' rates

According to researchers at the University of Minnesota, since 2007 an average of 20 percent of all bee colonies in the U.S. have died. Danky has witnessed the decline first hand.

"Every winter… wintering in Minnesota has been very difficult," said Danky.

So what's behind the buzz kill? Disease, low plant diversity, pesticide misuse, flowerless landscapes and parasites.

"Smaller beekeepers in particular are having a harder time trying to treat mites and mites are the biggest frustration for most of us," Danky told FOX9.

Researchers report bees pollinate 70 percent of our fruits and vegetables.

University of Minnesota Assistant Professor Dan Cariveau, who works in at the university's Department of Entomology, studies wild bees closely.

"This group of insects is really important pollinators," said Cariveau.

Some bee species have gone extinct over the past ten years. Part of the problem for farmers and beekeepers alike lies in what researchers still don't know yet.

"We don't even know how many species are here in Minnesota. We think there are about 400 or so, but we're just now starting to get that inventory."

When producers buy bees from other parts of the country, they risk contributing to the decline. Bees unfamiliar with the climate naturally find it hard to survive Minnesota's harsh winters.

Crystal Boyd, a bee researcher with the Minnesota Department of Natural Resources, is currently conducting a survey of the state's population and is conducting work to identify native species.

"It's hard to track them without that data," Boyd told FOX 9 over the phone.

Fortunately, Boyd offers a solution to saving our bees everyone play a part in and it starts in our yards.
"Plant some local native wild flowers and keep those flowers clean," said Boyd, who adds there are hundreds of options.

Boyd says it's important to use a variety of flowers. Flowers of different shapes, sizes and colors all offer something different for the bees and flowers.

Bees help generate $29 billion in farm income.

Another way to help keep bees alive is to tolerate small amounts of weeds in your yard and reduce how much pesticide you use overall.

When Dead Bugs Do the Legwork

by Andrew Urevig | May 2nd, 2016

How the U's Insect Collection works—and works for science

Dr. Robin Thomson has nearly four million coworkers. Most of them are dead bugs.

These animals—dried and kept after death—occupy slides, vials, and drawers stacked in steel cabinets that fill the University of Minnesota Insect Collection, of which Thomson is the curator. "I get to play with bugs every day," she said.

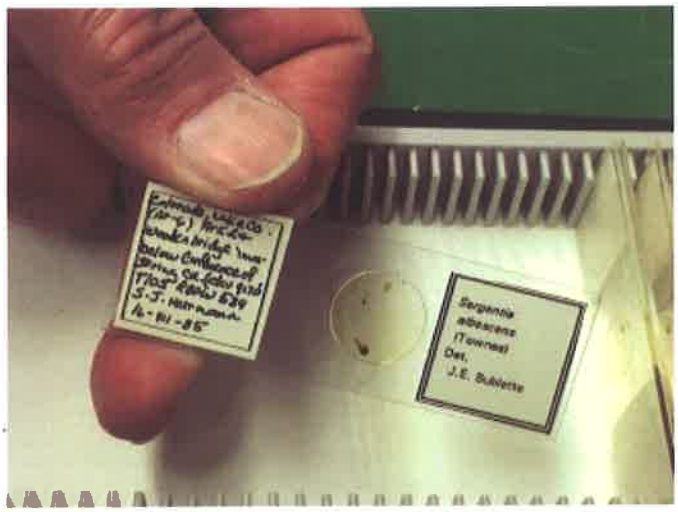
Photographer: Andrew Urevig

She manages more than 3.8 million specimens representing over 50,000 species. The collection contains countless kinds: ants, bees, wasps, moths, flies, butterflies, dragonflies, walking sticks, beetles, mosquitoes, and more. It even holds some non-insect arthropods including spiders, centipedes, and hermit crabs. Founded in 1879, the collection includes specimens from every continent except Antarctica, with Minnesota and the Midwest best represented.

Thomson's office houses books, binders, and insect vials. Across from her computer, a large microscope sits under a calendar illustrated with a dragonfly. As we talk, one worker peeks in to let her know they've received a phone call about a possible donation. The collection acquires some new specimens via donation, as gifts from the public—many hobbyists collect insects—while other specimens come from academic researchers.

The collection includes specimens from every continent except Antarctica.

Storing these donations is an art. Pins, like small spears, pierce the right side of many a specimen, mounting them in wooden boxes. Other dead insects are kept in glass slides or preserved in vials of alcohol. Every bug in the collection carries a paper tag listing when and where it was caught, along with other data. It's a library with bodies instead of books, sorted by biological classification.



Photographer: Andrew Urevig

"It's amazing how dynamic a room full of dead bugs can be," said entomology professor Dr. Ralph Holzenthal, the collection's administrative director.

"It's almost more than [Thomson] can handle," Holzenthal said. "Not because she's incompetent, but because there's so much that needs to be done."

Besides monitoring temperature, humidity, and light levels, Thomson looks out for live pests, including dermestid beetles, whose eggs and larvae hide in the carcasses of incoming insects. If they could ever sneak past, they would grow to devour specimen after specimen, turning the collection into their personal bug buffet. To kill dermestid stowaways, Thomson freezes new specimens before placing them in the collection.

Photographer: Andrew Urevig

Many count on this maintenance. "In my job, I get to grease the wheels of science for other people," Thomson said. Scientists can visit the collection, and researchers who need steadier access to specimens can borrow some. In 2015, the collection gave out 36 loans. Scholars have examined specimen data to study topics including agricultural pest control and the evolutionary history of insects.

The world outside academia uses the collection, too. The Minnesota Department of Natural Resources, for instance, is working to update the state list of bee species. DNR entomologist Crystal Boyd searches collections, including the University's, for specimens that tell her which counties need further field research. When Boyd is done with a specimen she's caught, she files it with the University collection.

Illustrator: Helen Teague

At the Minnesota Zoo, scientists are working to save two endangered prairie butterflies, the Dakota skipper and the poweshiek skipperling. Public outreach, habitat management, and captive breeding of Dakota skippers are among the strategies in play. In early 2015, the zoo started using the University's collection.

"These specimens represent some of the only hard evidence for where and when these poorly studied butterflies occurred," said Cale Nordmeyer, a butterfly conservation specialist at the zoo. Tag data hints at places to survey for these Minnesota natives, and could guide future reintroduction efforts. Researchers also compare skippers stored in the collection to skippers reared at the zoo to avoid breeding traits that could hurt the butterflies once they're released into the wild. Reintroduction might begin as soon as summer 2017.

Beyond research, the collection serves education for formal groups like scouting troops, 4-H clubs, and college courses, which can schedule tours. Thomson's public outreach also entails speaking to different groups. She supplements tours and talks alike with the collection's small assemblage of live creatures, which includes beetles, hissing cockroaches, a tarantula, and a whip spider.

Holzenthal sees a useful future for the collection. With the advance of DNA extraction technology, scientists will have reason to discover this resource again, using new tools on old organisms to infer evolutionary relationships. As climate change shifts the geographic range of species, conservationists can use these specimens as a historical record of insect distributions. And amid myriad specimens, new species no doubt lurk, their existence waiting to be unearthed. As science progresses, Dr. Thomson's collection colleagues—several million strong—will keep showing up to work, day after day. They can't exactly walk away from the job.

Right: Project showcased on MNDNR YouTube channel, August 2014

Below, Left: Presentation for League of Women Voters in Park Rapids featured on YouTube, March 2016

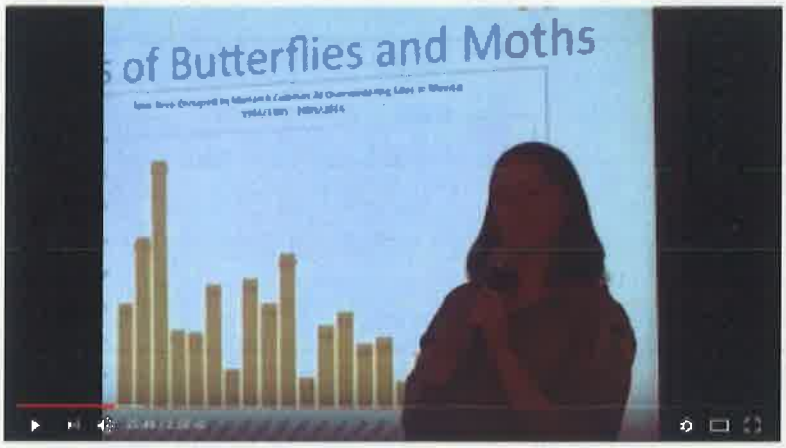
Below, Right: Interview for Burnsville Native Plant Sale featured on YouTube, March 2016

Wild Bee Surveys in Prairie-Grassland Habitats

MinnesotaDNR

1,516 views

Published on Aug 4, 2014
Take a field trip with Minnesota DNR Bee Researcher Crystal Boyd, as she collects native bees at Roscoe Prairie Scientific and Natural Area, a site owned and managed by The Nature Conservancy.



LWV Park Rapids Area: BEES, What's All the Buzz About?

23 views

Beautify Yards and Help the Environment by Planting Native Plants!

City of Burnsville

84 view

Published on Apr 29, 2016
Burnsville's Native Plant Market will be held on Saturday, May 21, 2016 from 9 a.m. - 1 p.m.

The City hosts this event each spring to encourage people to grow native plants in their yards. These plants help beautify neighborhoods,

Supplement B. Outreach Presentations

1. 2014
    a. Minneapolis Parks & Recreation
    b. Metropolitan Mosquito Control District
    c. Minnesota Nursery and Landscape Association
    d. Minneapolis Central Library
    e. Department of Natural Resources, State Fair
    f. The Dirt, State Fair
    g. Golden Valley Historical Society
    h. Project Earth
    i. Department of Natural Resources, Community of Practice
    j. Minneapolis Audubon Society
    k. Department of Natural Resources, Silviculture Progrtam
2. 2015
    a. Department of Natural Resources, Division of Wildlife
    b. Minnesota Landscape Arboretum
    c. Minnesota Master Gardeners
    d. Minneapolis Parks & Recreation
    e. Pollinator Town Hall Forum
    f. City of Eagan
3. 2016
    a. Science Rocks
    b. Department of Natural Resources, Roundtable
    c. North Central Beekeepers
    d. Department of Agriculture, Pollinator Summit
    e. Town Hall Forum
    f. Audubon Society, Alexandria
    g. League of Women Voters, White Bear Lake
    h. St. Croix River Association
    i. Mt. Zion Brotherhood
    j. League of Women Voters, Park Rapids
    k. Department of Natural Resources, Division of Parks & Trails
    l. Photo of presentation display

MNDNR
September, 2016

Partial funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative–Citizen Commission on Minnesota Resources (LCCMR).

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

A CELEBRATION OF BEES

POLLINATOR *Party*

THURSDAY, JULY 24, 2014 | 5-8 PM

LYNDALE PARK GARDENS

EAST SIDE OF LAKE HARRIET
JUST EAST OF THE PEACE GARDEN

BEES | HONEY | MUSIC | ART
PLANTS | GAMES | ICE CREAM

Learn How To Be An Urban Bee Keeper
Sample Minnesota Honey
Ice-Cream Made With Honey
Make Your Own Backyard Bee-Hospitable
Hands-On Games For The Entire Family
Discover The Wild Bees Of The Park
Minneapolis Institute Of Arts Art In The Park
Meet The 2014 American Honey Princess
Movie at Dusk: Disney's Wings of Life

Food & Beverages available from
la Loma Tamales

Minneapolis
Park & Recreation Board

Event Partners

Mpls Park and Recreation Board
University of Minnesota Bee Lab & Bee Squad
Bell Museum
The Beez Kneez

learn more at
www.minneapolisparks.org/bees

DRAFT AGENDA

METROPOLITAN MOSQUITO CONTROL DISTRICT
MDA RECERTIFICATION TRAINING
Thursday, July 24, 2014

TIME	TOPIC	PRESENTER
8:00 – 8:30	Licensing and Recertification/ MDA Record Keeping	Clarissa Hammond, MDA
8:30 – 9:15	Mapping areas of concern: What to look for, What to avoid	Mike McLean, MMCD Nancy Read, MMCD
9:15 – 10:00	Pollinators and Pesticides	Crystal Boyd, MN DNR
10:00 – 10:15	Break	
10:15 – 11:00	"Protecting Your Eyes"	Dean Herzfeld, U of M
11:00 – 11:45	Mosquito-borne disease West Nile virus/chikungunya update Prevention Through Targeted Treatment	Kirk Johnson, MMCD
11:45 – 12:15	Break	
12:15 – 12:45	Permethrin: What's with all these label changes?	Mark Smith, MMCD
1:00 – 1:30	Mosquito Control: Outdoor Workplace Hazards	MMCD Safety Team (TBD)
1:30 – 2:00	Pollinator Protection: Regulatory Changes On The Horizon	Mike McLean, MMCD

Pollinators & Pesticides: A 360 Degree Perspective

August 5, 2014
Wilder Center
451 Lexington Parkway N |St. Paul, MN 55104

Program Moderators: Debbie Lonnee, Bailey Nurseries; Jim Calkins, MnSTAC President

Morning Schedule

9:00am – 9:15am: **A Historical Perspective/Overview**
Join Jim Calkins and Tim Power as they present the lay of the land and how we've gotten to where we are today with the pollinator/pesticide issue

Speakers:
- Jim Calkins, President of MnSTAC
- Tim Power, MNLA Government Affairs Director

9:15am – 10:15am: **An Ecological Perspective**
Our panel of ecological experts will help us explore and understand the role pollinators play in ecosystems and native plant communities.

Panelists:
- *Heather Holm, Restoring the Landscape*
- *Elaine Evans, University of Minnesota*
- *Crystal Boyd, Minnesota DNR*
- *Karl Foord, University of Minnesota Extension*

10:15am – 10:30am: **Break**

10:30am – 11:15am: **An Entomological Perspective**
Research on pollinators, and especially honey bee colony collapse disorder and declines in bumble bee populations, and the potential role of insects, diseases, pesticides, apicultural practices, and environmental factors on pollinator populations has exploded in the past few years. We will hear about the latest in research findings related to these issues from our panel of university entomologists who are currently conducting research on pollinator/pesticide interactions and other factors related to pollinator populations.

Panelists:
- *Jeff Hahn, University of Minnesota Nursery and Landscaping Association*
- *Marla Spivak, University of Minnesota*
- *Vera Krischik, University of Minnesota*

11:15am – 11:45am: **An Apicultural (Beekeeper) Perspective**
An opportunity to hear the perspective of a beekeeper relative to the pollinator/pesticide issue. Join Erin Rupp from Beez Kneez who will describe the key issues from her vantage point.

Speaker:
- *Erin Rupp, Beez Kneez*

11:45am – 12:30pm: **Lunch**

ALL ABOUT BEES

OR

NATIVE BEES, WHAT'S THE BUZZ?

Photo by Laura Gooch Digger Bee (Anthophora terminalis)

350 SPECIES OF MINNESOTA NATIVE BEES WANT YOUR ATTENTION!

TO LEARN ABOUT OUR HOME GROWN POLLINATORS JOIN DNR ENTOMOLOGIST

CRYSTAL BOYD

AT

MINNEAPOLIS CENTRAL LIBRARY, IN THE DOTY BOARD ROOM N-280
on AUGUST 21ST

6:30 REFRESHMENTS, 7:00 PRESENTATION & QUESTIONS

MINNESOTA DEPARTMENT OF NATURAL RESOURCES
2014 DNR OUTDOOR STAGE

Celebrate Outdoor Traditions (theme) (Schedu

Date	Stage Focus	10:00 AM	11:00	12:00	1:00 PM	2:00	3:00	4:00	5:00	6:
Thursday August 21	STATE PARKS	Darlene And The Boys *(Country music)*	Animals Nobody Loves – *Wildlife Science Center*	Darlene And The Boys	Wildlife in Your Backyard *(live frogs, turtles, snakes, etc!)*	Darlene And The Boys	Wildlife in Your Backyard	Darlene And The Boys	Tear down time	Set up Ecuad Manta
August 21 & 26	Naturalist Tent next to the stage – Learn about rocks, birds, snakes, and other wildlife seen in MN State Parks and Trails. Kids can make and take home an animal track and get a nature									
Friday August 22	FIRE PREVENTION	The Roe Family Singers *(old-time and folk music)*	Celebrate Smokey Bear's 70th Birthday	The Roe Family Singers	Celebrate Smokey Bear's 70th Birthday	The Roe Family Singers	Celebrate Smokey Bear's 70th Birthday	The Roe Family Singers	Tear down time for The Roe Family Singers	Set up Ecuad Manta
August 22: Celebrate Smokey Bear's 70th birthday with fire prevention activities, games, prizes, and appearances of Smokey from 10 AM – 4 PM. Make an ornament to go on the U.S. Capitol Christmas Tree traveling from										
Saturday August 23	LANDS & MINERALS	Red Rock Swing Band	Red Rock Swing Band	Ring of Fire : The Life and Music of Johnny Cash Plymouth Playhouse *(Jukebox Musical)*	Volcanoes in Minnesota	Red Rock Swing Band	Lake Superior Agates *(w/TV Host, Scott Wolter, of America Unearthed)*	Red Rock Swing Band	Break	Bre
Sunday August 24	U OF M COLLEGE of FOOD, AG, & NATURAL RES SCIENCES	Bill & Kate Isles *(folk music)*	Woody Invasive Species: ID and Control	Bill & Kate Isles	Invasive Insects in MN: Are they in your yard and garden?	Bill & Kate Isles	MN Wildlife Quiz Show	Bill & Kate Isles	Honeybees, Beekeeping and Research	Bre
Monday August 25	FISHERIES	Overland Band *(Country and Rock n' Roll)*	Junior Bass Fishing Clubs	Overland Band	Bass Tackle	Overland Band	Bass Fishing Tournaments	Overland Band	Break	Bre
Tuesday August 26	STATE TRAILS	Set up for Peter Neuman and the Real Deal *(Rockin' Blues)*	Biking with Kids *(Nick Mason of BikeMN)*	Peter Neuman and the Real Deal	Off-Highway Vehicle (OHV) Youth Safety	Peter Neuman and the Real Deal	Mountain Biking and "Fat Tire" Biking in MN	Peter Neuman and the Real Deal	Break	Pe Neu and Real
August 26 : 80th Anniversary of DNR State Fair Building - Celebrate Outdoor Traditions by joining us for tours of the prairie garden plantings at 11 AM and 1 PM. Receive a free packet of wildflower seeds whi										
Wednesday August 27	K-9 ENFORCEMENT	Bitter Ridge *(Bluegrass Music)*	MNDNR K-9 Law Enforcement Unit Demonstration	Bitter Ridge	MNDNR K-9 Enforcement Unit Demonstration	Bitter Ridge	What's the Buzz about Native Bees?	Bitter Ridge	Tear down time for Bitter Ridge	Set u Ecu Ma
Thursday August 28	FISHERIES	BLT Band *(Bill Lommel and Troop)*	Family Fishing Feud (game show)	BLT Band	Family Fishing Feud (game show)	BLT Band	Break	Break	BLT Band	Tear time f
Friday August 29	CALL OF THE MOOSE MINNESOTA	Joe Meyer Band *(easy-going blues, pop & folk)*	DNR Commissioner's 4-H and FFA Youth Awards	Joe Meyer Band	Call of the Moose Minnesota	Joe Meyer Band	Call of the Moose Minnesota	Joe Meyer Band	Break	Joe M Band
Saturday August 30	LEAVE NO TRACE IN MINNESOTA	Ecuador Manta *(Music from the Andes)*	Ring of Fire : The Life and Music of Johnny Cash - Plymouth Playhouse *(Jukebox Musical)*	Ecuador Manta	Take the Bigfoot Challenge: Leave No Trace in MN	Ecuador Manta	Take the Bigfoot Challenge	Ecuador Manta	Take the Bigfoot Challenge: Leave No Trace in MN	Ecuad Manta
Sunday August 31	BOAT & WATER SAFETY	Roxxy Hall Band *(All Women's Jam)*	Put Out That Fire! Try Laser Fire Extinguishing	Roxxy Hall Band	Put Out That Fire! Try Laser Fire Extinguishing	Roxxy Hall Band	Put Out That Fire! Try Laser Fire Extinguishing	Roxxy Hall Band	Break	Break
Monday September 1	WILDLIFE	Set up for Peter Neuman and the Real Deal *(Rockin' Blues)*	The Raptor Center at the University of MN	Peter Neuman and the Real Deal	The Raptor Center at the University of MN	Peter Neuman and the Real Deal	The Raptor Center at the University of MN	Peter Neuman and the Real Deal	Break	Pe Neu and Real

Smokey Bear will appear every day at 11 AM and 1 PM. Emerald Ash Borer costumed character will appear every day at 12 Noon and 2 PM. Ask a DNR Expert
Fire Tower will be open 9 AM – 5 PM daily, dependent on weather. Fish Pond Talks by DNR MinnAqua Program Specialists (15 minutes)

"The DIRT" 2014 Schedule

Saturday, Aug. 23rd:

[redacted] Theresa Rooney: *"Lazy (Sustainable Gardening)."* Theresa Rooney /U of MN Extension Master Gardener-Hennepin County

[redacted] Theresa Rooney: *"Growing a Less Turf Yard."* Theresa Rooney /U of MN Extension Master Gardener-Hennepin County

[redacted] JoAnne Sabin: *"Food for Bees – a Pollinator's Garden."* U of MN Extension Master Gardener-Dakota County

[redacted] Jim Calkins: *"Every Landscape Needs a Rain Garden."* Minnesota Nursery & Landscape Association

2 pm: Mark Molitor: *"Clean Hydroponic Produce."* Forever Yours Farms

3 pm: Burt Scripture: *"How to Grow Glorious Gladiolus."* Minnesota Gladiolus Society

[redacted] Bill Foss: *"How to grow Giant Pumpkins, Squash and Watermelons."* BillsBigPumpkins.Com

Sunday, Aug. 24th:

[redacted] Pine Tree Apple Orchard: *"Growing Apples in Minnesota."*

11am: Linda Paulsen: *"Learn about Crop Art."* Crop Artist

Noon: Marsha Van Denburgh: *"Onions from Ground to Table."* Local Family Producer

[redacted] Heather Holm: *"What You Can Do For Pollinators: Creating a Pollinator Friendly Garden Habitat."* Author of Pollinators of Native Plants

[redacted] Joel Karsten: *"Learn To Grow a Straw Bale Garden."* Author of "Straw Bale Gardening"

3pm: Lew Wallace: *"Arranging with Gladiolus."* Minnesota Gladiolus Society

[redacted] Crystal Boyd: *"The Buzz about Native Bees."* Minnesota-Department of Natural Resources

5pm: Donna Revak & Todd John: *"My Name is Mr. Twiggy" Creating a Charming Lighted Snowman.* Minnesota Christmas Tree Association

"The DIRT" 2014 Schedule

Sunday, Aug. 31st

10 am: Linda Paulsen: *"Learn about Crop Art."* Crop Artist

[redacted] Pine Tree Apple Orchard: *"Growing Apples in Minnesota."*

Noon: Dave Roeser: *"Indoor Commercial Aquaponic Farming."* Garden Fresh Farms

[redacted] Jim Calkins: *"Pruning in the Home Landscape."* Minnesota Nursery & Landscape Association

[redacted] Joel Karsten: *"Learn To Grow a Straw Bale Garden."* Author of "Straw Bale Gardening"

[redacted] David Gray: *"Tomatoes: Indeterminate versus Determinate. What's the difference, and what's the best choice for you?"* eQuality Farms LLC

[redacted] Crystal Boyd: *"The Buzz about Native Bees."* Minnesota-Department of Natural Resources

[redacted] Bryan Lawrence: *"Where the Green Grass Grows."* Minnesota Turf Association

Monday, Sept. 1st:

[redacted] PIne Tree Apple Orchard: *"Growing Apples in Minnesota."*

11 am: Karen Zierdt: *"Knowing and Growing Dahlias."* Minnesota Dahlia Society

[redacted] Bob Dahm: *"Organic Lawn Care."* Organic Bob

[redacted] Jim Calkins: *"Landscaping for Wildlife."* Minnesota Nursery & Landscape Association

[redacted] Joel Karsten: *"Learn To Grow a Straw Bale Garden."* Author of "Straw Bale Gardening"

[redacted] Rachael Cochrane: *"Heirloom Beans from Start to Finish."* U of MN Extension Master Gardener-Dakota County

The Little White Paper

The Monthly Newsletter of the Golden Valley Historical Society
Mailing Address: 7800 Golden Valley Road, Golden Valley, Minnesota 55427
Historic Church and Museum: 6731 Golden Valley Road, Golden Valley
October 2014

Don Anderson, Editor 763-588-8578 e-mail: maryanddon3030@aol.com

October 9 meeting...

Sannes focuses on Civil War in 1864

Darryl Sannes, co-author of the Patriots of Brooklyn book series, will present the year 1864 of the Civil War and the drawing of the Battle of Acton.

Sannes was appointed to the Minnesota Civil War Commemoration Task Force by Governor Mark Dayton in 2011. The commission was established to commemorate Minnesota's role in the American Civil War with a wide variety of programs and events. Sannes has also been a long-time member of the Brooklyn Historical Society (Brooklyn Center and Brooklyn Park) and co-authored the Patriots of Brooklyn book series. He recently retired after a 35-year career with Medtronic and now pursues history full time.

The general membership meeting will be held at the Golden Valley Historical Society's historic church at 6731 Golden Valley Road, Golden Valley at 7:00 p.m. Refreshments will be served following the program. The meeting is free and open to the public.

Program review...

Boyd described bee population, protective legislation

The September 11 kickoff program was presented by Crystal Boyd, entomologist with the Minnesota DNR. Boyd described the biology of our state's native bees, the important legacy of bee research in Minnesota, recent legislation to protect pollinators, and the components of a bee-friendly backyard. Boyd is also a bee specialist with the Minnesota Biological Survey. Her power point presentation was well done and the 34 members and guests in attendance flocked to ask her questions following her presentation.

(Boyd graciously substituted for Doug Ohman who was ill.)

Members approve four for three-year terms

Society members attending the September 11 general membership meeting elected to a three-year term on the Society's board of directors: Don Anderson, Crystal Boyd, Betty Crews and James Hera. Other board members with two-year terms remaining: Kenneth Huber, Nancy Kochenderfer, Linda Loomis, Rudi Martignacco and Peggy Nelson; and with one-year terms remaining: Nancy Azzam, John Colwell and DeDe Scanlon. Director Steven Schmigdall was appointed by the Golden Valley City Council to a one-year term at the beginning of 2014.

Mark the dates for future programs

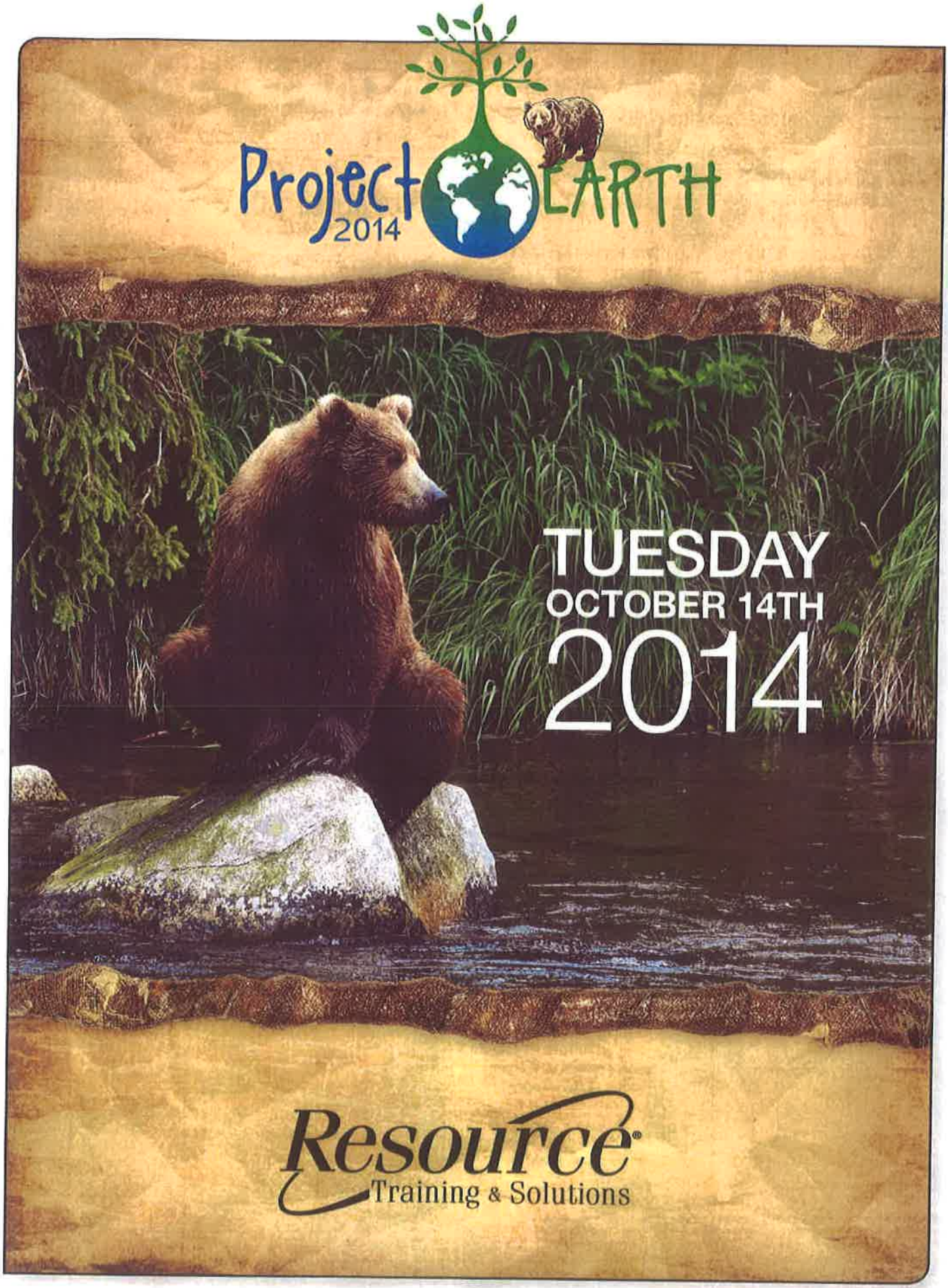
November 13 – Peter James Ward Richie, Robbinsdale author, will present the history of Robbinsdale, including early photos of fishing and boating on the city's sparkling lakes, nostalgic images of the city's beautiful old movie theaters, Captain Billy and Robbinsdale's Whiz Bang legacy, its bars and streetcars on West Broadway.

January 8 – Nuance/duo will present the life and music of George Gershwin. Dan Wascoe will play the piano and Baibi Vegners will sing and narrate photos of Gershwin.

February 12 – Doug Ohman will return with his latest research on the Great Depression, which resulted in the WPA, CCC and other government-sponsored work projects that put thousands of men to work building various structures, parks and other public improvements in Minnesota.

Fall cleanup set for November 8

The Society's Director of Buildings and Grounds, Jim Hera, has scheduled the fall yard cleanup for Saturday, November 8, beginning at 8:30 a.m. Please mark your calendar and plan to join other volunteers that morning if you are able to help. Check the November newsletter for more information.


Project 2014 EARTH
TUESDAY
OCTOBER 14TH
2014
Resource
Training & Solutions

MN DNR Project Management Community of Practice presents:

"Bees and Been There's"

Wednesday, Oct 29, 2014

12:00pm-1:00pm

Attend in 6th floor N/S conference rooms or via Lync link below:

Join us for a lively discussion as Crystal Boyd shares the challenges and lessons learned during her bee research:

Project approach, tools, and communication strategies under a media spotlight.

We'll also conduct a brief retrospective: What is the PMCoP doing well? Where can we improve? What topics are of most interest to you?

MINNEAPOLIS AUDUBON SOCIETY

PROGRAMS: FALL 2014 – SPRING 2015

September 12:** **PLACES, SPACES & BIRDS IN BETWEEN** -- MICHAEL SHOOP, PHOTOGRAPHER

October 10: **SEABIRDS OF THE BERING STRAIGHTS AND NORTH PACIFIC** -- DAVID CAHLANDER

November 14 **MINNESOTA BEES** -- CRYSTAL BOYD, MN DNR

December 12: **ADVENTURES IN ICELAND** -- DOROTHY AND FRED WALTZ

January 9: **ELOISE BUTLER WILDFLOWER GARDEN** -- DON BEIMBORN

February 13: **SCENES FROM A BLOOMINGTON MARSH** -- DR. SCOTT SHARKEY

March 13: **RED-HEADED WOODPECKER RESEARCH** -- CHET MEYERS

April 10: **AITKIN WILDLIFE - ENCORE** -- WARREN NELSON

May 8: **FOR THE LOVE OF LAKES** -- DARBY NELSON

** Sept. 12: ANNUAL POTLUCK PICNIC. TIME???*Bring a dish to share; plate, cup and silverware for yourself.*

Programs begin at 1 P.M., second Friday of each month, at the Bryant Square Park Building in Minneapolis.

Located at the corner of Bryant Avenue South and 31st Street (one block south of Lake Street).

OPEN TO THE PUBLIC – EVERYONE WELCOME

Silviculture Program Annual Meeting
December 9 & 10, 2014
Cloquet Forestry Center

Agenda

Tuesday, December 9

9:30 - Welcome, Introductions, Rick Klevorn

9:45 - Aerial Regen Surveys, Rick Klevorn, Curtis Vanderschaaf, Joel Perrington

10:30 – Regen Surveys Policies and Procedures, Mike Locke

11:15 - Open Discussion, All

12:00 - Lunch

12:45 - Certification Audit Review, Tim Beyer

1:15 - Invasive Species, Susan Burks

2:00 - Case Studies, John Almendinger

2:45 - Break

3:00 - Forestry Herbicides & Surfactants, Dale Sutherland

3:30 - Area Herbicide Use, Rick Klevorn

4:15 - Adjourn

Wednesday, December 10

8:00 – How *Diplodia* pathogens disrupt natural and artificial regeneration of red pine, Jana Albers

8:30 - Forest Health Update, Mike Albers

9:15 - Heterobasidion root disease (HRD), Brian Schwingle

9:45 - Break

10:00 – Pollinator Habitat, Crystal Boyd

10:45 – Wrap-up

11:00 - Adjourn

May 19th	Hangar Conference Center	Moderator - Lou Cornicelli
12:00	**Lunch**	
1:00	Welcome / Housekeeping - Paul Telander	
1:15	Safety (Handling wild bird samples) - Erik Hildebrand	
1:30	Invasives	
1:40	Section update - Paul Telander	
2:00	Legislative Update - Kathy DonCarlos	
2:15	Director's Message - Ed Boggess	
2:30	Data Practices - Sheila Deyo	
3:00	Break	
3:15	Managing Conflict - Grant Wilson	
4:00	North American Waterfowl Mgmt Plan - Dale Humburg	
6:30	**Dinner (DeParq Woods)**	
May 20th	Hangar Conference Center	Moderator - Bob Welsh
7:00	**Breakfast**	
8:30	WMAs across Minnesota - Kyle Arola	
9:15	WAHMA update - Steve Benson	
10:00	Break	
10:15	Update on Deer Goal Setting - McInenly/Clower	
11:00	HR Update, Q/A - Denise Legato	
12:15	**Lunch**	
1:30 - 5:30	Breakout Sessions (Education Center)	
6:00	**Dinner**	
??	**GIS technology show and tell (Hangar)**	
May 21st	Hangar Conference Center	Moderator - Steve Merchant
7:00	**Breakfast**	
8:30	High Path AI update - Michelle Carstensen	
9:00	Elk Restoration - Huener, Schrage, D'Angelo	
10:15	Break	
10:30	Lynx Reporting - John Erb	
11:00	What you need to know about NLEB's - Bryan Lueth	
11:15	Questions and Answers/Other/Housekeeping - SMT	
12:00	**Lunch (adjourn)**	
1:00	Firearm Qualification Classroom	

Minnesota Landscape ARBORETUM | ARBORETUM Education

UNIVERSITY OF MINNESOTA

Pollinators³: Addressing Pollinator Decline Through Change

Thursday, May 21, 2015, 12:30 p.m. – 4:30 p.m.

Overview: Learn about the ongoing efforts regarding biodiversity of butterflies and bees, habitat with bee-friendly plants, and research on factors that affect bee colony health. Also learn about federal, state, and local policies that intend to conserve pollinators, and examine ways that we can affect change for the common good on a topic that has affects our landscapes and our communities.

Agenda:

12:30 *Welcome and Introductions*
Leslie Yetka, Minnesota Landscape Arboretum

12:40 *Ways to Affect Change for the Common Good*
Tim Kenny, Education Director, Minnesota Landscape Arboretum

1:00 *Change Through Laws and Regulations: Update on 2013 Pollinator Habitat Bill and new Minnesota Bee Labeling Law*
Jamison Scholer, Minnesota Department of Agriculture

1:30 *Change Through Government Guidelines: Summary of Minnesota Department of Natural Resources Programs around Pollinator Conservation*
Crystal Boyd, Minnesota Department of Natural Resources

2:15 *Break*

2:30 *Change Through Advocacy: Local Policies to Protect Pollinators*
Laurie Schneider, Pollinator Friendly Alliance

3:00 *Change Through Advocacy: Grass Roots Efforts to Protect Pollinators*
Kristy Lynn Allen, Beez Kneez

3:30 *Change Through Non-Governmental Organizations: The Role of NGO's in Facilitating Change in Policy*
Vera Krischik, Department of Entomology, University of Minnesota

4:00 *Q & A with Presenters*

Extension Master Gardener Volunteer State Conference

Our Plants, Our Planet, Our Volunteers

Friday, June 26 & Saturday, June 27

Minnesota Landscape Arboretum

What does it take to be a Master Gardener in 2015? This State Conference will explore that question and take Master Gardeners to the "next level" in their horticulture knowledge and skill base. Workshops on advanced topics will present new, emerging research-based horticulture information; discuss sustainability in a changing climate; and prepare Master Gardeners to be more effective volunteers in diverse and changing communities. This is a conference for every Master Gardener who wants to go beyond the basics and gain new energy and direction for their role as a volunteer.

Minnesota Landscape
ARBORETUM

www.arboretum.umn.edu/EMGConference2015.aspx • 3675 Arboretum Drive, Chaska, MN 55318 • 612-301-1210

A CELEBRATION OF BEES

POLLINATOR Party

THURSDAY, JULY 30, 2015 | 5-8 PM

LYNDALE PARK GARDENS

EAST SIDE OF LAKE HARRIET
BY THE TURTLE FOUNTAIN

- Learn How To Be An Urban Bee Keeper
- Sample Minnesota Honey
- Ice-Cream Made With Honey
- Make Your Own Backyard Bee-Hospitable
- Hands-On Games For The Entire Family
- Discover The Wild Bees Of The Park
- Minneapolis Institute Of Arts Art In The Park
- Meet The 2015 American Honey Princess
- Movie at Dusk: Disney's Wings of Life

Live Music at 5pm

Featuring the
Brass Messengers

www.minneapolisparks.org/bees

Minneapolis
Park & Recreation Board

la Loma

Food & Beverages available from
la Loma Tamales

Event Partners

Mpls Park and Recreation Board
University of Minnesota Bee Lab & Bee Squad
Pollinate Minnesota
The Beez Kneez

POLLINATOR TOWN HALL FORUM

Wednesday, October 28
6:30 p.m. - 8:00 p.m.

Van Cleve Park and Recreation Center
901 15th Avenue S.E. | Minneapolis

Hosted by

Senator Kari Dziedzic
Representative Phyllis Kahn
and Representative Diane Loeffler

Special Guests

Erik Runquist, Minnesota Zoo
Crystal Boyd, MN Department of Natural Resources
Daniel Cariveau, Dept. of Entomology, University of Minnesota
Lex Horan, Pesticide Action Network
Tina Markuson, MN Department of Transportation
Kevin Cavanaugh, MN Department of Agriculture

Please RSVP to Mary Underwood
at 651.296.7809 or mary.underwood@senate.mn

City of Eagan

ENERGY & ENVIRONMENT ADVISORY COMMISSION
Tuesday, December 8, 2015, 7:00 – 9:00 p.m.
Eagan Municipal Center, Council Chambers

Work Group Meeting (Aditya, Peter, and Susan)
6:30-7:00 – Second Floor Conference Room

- Effective Communication (Goal #3 Review)

Agenda

I.	Call to Order and Pledge of Allegiance	7:00 p.m.
II.	Adopt Agenda	7:02 p.m.
III.	Approval of Minutes of the Regular Meeting on October 13, 2015	7:04 p.m.
IV.	Visitors to be Heard	7:08 p.m.
V.	Director Updates (None at this time)	7:10 p.m.
VI.	Old Business (None at this time)	7:15 p.m.
VII.	New Business A. Presentation on Bee and Butterfly Pollinator Project - Crystal Boyd - MN DNR B. Maintaining Bee Hives on City Property - Joanne Sabin - MN Bee Keepers Association C. Community Solar Garden Subscription Agreement - Russ Matthys D. Metropolitan Council Water Efficiency Grant Program - Russ Matthys	7:16 p.m.
VIII.	Communications (None at this time)	8:16 p.m.
IX.	Roundtable A. Work Group Updates	8:17 p.m.
X.	Adjournment	8:30 p.m.

The City of Eagan is committed to the policy that all persons have equal access to its programs, services, activities, facilities, and employment without regard to race, color, creed, religion, national origin, sex, disability, age, marital status, sexual orientation, or status with regard to public assistance. Auxiliary aids for disabled persons wishing to participate are available upon request at least 96 hours in advance of the event. If a notice of less than 96 hours is received, the City will attempt to provide the aids.

NEXT REGULAR ENERGY & ENVIRONMENT ADVISORY COMMISSION MEETING
TUESDAY, FEBRUARY 9, 2016 7:00 P.M. COUNCIL CHAMBERS

Science ROCKS! 2016

Hands-on Science & Nature Conference

January 5, 2016 | For 5th & 6th Grade Students

Resource Training & Solutions

A Minnesota Service Cooperative

MNDNR

COME JOIN US FOR A DISCUSSION ABOUT

MONARCH BUTTERFLIES AND NATIVE POLLINATORS IN MINNESOTA

FRIDAY JANUARY 15, 2016
FROM 7 – 9 PM

Earle Brown Conference Center ; Room: Carriage Hall B
6155 Earle Brown Drive Minneapolis, MN 55430 763.569.6300
(near 694 and Shingle Creek Parkway)

This evening event is part of the 2016 DNR Roundtable.

THE EVENING SCHEDULE

6:30 pm	Doors Open	Check-in at front desk
7:00	Welcome	Luke Skinner, DNR Div. Director
7:05	Description of the Evening	Jill Townley, Emcee
7:10	The Monarch Butterfly and the Monarch Joint Venture	Karen Oberhauser, UM/MJV
7:30	Pheasants Forever commitment to the National Monarch Initiative	Rick Young, Pheasants Forever
7:40	Native Pollinators in Minnesota	Crystal Boyd/Robert Dana, DNR
8:00	Minnesota DNR commitment to the National Monarch Initiative	Rich Baker, DNR
8:10	Table Top Discussions: 1. What are some memorable personal encounters you have had with Monarchs and Pollinators? 2. What can you personally do to help Monarchs and Native Pollinators in Minnesota? 3. What are three things the MNDNR should do to support Monarchs and Native Pollinators? 4. What questions do you have for our speakers?	
8:40	Large Group Discussions and Questions/Answers	Jill Townley, Emcee
9:00 pm	Final Thoughts	Luke Skinner, DNR Div. Director

North Central Bee Keepers February, 2016

Greetings Bee Keepers;

Lunch committee;

Jo and Dave Lange

Speakers;

Lewis Struthers : Parkers Prairie, Mn. Lewis caught 16 swarms last summer . He will explain how he uses swarm traps or bait hives. We all need FREE bees!

Duane Williams: Pequot Lakes, Mn. Duane will share his experiences with his TOP BAR HIVE last year. If you are thinking top bar you need to hear Duane's report.

New meeting location !!!

First Lutheran Church, koinonia Room

424 S. 8th. St. Brainerd Mn. 56401

Recap of January Meeting;

Entomologist Crystal Boyd from the DNR gave an excellent talk, along with pictures of many species of wild bees in Minnesota and the Dakotas, and their role in pollinating prairie flowers. She also discussed some of the difficulties caused by loss of prairie habitat, disappearance of wild flowers and the killing of wild pollinators with chemicals used by modern agriculture. It was all informative and sobering. Minnesota has a seed selector on line to help choose the right seeds to use along roadways.

Environmental INITIATIVE

Powerful Partnerships, Effective Solutions

Minnesota Department of Agriculture Pollinators Summit

Draft Agenda

Friday, February 12, 2016
8:30 a.m. – 4:30 p.m.
The Wellstone Center
179 Robie Street East
Saint Paul, MN 55107

8:00 Registration & Continental Breakfast

8:30 Introductions & Housekeeping
Mike Harley, Executive Director, Environmental Initiative

8:35 Welcome
Dave Frederickson, Commissioner, Minnesota Department of Agriculture

8:45 Current Research Updates Related to Stressors Facing Minnesota Pollinators

- *Dr. Marla Spivak, MacArthur Fellow and Distinguished McKnight Professor in Entomology, University of Minnesota Bee Lab*
- *Dr. Dan Cariveau, Assistant Professor, University of Minnesota Bee Lab*
- *Wendy Caldwell, Community Program Specialist, Monarch Joint Venture, University of Minnesota Monarch Lab*
- *Dr. Erik Runquist, Butterfly Conservation Biologist, Minnesota Zoo*

10:00 Break

10:15 State Pollinator Programs & Initiatives

- *TBD, Minnesota Department of Agriculture*
- *Dan Shaw, Native Vegetation Specialist, Board of Water and Soil Resources (invited)*
- *Crystal Boyd, Entomologist/Bee Specialist, Minnesota Department of Natural Resources (invited)*
- *Tina Markeson, Roadside Vegetation Management Unit Supervisor, Minnesota Department of Transportation (invited)*

11:30 Lunch

12:00 Federal Pollinator Programs & Initiatives

- *Tom Melius, Midwest Regional Director, U.S. Fish and Wildlife Service (invited)*

Senators Scott Dibble and Patricia Torres Ray
Reps. Jim Davnie, Frank Hornstein, and Jean Wagenius
Council Members Andrew Johnson and John Quincy

Invite you to a:

TOWN HALL POLLINATOR FORUM

Monday, February 22, 2016 at 7:00 p.m.

Moderated by Rep. Rick Hansen
DFL-Lead on Environment and Natural Resources Committee

Program followed by Q&A

Washburn High School
201 West 49th St

With:

Monarch Expert, **Dr. Karen Oberhauser**
University of Minnesota
Butterfly Conservation Biologist **Dr. Erik Runquist**
Minnesota Zoo
Native Bee Specialist **Crystal Boyd**
Minnesota Department of Natural Resources

Also participating are representatives from the Pesticide Action Network, Pollinate Minnesota, and the U of M Bee Squad

For more information, contact: Kyle Olson at 651-296-4191 or Nanette Moloney at 651-296-5402

There is no cost to attend this forum.

Monthly Meeting of the Prairie Lakes Audubon Chapter

You're invited
to enjoy…

"What's the Buzz About Native Bees?"

WHEN: TUESDAY, MARCH 8, 2016 @ 7:00PM

WHERE: ALEXANDRIA SENIOR & COMMUNITY CENTER
414 HAWTHORNE ST, ALEXANDRIA

WHAT: Crystal Boyd, an entomologist with the Minnesota Department of Natural Resources, will discuss the biology of our state's native bees. She will also describe the legacy of bee research in Minnesota, recent pollinator legislation, and the components of a bee-friendly backyard. Crystal earned her undergraduate degrees in English and Spanish at the University of Minnesota, alongside her minor in Entomology. She earned her Master's degree in Museum and Field Studies from the University of Colorado Boulder, where her thesis focused on bumblebees. Crystal now works as a native bee researcher with the DNR's Minnesota Biological Survey. She spent the past summer surveying bees in the prairie region from Thief River Falls to Granite Falls. Please buzz on by this program to learn more about native bees!

FOR MORE INFORMATION, CONTACT: BEN ECKHOFF AT 320-852-7471 X225

THERE IS NO COST TO ATTEND THIS PROGRAM

What's the BUZZ about native bees?

POLLINATORS IN PERIL

Thursday, March 17, 2016 • 6:30–8 p.m.
Wildwood Library, 763 Stillwater Rd, Mahtomedi, MN 55115

Pollinators contribute substantially to the economy of the United States and are vital to keeping fruits, nuts, and vegetables in our diets. Over the past few decades, there has been a significant loss of pollinators—including honey bees, native bees, birds, bats, and butterflies—from the environment. The problem is serious and poses a significant challenge that needs to be addressed to ensure the sustainability of our food production systems, avoid additional economic impacts on the agricultural sector, and protect the health of the environment.

FEATURING

Crystal Boyd
MN Department of Natural Resources

Boyd, an entomologist with the Minnesota Department of Natural Resources, will discuss the biology of our state's native bees. She will also describe the legacy of bee research in Minnesota, recent pollinator legislation, and the components of a bee-friendly backyard. Boyd earned her undergraduate degrees in English and Spanish at the University of Minnesota, alongside her minor in Entomology.

Marcie Forsberg
Pollinator Friendly Alliance

Forsberg is Co-Director of the Pollinator Friendly Alliance. An avid environmentalist and beekeeper, Forsberg graduated from St. Olaf College with a degree in biology and later earned an associate degree in landscape horticulture. She is owner of Green City Gardeners, which provides professional gardening and landscape design services that are environmentally sound, sustainable and pollinator-friendly.

FREE & OPEN TO THE PUBLIC

Sponsored by
League of Women Voters, White Bear Lake Area,
Izaak Walton League and The Honeybee Club of Stillwater

2016 Speaker Series

St. Croix River Association

"What's the Buzz About Native Bees?"

Crystal Boyd, Minnesota
Department of Natural Resources
Saturday, March 19, 10:00 am

St. Croix River Association
230 S. Washington St. Unit 1
St. Croix Falls, WI
www.stcroixriverassociation.org

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What's at Mount Zion for Me?
Learning
Worship
Caring Community
Social Justice
Israel
Lifecycle Events
Membership
Contact Us

Brotherhood Speaker Series and Bagel & Lox Brunch

Sunday, April 3, 10:00 a.m. Brunch; 10:30 Presentation

We are looking forward to hearing Crystal Boyd present "What's the Buzz About Native Bees?" Crystal is with the Department of Natural Resources and is an expert on pollination. Her excellent and very informative presentation will show how climate change and other factors threaten our huge agricultural economy.

1300 Summit Avenue, St. Paul, MN 55105 | Phone 651-698-3881 | Contact Us

Bees: What's all the Buzz About?

Presented by

LEAGUE OF WOMEN VOTERS®
Park Rapids Area

UNIVERSITY OF MINNESOTA
EXTENSION

UNIVERSITY OF MINNESOTA
EXTENSION
MASTER GARDENER PROGRAM

Nevis Study Club of GFWC

Saturday April 23, 2016 1 to 3 pm

Featuring : Crystal Boyd: Minnesota DNR Bee Specialist

Come find out all about bees and other pollinators. What can we do to be part of the solution ?

Featuring Rhonda Fleming Hayes: Author of Pollinator Friendly Gardening

Northwoods Bank: Community Room: 1200 East 1st Street Park Rapids, MN 56470

Can we be Pollinator Friendly?

for more information email:
lwvparkrapids@lwvmn.org

Statewide Interpretive Meeting ***DRAFT Agenda 3-11-16***
Minnesota State Parks and Trails
April 26-28, 2016

Mille Lacs Kathio State Park Visitor Center

TUESDAY, APRIL 26
Today's Emphasis: Healthy Environments
Lunch, on own

12:30 – 12:40	Welcome	Jennifer Conrad
12:40 – 1:20	Director's Update	Erika Rivers, PAT Director
1:20 – 2:40	Staying Positive in Changing Times	Rebecca Carpentier, HR
2:40 – 2:45	Wheelchair Experience *(throughout next 3 days)*	Retta James-Gasser
2:45 – 3:00	Break	
3:00 – 4:00	Bees: What's All the Buzz About!	Crystal Boyd, Eco Services
4:00 – 4:15	Wheelchair Experience continued	Warren Netherton
4:15 – 4:30	Safety Message	Mike Dunker
4:30 – 4:45	Interpretive Services Updates	Jennifer Conrad, et al.
4:45 – 5:00	The Day's Wrap Dinner, on own	

WEDNESDAY, APRIL 27
Today's Emphasis: Cultural, Historical, & Resource Management Interpretation
Location: Mille Lacs Kathio State Park Visitor Center in morning / Mille Lacs Indian Museum in afternoon

8 am – 8:30	Interpretive Services Updates	Jennifer Conrad, et al.
8:30 – 8:45	Interpretive Inspiration (Program) Moment	Mike Dunker
8:45 – 9:45	Public Interpretation of Archaeology & the National Register of Historic Places (w/Q&A time)	Jim Cummings David Mather, MHS
9:45 – 10:00	Break	
10:00 – 11:30	Ogechie Lake Wild Rice Restoration Project Perry Bunting, Project Manager, Mille Lacs Band of Ojibwe DNR Kris Erickson, Park Manager Jim Cummings, Mille Lacs Band of Ojibwe Consulting Archaeologist	
11:30 – 12:00	Lunch provided in Mille Lacs Kathio visitor center	


DEPARTMENT OF NATURAL RESOURCES
Preserve
• Thirty-five percent of the global food supply depends on pollinators
• Pollinators include bees, butterflies, moths, flies, beetles and more
• Minnesota is one of the top honeybee and honey producing states
• In Minnesota there are over 300 species of native bees
• We need pollinators and pollinators need our help
What's the BUZZ
Plant
• Plant local varieties of native flowers that provide nectar and pollen
• Plant flowers in clumps
• Select a variety of native plants to provide blooms in spring, summer, and fall
• Include flowers of different colors and shapes
• Protect some plants by reducing mowing & pesticide
Provide
• Provide safe refuges for bees
• Leave areas next to fields untilled and unsprayed
• Support organic farmers
• Minimize pesticide use and tillage
• Select least harmful formulations
• Spray on dry evenings when bees are not active
• Provide nesting habitat for ground-nesting and cavity-nesting bees
POLLINATORS

Supplement C. Tallgrass Prairie Bee Workshop

1. Overview
2. Presentation Flyer
3. Sample Award Certificate
4. Workshop Flier
5. Agenda
6. Information for Applicants
7. Application

MNDNR

September, 2016

Partial funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative–Citizen Commission on Minnesota Resources (LCCMR).

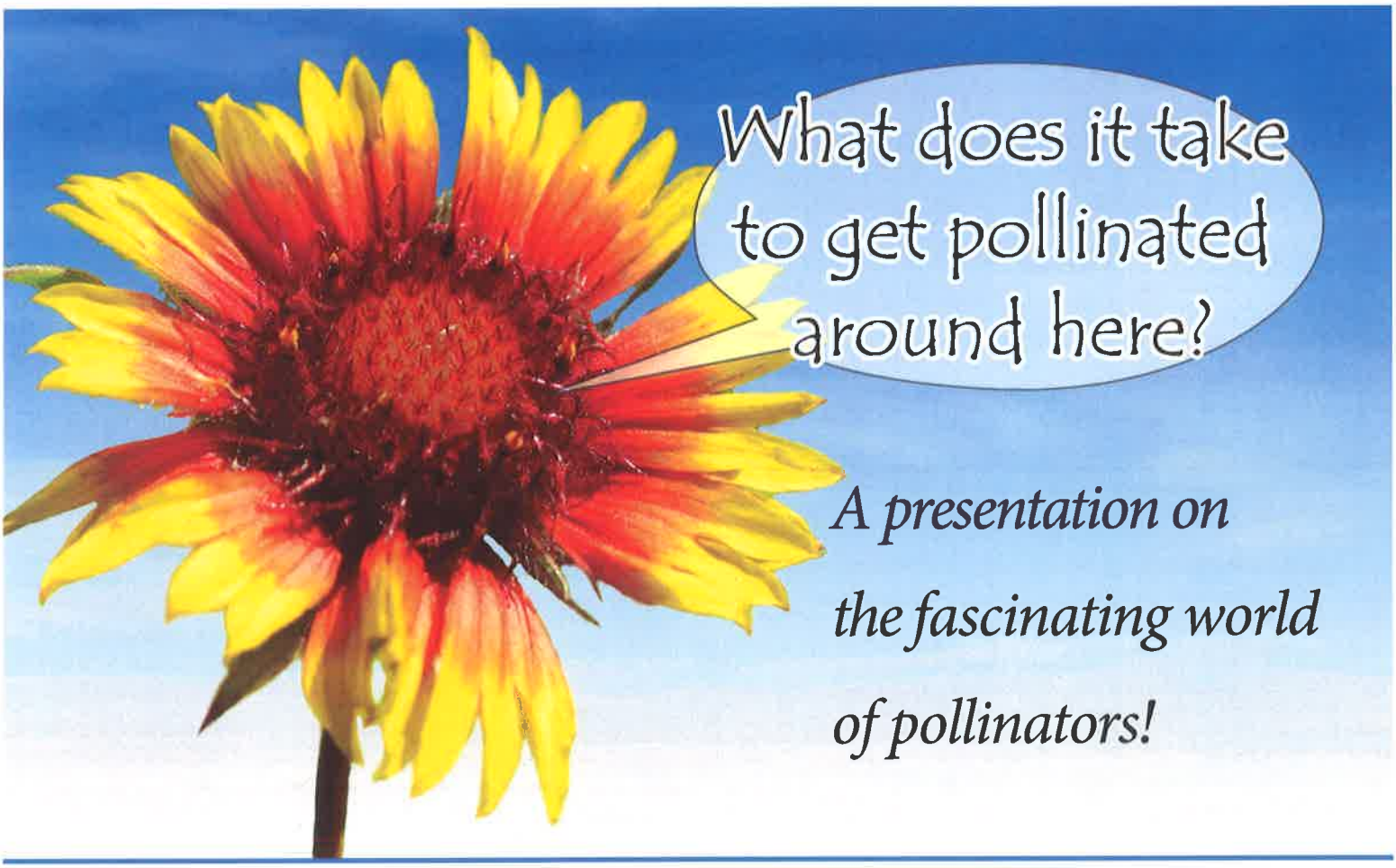
ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

2015 Tallgrass Prairie Bee Workshop

The Minnesota DNR and University of Minnesota collaborated to host the 2015 Tallgrass Prairie Bee Identification Workshop.

Staff support was provided by ENTRF projects *Wild Bee Pollinator Surveys in Prairie-Grassland Habitats* and *Enhancing Pollinator Landscapes.* Additional funding for workshop materials was provided by the Institute on the Environment.

This five-day workshop included 21 participants from 8 states. It also reached 90 members of the public through 3 special events.



Who: Mike Arduser, retired biologist from the Missouri Department of Conservation

What: Free bee presentation for the public; "*What Does it Take to Get Pollinated Around Here?*"

When: Doors open at 6:30. Lecture starts at 7:00pm on Tuesday, January 13, 2015

Where: Bell Auditorium, University of Minnesota (East Bank)

Why: To learn about the fascinating world of pollinators, why they're important in natural and managed habitats, plus how to attract pollinators to your yard.

Price: ***Free and open to the public***

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

BELL MUSEUM OF NATURAL HISTORY
UNIVERSITY OF MINNESOTA
Driven to Discover℠

MNDNR

INSTITUTE ON THE ENVIRONMENT
UNIVERSITY OF MINNESOTA
Driven to Discover℠

Student Presentation Award

This certificate is awarded to

_____

1st Annual Minnesota Bee Identification Workshop
January 12-16, 2015

_____

Mike Arduser, Instructor January 16, 2015

Tallgrass Prairie Bees: An Identification Training Workshop
January 12-16, 2015
Hosted at the University of Minnesota
Supported by the University of Minnesota's IonE minigrant program and the Minnesota Department of Natural Resources

Overview:
This course is geared towards researchers and bee students looking to expand their identification skills of Midwestern bee species. The goal is to introduce participants to most genera and common species of bees in tallgrass prairie communities, their ecological relationships, and the resources useful in helping participants learn more about bees on their own. Some background in entomology, prairie ecology, and pollination biology is preferred. Classes include lectures and microscope time for identifying specimens. Please bring your own pinned specimens, if possible.

The course also includes several special events. Class participants are invited to join an evening networking event, an outreach presentation, and a research lecture. These events are open to a wider audience and do not require a background in bees.

Instructors:
1) Mike Arduser has studied native bees for over 30 years and has organized and taught courses on native bees for the US Fish and Wildlife Service, The Nature Conservancy, and others. Mike was a natural history biologist with the Missouri Department of Conservation for 19 years and is currently writing a book on the identification and ecology of tallgrass prairie bees.
2) Elaine Evans is a PhD candidate studying bee biodiversity at the University of Minnesota.
3) Joel Gardner earned his M.S. degree in 2013 doing a survey of Megachilidae. He is currently verifying bee identifications in the University of Minnesota Insect Museum.

Organizers: Colleen Satyshur, Crystal Boyd, Elaine Evans, Joel Gardner

Location: University of Minnesota--Saint Paul Campus: 480 Hodson Hall, 1980 Folwell Ave, Saint Paul, MN 55108

Dates: 8:00am to 5:00pm Monday through Friday, January 12 - 16, 2015

Cost: $60/person

Questions: Please contact Colleen Satyshur: csatyshu@umn.edu, (608) 215-0679.

To apply: Two events are open to the public, but the main workshop space is limited to 15-18 students. Preference will be given to those actively researching bees, those with limited opportunities to learn native bee identification in other settings, and those who can "pay it forward" by teaching bee identification to other people in their organization. Please email your completed application to Colleen Satyshur at csatyshu@umn.edu by Monday, November 24, 2015. Participants will be notified by Tuesday, December 2, 2014. If selected, participants should submit their class fees by Wednesday, December 10th. Checks should be made payable to "University of Minnesota" and mailed to: University of Minnesota, c/o Colleen Satyshur, 100 Ecology, 1987 Upper Buford Circle, Saint Paul, MN, 55108

AGENDA

Monday, January 12, 2015

8 am	Welcome, course objectives, housekeeping and introductions
8:30 am	Review course materials, scopes, etc.
9:30 am	Bee classification, nomenclature, and morphology
10:30 am	Break
10:45 am	Overview of tallgrass prairie bees
12 noon	Lunch
1-5 pm	Bee id: families and subfamilies; genera and representative species of Colletidae and Melittidae
6 pm	Evening networking event (For class participants and others by invitation only. Snacks or light meal provided. Room 150 Ecology Building)

Tuesday, January 13

8 am	Bee id: genera and representative species of Andrenidae (Andreninae)
12–1:15 pm	Lunch & photography presentation (Room 310 Alderman Hall)
1:30 pm	Specimens: processing, preparing, labelling, mailing, pest-proofing etc. (Room 310 Alderman Hall)
2-5 pm	Bee id: genera and representative species of Andrenidae (Panurginae) and Halictidae (Rophitinae, Nomiinae and Augochlorini)
7 pm-	Evening outreach event by Mike Arduser: "What Does It Take to Get Pollinated Around Here?" (location TBD, free and open to the public)

Wednesday, January 14

8 am	Bee id: genera and representative species of Halictidae (Halictini)
12 noon	Lunch
1-1:45 pm	Research talk by Mike Arduser: "Using native bees to evaluate and monitor prairie restorations" (Room 495 Hodson Hall, free and open to the public)
2-5 pm	Bee id: genera and representative species of Megachilidae (Megachilini)

Thursday, January 15

8 am	Bee id: genera and representative species of Megachilidae (Osmiini) and Apidae (Xylocopinae)
12 noon	Lunch
1-1:45 pm	Talk by Joel Gardner, topic TBA.
2-5 pm	Bee id: genera and representative species of Apidae (Apinae and Nomadinae)

Friday, January 16

8 am	Review, loose ends, last of Apidae, questions, etc.
12 noon	Lunch
1-2 pm	Course review

What Participants Should Bring to the Workshop

1. Laptop: If you have one, bring it along; remote internet access is available at Hodson, and certain bee resources are available only online.

2. Books on bees, etc.: If you have copies of the following resources, please bring them along. These are **not** required, and there will be at least one copy of each in the lab.

-Mitchell's two volume "Bees of the Eastern US"
-Michener, McGinley and Danforth's "Bee Genera of North and Central America"
-Michener's "Bees of the World"
-Other bee-related publications that you want to use

3. Notebooks, pens, scissors, fine forceps, clay/cork/etc to hold specimens: You may want to make notes and illustrations so a notebook and pencils/pens will be useful. Fine-tipped permanent pens (.01-.005), available at art supply stores and elsewhere, are preferred for writing identification labels. Scissors are necessary, though we will have several pairs of these. Fine forceps will be helpful, as well as modeling clay, a cork, or spare foam to position specimens under the microscopes (eg. http://www.quekett.org/starting/stereo-microscopes/specimen-holders)

4. Bee specimens: If you have pinned specimens that you want to id, bring them along. Please do not bring specimens in alcohol.

5. Pinning boxes, storage boxes, Schmitt boxes etc.: Bring one or two if you have them, but we will provide them if needed.

6. Meals: Coffee and some snacks will be provided (bring your own mug!) but all meals will be on your own. There are limited lunch options within walking distance of the St. Paul campus (Subway, student convenience store and Mim's Middle Eastern Café). Some places will deliver, such as Jimmy Johns or restaurants on bitesquad.com, but we recommend packing your meals.

7. **Parking fees**: There is a lot outside Hodson hall for $12/day. There are other lots available for lower cost such as State Fairgrounds (lots S104 and S108) and one on the corner of Cleveland Ave. and Commonwealth Ave. (lot SC101). The Gibbs Museum (north of campus, on the northwest corner of Cleveland Ave. and Larpenteur Ave.) has a limited amount of parking for a minimal fee and will require a short walk to Hodson. Parking in the surrounding neighborhoods is free, but may require walking ¾ of a mile.
https://www1.umn.edu/pts/maps/Library/pdf/StPaul.pdf
http://www1.umn.edu/pts/park/parkingrates.html

What We Will Provide:

-Study specimens
-Identification keys
-Course guide
-Specimen trays and boxes
-Scopes and lights
-Snacks, coffee, tea, etc. (bring your own mug!)
-Reminder: All meals will be on your own.

Application for Tallgrass Prairie Bee Workshop
University of Minnesota
January 12 – 16, 2015
Name:

Professional address:

Position title:

Highest degree obtained and year (example: Master's degree, 2010):

Phone number:

Email address:

Emergency contact (name, email address, phone number):

On a separate page with your name on top, please supply a paragraph detailing the reason(s) for wishing to take the course.

Please indicate the following:
I am actively working with native bees as a student or researcher.
Check: ____Yes ____No
If yes, name your institution and project here:
_____

I have attended bee identification workshops (like The Bee Course in Arizona) in the past.
Check: ____Yes ____No
If yes, please list workshop(s) here: _____

I have concrete opportunities to pass along the bee knowledge I gain to... (check all that apply)
____ volunteers
____ interns
____ students
____ researchers
____ colleagues
____ the general public.

PLEASE SEND THIS APPLICATION TO: Colleen Satyshur at csatyshu@umn.edu

DEADLINE FOR APPLICATION: NOVEMBER 24, 2014

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

Funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative-Citizen Commission on Minnesota Resources (LCCMR). The Trust Fund is a permanent fund constitutionally established by the citizens of Minnesota to assist in the protection, conservation, preservation, and enhancement of the state's air, water, land, fish, wildlife, and other natural resources.

Supplement D. Websites

1. New Websites
    a. Minnesota's Pollinators
    b. Minnesota Pollinator Resources
    c. Native Bees of Minnesota Grasslands
2. Update Websites
    a. Native Plant Suppliers and Landscapers in Minnesota

MNDNR

Partial funding for this project was provided by the Minnesota Environment and Natural Resources Trust Fund as recommended by the Legislative–Citizen Commission on Minnesota Resources (LCCMR).

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND

September, 2016

Minnesota's Pollinators

Pollination happens when wind, water, or wildlife carry pollen from the anther (male part) to the stigma (female part) of flowers. Almost 90% of the world's flowering plant species rely on animal pollinators.

Pollinators help us to enjoy well-balanced diets and healthy ecosystems. They provide nutritious fruits, vegetables, and nuts like blueberries, squash, and almonds. This food is important for wildlife, too. Black bears, for example, eat raspberries that are pollinated by bumble bees.

Pollinators also create stable environments. They pollinate plants that stabilize the soil and prevent erosion. These plants can buffer waterways, store carbon, and provide habitat for other wildlife. Plus, flowering landscapes are beautiful. Without pollinators, our environment would look very different.

Agents of Pollination...






Frequently Asked Questions

Click on topic below to reveal more information. Click again to hide.

How can I support pollinators in my garden?

How can I support pollinators in my landscape restoration?

What funding is available for creating pollinator habitat?

Where can I learn about honey bees and bee keeping?

Where can I learn more about neonicotinoid pesticides?

What pollinator activities can I do with kids?

What opportunities are there to volunteer with the DNR or get involved with citizen science related to pollinators?

How can I identify my photo of an insect?

How can I build a nesting block for native bees?

What is the Minnesota DNR doing to support pollinators?

Further information

- Surveys underway for Minnesota's native bees are featured in a recent Minnesota Conservation Volunteer article.
- Please consult the DNR's Minnesota Pollinator Resources page for more information on pollinators
- Pollinator Conservation Resource Center from the Xerces Society for Invertebrate Conservation
- Pollinator Partnership, an affiliate of the North American Pollinator Protection

Campaign

- Pollinator information from the USDA-Forest Service

Minnesota Pollinator Resources

Interest in pollinators has grown since the term Colony Collapse Disorder appeared in 2006. This phrase refers to the puzzling disappearance of honey bees from their hives. While Colony Collapse Disorder does not affect native pollinators, many of the challenges that face honey bees also affect our native insects. These challenges include pesticide use, habitat loss, pathogens, parasites, climate change, invasive species, and other factors that influence Minnesota's pollinators today.

The Minnesota Legislature passed the Pollinator Habitat Bill (H.F. 976) in 2013. This prompted many organizations and the public to increase their knowledge about pollinators. This page is intended as an inventory of pollinator projects in Minnesota. It will also compile pollinator resources simply and in one place for the public.

The Minnesota Department of Natural Resources has established Pollinator Best Management Practices and Habitat Restoration Guidelines (December,2014) PDF to manage and enhance pollinator habitat on DNR-managed lands and on state-funded prairie restoration projects. Also included as part of the best management practices guidelines are Grant&Contract Language (December,2014) PDF as well as Conservation Grazing Dewormer/Insecticide Guidelines.(December,2014) PDF

Questions or comments? Please contact:

Crystal Boyd, MNDNR Bee Specialist
crystal.boyd@state.mn.us
651-259-5699.

General Information About Pollinators

- The Xerces Society
- North American Pollinator Protection Campaign and Pollinator Partnership
- The University of Minnesota Bee Lab
- Restoring the Landscape blog and Pollinators of Native Plants (book) from Minnesota photographer/landscaper Heather Holm

Pollinator-Friendly Plant Lists for Minnesota

- MNDNR's *draft Pollinator Resource Values for Upland & Wetland Prairies* tables (single page format) and printable booklet (formatted for two-sided printing on 8.5" x 14" paper)
- University of Minnesota's Plant lists for Bees (short version)
- Xerces Society Plant Lists
- University of Minnesota's Plants for Pollinators
- St. Paul Audubon Society booklet

Gardening Resources, Restoration Funding & Restoration Evaluation

- **Xerces Society.**
    1. Attracting Native Pollinators (book)
    2. Pollinator Habitat Assessment Form and Guide-Natural Areas and Rangelands assessment tool
- **Heather Holm.** Restoring the Landscape blog and Pollinators of Native Plants (book) .
- List of funding options from the Minnesota Board of Water and Soil Resources. See Incorporating Pollinator Habitat into Conservation Projects

Citizen Science Opportunities for Pollinator Research

- **Wild Ones Oak Openings Region Chapter** Report your monarch butterfly sightings
- **UMN & Karen Oberhauser** Monarch Larva Monitoring Project
- **UMN & Elaine Evans** Minnesota Bumble Bee Survey.
- **UMN & Joel Gardner** Wild Bees and Building Wild Bee Houses

Pollinator Education and Outreach

- **Jan Welsh.** DNR. Project Wild: pollinator curriculum.
- What's the Buzz about Pollinators and Roadsides? poster.

Pollinator Reports and Legislation

- **Xerces Society.** Pollinator Conservation in Minnesota and Wisconsin.
- **Minnesota Department of Agriculture.** 2013 Pollinator Legislation page .
- Board of Water and Soil Resources. See BWSR Pollinator Plan
- Minnesota Statute 84.973 Pollinator Habitat Program

DNR Research About Pollinators

- **Catherine Reed.** DNR. Surveys in the 1990s. Reports from 1993, 1995, and 1996.
- Crystal Boyd (Minnesota Biological Survey) Minnesota's grassland bees website.
- Scott Haire, Science Museum of Minnesota permit to collect through MNDNR. Permit to conduct surveys for *Perdita perpallida* at Grey Cloud Dunes SNA in 2013.
- Robert Dana. Minnesota Biological Survey. Surveys for butterflies and moths in Minnesota prairies.

Legislative-Citizen Commission on Minnesota Resources (LCCMR) - Funded Pollinator Projects

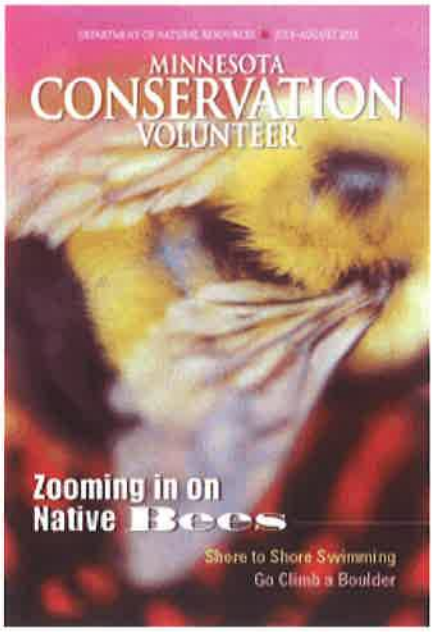
Click on topic below to reveal more information. Click again to hide.

LCCMR Pollinator Projects (starting July 1, 2013)

LCCMR Pollinator Projects (starting July 1, 2014)

LCCMR Pollinator Projects Recommended for Funding (starting July 1, 2015)

Native Bees of Minnesota's Grasslands



There are approximately 400 native bee species in Minnesota. The exact number is unknown because the most recent state species list was published in 1919. Additionally, less than 2% of Minnesota's prairie habitat remains today. It's important to record what bee species live in Minnesota and which habitats they prefer so we can practice effective pollinator conservation. To support this research, the Minnesota Biological Survey applied to the Legislative-Citizen Commission on Minnesota Resources for a grant from the Environment and Natural Resources Trust Fund. This project began July 1, 2014.

Minnesota entomologist Crystal Boyd tells about pan trapping in this instructional video. Entomologists will also collect bees using sweep nets and blue vane traps when possible.

The *Minnesota Conservation Volunteer* recently published (Jul/Aug 2015 issue) a feature article on the Minnesota Biological Survey's grassland bee surveys.

LCCMR Project ENRTF ID: 006-A

Wild Bee Surveys in Prairie-Grassland Habitats

Why are wild bees important?

Wild bees provide vital pollination services and are an integral component of species diversity in prairie-grasslands. The Minnesota Prairie Conservation Plan seeks to restore

functioning prairie systems with stable or increasing native plant diversity. Wild bee pollinators play a major role in prairie restoration efforts. Enhanced prairie condition provides food and cover for wildlife, prevents soil erosion, and promotes animal and plant diversity.

Are our wild bees in peril?

The health of our wild bee population is uncertain. We know very little about the diversity and distribution of wild bees in Minnesota. Research elsewhere suggests that wild bees have suffered serious declines as habitat loss and pesticide use have accelerated. Successful enhancement of pollinator habitat depends on baseline data about our wild bees.

Project Objectives

- Compile existing information about wild bees in Minnesota
- Conduct surveys of wild bees on native prairies in Minnesota
- Compare wild bee fauna on native versus restored prairie-grasslands

Activity 1. Checklist of wild bees in Minnesota

- Collect specimen data on Minnesota wild bees from museums
- Compile literature and reports on wild bees in Minnesota
- Develop a wild bee database
- Prepare a checklist of wild bees in Minnesota

Activity 2. Wild bees associated with native prairie

- Conduct surveys of wild bees in high-quality native prairie sites identified by the Minnesota Biological Survey
- Compare wild bee diversity with native plant species diversity
- Incorporate new findings into the Minnesota wild bee database

Activity 3. Comparison of wild bee fauna in prairie-grasslands

- Compare wild bee fauna between native prairie and restored prairie-grasslands
- Associate wild bee diversity with flowering resources
- Recommend best management practices to enhance pollinator habitat

Methods:
Field staff with the Minnesota Biological Survey will set pan traps along transects at sites across the Prairie Parkland Province and the Tallgrass Aspen Parklands Province. The pan traps are yellow, blue, or white cups that look like flowers to pollinators. The cups are filled with soapy water, and field staff return 24 hours later to retrieve the specimens that were trapped in the water.

Updates:
Please visit the Minnesota Biological Survey's News from the Field page to learn more as this project takes shape.

Native plant suppliers and landscapers in Minnesota

Recommend a business. Please include the business name, URL, and contact person's name and phone number in your message.

Native plant suppliers and landscapers lists

Lists of native plant nurseries and native vegetation consultants are organized by regions of the state. *Last updated June 20, 2016*

- Northwestern Minnesota PDF
- Northeastern Minnesota PDF
- Central Minnesota PDF
- Southern Minnesota PDF
- Out-of-State PDF

Erosion Resources

- Wildlife-friendly Erosion Control PDF
- Erosion Control Suppliers PDF

Seed Source

Remember to ask about seed source location; seed from sources closest to your site will be more adapted to local conditions.

The Minnesota Crop Improvement Association (MCIA), the state's official seed certification agency as designated by the Minnesota State Legislature, certifies native grasses and forbs to assure buyers that seed labeled with certification tags meets specified standards. The program responds to market demands for native plant materials of known and verified origin. Ask for certified seed. To contact MCIA call (800) 510-6242.

Look for plant sources from your Ecological Classification (ECS) subsection. ECS subsections are defined by glacial landforming processes, bedrock formations, local climate, topography, and the distribution of plants.

Additional Resources

- What every native plant seller should know about invasive aquatic plants PDF
- What every water gardener and shoreline restorer should know about invasive aquatic plants PDF