

M.L. 2016, Chp. 186, Sec. 2, Subd. 03b Project Abstract

For the Period Ending June 30, 2019

PROJECT TITLE: Native Bee Surveys in Minnesota Prairie and Forest Habitats

PROJECT MANAGER: Jessica Petersen

AFFILIATION: Minnesota Department of Natural Resources

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FUNDING SOURCE: Environment and Natural Resources Trust Fund

LEGAL CITATION: M.L. 2016, Chp. 186, Sec. 2, Subd. 03b

APPROPRIATION AMOUNT: \$600,000

AMOUNT SPENT: \$598,302

AMOUNT REMAINING: \$1,698

Sound bite of Project Outcomes and Results

Wild bees were surveyed in the prairie-forest region of Minnesota, in 38 counties, expanding the state list of bee species to 470. Two bee identification workshops were held in collaboration with partners. Information regarding the distribution and diversity of wild bees in Minnesota was disseminated.

Overall Project Outcome and Results

Wild bees provide vital ecosystem services including pollination, thus working to sustain resilient ecosystem functioning. Without baseline information about the diversity and distribution of bees in Minnesota, we lack the ability to provide efficient and effective conservation actions to protect bees and their habitats. We addressed these knowledge gaps by surveying natural areas in the Prairie Parkland, Tallgrass Aspen Parklands, and Eastern Broadleaf Forest ecological provinces. Since 2016, we surveyed bees using bowl traps at 70 sites and hand netting bees from flowers at 93 sites across 38 counties. Bowl trap methods were used to survey bees every three weeks during the season, for a total of up to eight survey rounds each year. These survey efforts resulted in nearly 23,000 bee specimens collected across the two methods. Several new state records were added to the list for a total of [470 species](#), up from 432 at the beginning of the project. Our survey efforts have yielded countless county-level records for many species, thus gaining valuable knowledge about the distribution of bees in Minnesota. These specimens are continually being accessioned into the permanent repository at the University of Minnesota Insect Collection. Additionally, we trained a total of 35 individuals during partnered workshops held in collaboration between the MNDNR and the U of M Bee Lab to identify wild bees of Minnesota. Staff also participated in countless outreach events, promoting bees and other pollinators to Minnesotans.

Project Results Use and Dissemination

We have conducted countless outreach presentations to the public about bees in Minnesota. Likewise, we continue to update and maintain the various MNDNR [pollinator-related websites](#). Specifically related to an update on the wild bee survey, we created a [short two-page handout](#) that summarizes the findings to date. These outreach and education efforts have provided easily-accessible information and facilitated communication concerning Minnesota's pollinators amongst researchers.



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

Date of Report: August 20, 2019

Final Report

Date of Work Plan Approval: June 7, 2016

Project Completion Date: June 30, 2019

Does this submission include an amendment request? No

PROJECT TITLE: Native Bee Surveys in Minnesota Prairie and Forest Habitats

Project Manager: Jessica Petersen

Organization: Minnesota Department of Natural Resources

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Location: Anoka, Becker, Benton, Big Stone, Blue Earth, Brown, Carver, Chippewa, Chisago, Clearwater, Cottonwood, Dodge, Douglas, Faribault, Fillmore, Goodhue, Grant, Hennepin, Houston, Isanti, Jackson, Kittson, Lac qui Parle, Le Sueur, Lincoln, Lyon, Mahnomen, Martin, McLeod, Meeker, Mille Lacs, Mower, Murray, Nicollet, Nobles, Olmsted, Otter Tail, Pennington, Polk, Pope, Ramsey, Red Lake, Renville, Rice, Rock, Roseau, Sherburne, Sibley, Stearns, Stevens, Swift, Todd, Traverse, Waseca, Washington, Watonwan, Wilkin, Winona, Wright, Yellow Medicine

Total ENRTF Project Budget:	ENRTF Appropriation:	\$600,000
	Amount Spent:	\$598,302
	Balance:	\$1,698

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 03b

Appropriation Language:

\$600,000 the second year is from the trust fund to the commissioner of natural resources to continue to assess the current status and distribution of native bee pollinators in Minnesota by expanding surveys into the prairie-forest border region and facilitating interagency collaboration and public outreach on pollinators. This appropriation is available until June 30, 2019, by which time the project must be completed and final products delivered.

I. PROJECT TITLE: Native Bee Surveys in Minnesota Prairie and Forest Habitats

II. PROJECT STATEMENT:

Wild bees, such as bumble bees and leafcutter bees, are vital components of prairie and forest ecosystems. The DNR's Minnesota Biological Survey (MBS) proposes to expand its wild bee surveys into the prairie-forest border region. Accumulated data from these and previous surveys will be disseminated in multiple ways, including bee identification workshops, the state species list of bees, and public outreach activities.

Bees and other animals pollinate an estimated 78% of plants in temperate ecosystems¹—thereby supporting native plant communities that store carbon, prevent soil erosion, and provide food and shelter for wildlife. Bees are sentinels of landscape change, and Minnesota's prairie-forest border is viewed as particularly sensitive to the effects of climate change.² Unfortunately, few wild bee studies have examined this region, and most counties beyond the metropolitan area are severely under-sampled (see map in Section IX).

The Minnesota Biological Survey proposes to address these knowledge gaps by surveying high-quality sites in portions of the Prairie Parkland, Tallgrass Aspen Parklands, and Eastern Broadleaf Forest ecological provinces. These field surveys will gather baseline data on wild bees in the western, northwestern, central, and southeastern portions of the state. By augmenting information collected through MBS's initial ENRTF-funded bee surveys (M.L. 2014-6a Wild Bee Surveys in Prairie-Grassland Habitats), these data will enable future assessments of the impacts of landscape change on the diversity and distribution of Minnesota's bee fauna.

The welfare of Minnesota's pollinators has inspired a passionate audience that is eager to learn more and participate in pollinator conservation. To date, MBS's successful education efforts have provided easily-accessible information and facilitated communication concerning Minnesota's pollinators. These efforts include the development of DNR pollinator webpages and a draft document of Pollinator Resource Values for Upland & Wetland Prairies.³ Additional efforts include co-leading a pollinator networking group, collaborating on an expert-guided bee identification workshop, and conducting numerous public outreach presentations. MBS proposes to continue and enhance these educational and collaborative efforts through a state list of wild bees, identification workshops, and public outreach activities.

III. OVERALL PROJECT STATUS UPDATES:

Project Status as of February 21, 2017:

Field surveys of wild bees and flowering plants in high-quality native prairies were conducted from July through October 2016. Pan-trap transects were run on 36 sites in the Prairie Region. Voucher specimens for approximately 7,600 bee specimens were pinned, labelled, and databased. Identification is ongoing. Specimens continue to be accessioned at the University of Minnesota Insect Collection.

The state species list of Minnesota bees continues to grow. The current tally stands at 432 species, with 29 problematic species awaiting expert confirmation. DNR volunteers and staff, in partnership with Dr. Marla Spivak and Joel Gardner (M.L. 2014-6f *Enhancing Pollinator Landscapes*), have finished databasing 25,900+ bee specimens from the University of Minnesota Insect Collection. Quality control is ongoing.

In the process of documenting bee species, this project has collected 30 potential plant county records from 14 counties. A specimen of the rusty patched bumble bee (*Bombus affinis*) was confirmed through photographic

¹ Ollerton, J., Winfree, R., & Torrant, S. (2011). How many flowering plants are pollinated by animals?. *Oikos*, 120(3), 321-326.

² Frelich, L.E., & Reich, P.B. (2010). Will environmental changes reinforce the impact of global warming on the prairie-forest border of central North America?. *Frontiers in Ecology and Environment*, 8(7), 371-378.

³ Minnesota Biological Survey. (2014). Pollinator Resource Values for Upland and Wetland Prairies. http://www.dnr.state.mn.us/pollinator_resources/index.html

documentation of a research collaboration with the Washington County Parks Division. This species has suffered severe declines over much of its range in the eastern and central United States.

Planning and preparation for the 2017 bee field surveys was initiated. Minnesota Biological Survey (MBS) plant ecologists were consulted about high-quality sites in the Prairie Region and the Eastern Broadleaf Forest Province. A meeting was scheduled with biometricalians to discuss current and future site selection.

The project coordinator/bee specialist (Crystal Boyd) delivered information on this project through 7 research collaborations, 9 educational presentations, 9 interviews and articles, and 11 conferences or meetings since the project began on July 1, 2016. She highlighted Minnesota's wild bees at a wide variety of public venues.

Amendment Request (6/1/17):

It was requested to change the due dates for status update reports by six months. This will ensure more accurate reporting and accommodate seasonal workflow. Requested changes include July 31, 2017 to October 31, 2017; December 31, 2017 to March 31, 2018; July 31, 2018 to October 31, 2018; and December 31, 2018 to March 31, 2019.

Amendment Approved: 6/1/17. Was advised that changing due dates for status update reports does not require an Amendment Request, but it should be noted in the October 2017 report.

Project Status as of October 31, 2017:

Field surveys of wild bees and flowering plants in high-quality native prairies were conducted from June through September 2017. Pan-trap transects were run on 30 sites in the Prairie and Eastern Broadleaf Forest Region. Voucher specimens for approximately 5,600 bee specimens are being pinned, labelled, and databased. Identification is ongoing. Specimens continue to be accessioned at the University of Minnesota Insect Collection.

The state species list of Minnesota bees continues to grow. The current tally stands at 432 species, with 29 problematic species awaiting expert confirmation.

In the process of documenting bee species and flowers in bloom at survey sites, this project has collected 54 potential plant county records since the project began on July 1, 2016.

Two records of the rusty patched bumble bee (*Bombus affinis*) were confirmed through photographic documentation. This species has suffered severe declines over much of its range in the eastern and central United States. Two records were also confirmed for the yellow banded bumble bee (*Bombus terricola*), which may also be experiencing population declines.

The project coordinator/bee specialist (Crystal Boyd) delivered information on this project through 13 research collaborations, 19 educational presentations, 14 interviews and articles, and 12 conferences or meetings since the project began on July 1, 2016. She has highlighted Minnesota's wild bees at a wide variety of public venues.

Amendment Request (2/15/18):

It was requested to change the project manager from Crystal Boyd to Gerda Nordquist because Crystal Boyd has accepted a new position with the National Fish and Wildlife Foundation.

Amendment Approved: 2/16/18. Was advised that changing the project manager does not require an Amendment Request, but it should be noted in the March 2018 report.

Project Status as of March 31, 2018:

Voucher specimens for approximately 3,500 bee specimens are being pinned, labelled, and databased. Identification is ongoing. Specimens continue to be accessioned at the University of Minnesota Insect Collection.

The state species list of Minnesota bees continues to grow. The current tally stands at 442 species. Two records of the yellow banded bumble bee (*Bombus terricola*) were confirmed. This species has suffered severe declines over much of its range.

In the process of documenting bee species and flowers in bloom at survey sites, this project has collected 54 potential plant county records since the project began on July 1, 2016.

Planning and preparation for the 2018 bee field surveys was initiated. Minnesota Biological Survey (MBS) plant ecologists were consulted about high-quality sites in the Prairie Region and the Eastern Broadleaf Forest Province.

The project coordinator/bee specialist (Crystal Boyd) has delivered information on this project through 15 research collaborations, 23 educational presentations, 14 interviews and articles, 13 conferences or meetings, and 2 bee identification workshops since the project began on July 1, 2016. She has highlighted Minnesota's wild bees at a wide variety of public venues.

Project Status as of October 31, 2018:

During the 2018 field season, approximately 4,000 specimens were collected through hand net and transect surveys at 125 and 20 sites respectively, covering 24 counties. All specimens have been pinned and database and identification efforts are ongoing. The rusty patched bumble bee (*Bombus affinis*) was observed during one hand net survey in Carver County. Three species were added to the state list, for a running total of 445 bee species in Minnesota.

Collaborations with various bee-related projects in Minnesota have continued, including coordination with the Minnesota Bee Atlas, the Statewide Monitoring Network, and Emilie Snell-Rood's project on Nutrition of Roadside Plants for Pollinators. MNDNR staff attended one outreach event and one conference during the reporting period.

Amendment Request (10/31/2018):

- Jessica Petersen has been hired to oversee this project. She replaces Gerda Nordquist who held the position temporarily after the departure of Crystal Boyd.
- Add to Professional/Technical/Service Contracts 1) DNR Service Level Agreements with biologists for technical services and 2) MN.IT Service Level Agreements for data and database services specific to this project.
- Move \$2,885 from Activity 2 Travel Expenses – Travel for instructors to Activity 2 Professional Contracts for instructors. This is done because contractors invoiced for all services provided as a whole – travel expenses were not broken out.
- Move \$5,000 from Activity 2 Travel Expenses – Travel for instructors to Activity 1 Professional Contracts - biologists. This is done because Travel for instructors came in well below budget. Dollars will be used for biologist contractors to provide specimen preparation and identification services.
- Move \$2,115 from Activity 2 Travel Expenses – Travel for instructors to Activity 1 Personnel. This is done to close out the travel budget for instructors that was not needed.
- Move \$2,000 from Activity 2 Equipment/Tools/Supplies to Activity 1 Personnel. This is done because Activity 2 will not use this budget and Activity 1 personnel is forecasted to be under budgeted.
- Move \$5,000 from Activity 1 Equipment/Tools/Supplies to Activity 1 Professional Contracts – MN.IT. This is done because Equipment is coming in under budget. Dollars will be used for MN.IT data and database services specific to this project deliverables.

- Move \$5,000 from Activity 1 Equipment/Tools/Supplies to Activity 1 Professional Contracts - biologists. Dollars will be used for biologist contractors to provide bee specimen preparation and identification services.

Amendment Approved 11/9/18

Project Status as of March 31, 2019:

Voucher specimens for approximately 4,000 bee specimens from 2018 have been identified and databased. From all 41,000 specimens collected by MBS, 59% of the specimens have been identified to species, 40% to genus, and 1% are unidentified. Further refinement of identifications is ongoing. Specimens continue to be accessioned at the University of Minnesota Insect Collection.

The state species list of Minnesota bees continues to grow. The current tally stands at 466 species. Four additional records of the yellow banded bumble bee (*Bombus terricola*) were confirmed. This species has suffered severe declines over much of its range.

Collaborations with various bee-related projects in Minnesota have continued. MNDNR staff attended one outreach event and two conferences during the reporting period.

Planning and preparation for the 2019 bee field surveys was initiated.

Amendment Request (3/31/2019):

- Add category to Professional/Technical/Service Contracts: Contracts with UMN per DNR-UMN Master Contract terms for entomological technical services.
- Move \$7,500 from A1 DNR SLAs (line 21) to Contracts with UMN (line 23) to direct contract dollars to UMN for bee specimen identification services.
- Move \$3,800 from A1 Travel to line 22 DNR SLAs with MN.IT. Travel budget has come in under budget. Redirect dollars to critical MN.IT work necessary to fully integrate bee data from this project into the DNR Natural Heritage System.
- Move \$4,172 from A1 Travel to line 23 DNR contract with UMN. A1 travel has come in under budget. Redirect a portion of the travel remaining budget to UMN for bee specimen identification services.
- Move \$34,918.84 from A2 Personnel to A1 Personnel. A2 is complete and came in under budget. Redirect A2 personnel remaining budget to A1 personnel for field survey and data processing.
- Move \$876 from A2 Printing to A1 Personnel. A2 printing is complete and came in under budget. Redirect A2 printing remaining budget to A1 personnel for field survey and data processing.
- Move \$4,347 from A1 Equipment to A1 Personnel. A1 equipment is complete and came in under budget. Redirect A1 equipment remaining budget to A1 personnel for field survey and data processing.
- Move \$24,500 from A1 Travel to A1 Personnel. A1 Travel has come in under budget. Redirect a portion of A1 travel remaining budget to A1 personnel for field survey and data processing.

Amendment Approved by LCCMR 4/29/2019

Amendment Request (7/19/2019):

- Final budget close-out moves to correct small negative balances in the final budget. Travel expenses were under budget. Redirect travel expenses to equipment and personnel.
- Move \$921 from A1 Personnel to A2 Personnel.
- Move \$3,276 from A1 Travel Expenses to Equipment/Tools/Supplies
- Adjust Direct & Necessary A1 and A2 budgets to match proportional Amount Spent for each Activity. New A1 D&N budget = \$32,565.36, new A2 D&N budget = \$2,078.64

Amendment Approved (10/2/2019)

Overall Project Outcomes and Results:

The fundamental objectives of this project have been completed, including two partnered bee identification workshops, continually updating and adding to the state species list of bees, and conducting and participating in public outreach activities. Over the course of the Minnesota Wild Bee Survey we have successfully surveyed the Prairie Parkland, Tallgrass Aspen Parkland, and Eastern Broadleaf Forest Ecological Provinces. Because of the efforts of this project, the state species list has grown to 470 likely bee species in Minnesota, up from 432 at the beginning of the project in 2016. These baseline data will give future researchers a foundation upon which to build.

IV. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1: Native Bee Surveys in Minnesota Prairie and Forest Habitats

Description:

Surveys of wild bees and associated flowering plants will continue on a subset of high-quality native prairie sites in the Prairie Parkland and Tallgrass Aspen Parkland Provinces that were surveyed in MBS's previous grant (M.L. 2014-6a Wild Bee Surveys in Prairie-Grassland Habitats). Collected data will document annual variability of bee fauna and establish a baseline from which to assess the effects of future environmental change. Surveys will begin in forested and open habitats within the Eastern Broadleaf Forest Province. Surveys will continue through the active foraging period to maximize the diversity of species documented. Data will be evaluated in the context of phenology and landscape characteristics.

Approach:

Prairie and forest sites will be selected in the Minnesota Prairie Region and Eastern Broadleaf Forest Province. Bee trap transects will be run repeatedly at each site from April through October in prairie sites or until leaf out in forest sites to maximize diversity. 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 University of Minnesota Insect Collection.

*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 and other insects and arachnids captured during the survey will be collected and retained for a period of time for future investigations.

Summary Budget Information for Activity 1:

ENRTF Budget: \$564,710

Amount Spent: \$563,013

Balance: \$ 1,698

Outcome	Completion Date
1. Selection of up to 15 native prairie sites in the prairie region	July 2016
2. Selection of up to 35 survey sites in the Eastern Broadleaf Forest Province	March 2017
3. Field surveys of wild bees and associated plant species	June 2019
4. Data entry, specimen preparation, and delivery of specimens to museum collections	June 2019
5. Summarize findings, add to state species list, and distribute to partners	June 2019

Activity Status as of February 21, 2017:

Transect Dates for Pan Trap Surveys

2016 Western Sites	2016 Central Sites
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June 27 – 30 (M.L. 2014-6a Wild Bee Surveys in Prairie-Grassland Habitats)	July 1 - 2
July 18 - 21	July 18 - 19
August 17 – 18 and 21 - 23	August 17 - 18
September 17 - 19	September 19 - 20
October 9 – 11	n/a

Field Survey

From July through October 2016, surveys for wild bees and associated plant species were conducted approximately every three weeks along transects at 36 sites in the Minnesota Prairie Region. Field staff also spent 14 days in 14 counties hand netting over 220 specimens to augment county records and improve distribution maps.

Specimen Preparation

More than 7,600 bee voucher specimens (approximately 50% of the specimens collected in 2016) were sorted, pinned, labelled, and databased at the field stations. Identification is ongoing, with over 30% of bee specimens from 2016 identified to species and many more identified to genus before final identification to species. Specimens continue to be accessioned at the University of Minnesota Insect Collection. Non-bee specimens were preserved in ethanol for long-term storage.

DNR staff and volunteers collaborated with Dr. Marla Spivak and Joel Gardner (M.L. 2014-6f *Enhancing Pollinator Landscapes*) to finish databasing 25,900+ historic bee specimens at the University of Minnesota Insect Collection. DNR staff and volunteers databased approximately 50% of the specimens. Joel Gardner databased the remaining specimens and confirmed their identifications.

Data Entry

Upon completion of the 2016 field season, datasheets and field notebooks were archived. A backup system for data storage was implemented, and a data management project was revised. Field equipment and supplies were inventoried.

Site Selection and Field Season Preparation

In preparation for the 2017 field season, a subset of high-quality native prairie sites were selected that were surveyed in MBS's previous grant (M.L. 2014-6a *Wild Bee Surveys in Prairie-Grassland Habitats*). Sites were also selected in forested and open habitats within the Eastern Broadleaf Forest Province. A meeting was arranged with WEST Consulting to discuss current and future site selection. Additionally, DNR staff revised datasheets, posted positions for seasonal staff, drafted permit applications, purchased supplies, and evaluated lodging for the field season.

Noteworthy Observations

Project manager Crystal Boyd confirmed a photo observation of the federally listed rusty patched bumble bee (*Bombus affinis*) through a research collaboration with the Washington County Parks Division. Data was also obtained for *B. affinis* from the U.S. Fish and Wildlife Service for the DNR's Observation Database. Plant specimens were processed and potentially 30 plant county records from 14 counties were identified. Confirmation of plant identifications is ongoing.

Activity Status as of October 31, 2017:

Transect Dates for Pan Trap Surveys

2017 Central Sites	2017 North-West Sites	2017 Camp Ripley Sites
June 5 - 6	July 13 - 14	August 7 - 8
June 26 - 27	August 23 - 24	August 22 - 23

July 24 - 25	September 12 - 13	September 21 - 22
August 19 - 20		
September 8 - 9		
September 21 - 22		

Field Survey

From June through September 2017, surveys for wild bees and associated plant species were conducted approximately every three weeks along transects at 30 sites in the Minnesota Prairie and Broadleaf Forest Regions. Survey equipment was set up at an additional 5 sites that were not surveyed due to proximity to recent records of rusty patched bumble bee (*Bombus affinis*). Field staff also spent 24 days in 37 counties hand netting over 510 specimens. Using both approaches augments county records and improves distribution maps.

Specimen Preparation

In 2017, an estimated 5,600 bee specimens were collected. Over 510 specimens collected with handnets are pinned, labelled, and databased. Specimen processing and identification for the remaining specimens is ongoing, and specimens continue to be accessioned at the University of Minnesota Insect Collection. Non-bee specimens were preserved in ethanol for long-term storage and potential future analysis.

Data Entry

Datasheets and field notebooks are being archived. A data management project is being revised, and new methods are being developed for submitting bee data to the DNR's Observation Database. Batch uploading of an estimated 59,000 records is expected for data compiled through DNR field surveys, historic records at the University of Minnesota Insect Collection, and collaborations with research partners.

Noteworthy Observations

Project manager Crystal Boyd confirmed two photo observations of the federally listed rusty patched bumble bee (*Bombus affinis*). Two records were also confirmed for the yellow banded bumble bee (*Bombus terricola*), which is facing similar population declines. Plant specimens were processed including potentially 24 plant county records from 17 counties. Confirmation of plant identifications is ongoing.

Activity Status as of March 31, 2018:

Specimen Preparation

Specimens continue to be processed and accessioned at the University of Minnesota Insect Collection. For example, 100% of the 10,500 bee voucher specimens from 2016 are pinned, labelled, and identified to the subgenus or species level. In 2017, approximately 3,500 bee specimens were collected (excluding specimens in the subgenus *Dialictus*), and 100% are pinned and labelled. Identification to the genus and species level is ongoing. Non-bee specimens are preserved in ethanol for long-term storage and potential future analysis.

Data Entry

Datasheets and field notebooks are being archived . A data management project is being revised, and new methods are being developed for submitting bee data to the DNR's Observation Database. Batch uploading of an estimated 59,000 records is expected for data compiled through DNR field surveys, historic records at the University of Minnesota Insect Collection, and collaborations with research partners.

Site Selection and Field Season Preparation

In preparation for the 2018 field season, plant ecologists with the Minnesota Biological Survey (MBS) were consulted about high-quality sites in the Prairie Region and the Eastern Broadleaf Forest Province. Additionally, DNR staff revised datasheets, posted positions for seasonal staff, drafted permit applications, purchased supplies, and evaluated lodging for the field season.

Noteworthy Observations

Project manager Crystal Boyd confirmed two records of the yellow banded bumble bee (*Bombus terricola*), which is proposed for listing as a federally endangered species. The yellow banded bumble bees were observed in Pennington and Morrison counties during the 2017 field season, and the data were shared with the DNR's Endangered Species Coordinator, Rich Baker. Plant specimens were processed including potentially 24 plant county records from 17 counties. Confirmation of plant identifications is ongoing.

Activity Status as of October 31, 2018:

Field Survey

From June through September, 2018 bowl transect surveys for bees were conducted at 20 sites, approximately every three weeks in the Minnesota Prairie and Broadleaf Forest Regions. Additional hand netting surveys were conducted at 125 sites to improve upon our understanding of species distributions. A total of 24 counties were surveyed for bees in 2018. Six bee-sampling sites overlapped with the Ecological Monitoring Network long-term vegetation monitoring sites in order to better understand the relationships between plants and pollinators. These six sites were sampled a total of 18 times throughout the season.

Specimen Preparation

In 2018, 2,700 specimens from bowl trap transect surveys and 1,200 specimens from hand netting surveys have been pinned and labelled. Identification of the nearly 4,000 specimens is ongoing. Specimens continue to be accessioned at the University of Minnesota Insect Collection upon final identification confirmation. Non-bee specimens were preserved in ethanol for long-term storage and potential future analysis.

Data Entry

Data entry for specimens collected in 2018 is ongoing. A relational database was created for efficient entry of 2018 data and seamless uploading to the DNR's Observation Database.

Noteworthy Observations

Three observations of a federally endangered bee, the rusty patched bumble bee (*Bombus affinis*) were made during a hand netting survey in Carver County in July, 2018. Individuals were not collected, but identifications were confirmed via photographs. These data were shared with the DNR – Endangered Species Coordinator, Rich Baker and USFWS staff.

Activity Status as of March 31, 2019:

Specimen Preparation

Approximately 41,000 bee specimens have been pinned, labeled, and databased. Of these specimens 59% are to species, 40% to genus or subgenus, and 1% are unidentified. Identification to the genus and species level is ongoing. A taxonomist has confirmed 18% of the specimens. Confirmations of specimens is ongoing. Specimens continue to be accessioned at the University of Minnesota Insect Collection upon final identification confirmation. Non-bee specimens were preserved in ethanol for long-term storage and potential future analysis.

Data Entry

Data entry for specimens collected in 2018 has been completed. A data management project is underway and testing of phase one is almost completed. New methods are being developed for submitting bee data to the DNR's Observation Database.

Site Selection and Field Season Preparation

In preparation for the 2019 field season, DNR staff revised datasheets, posted positions for seasonal staff, drafted permit applications, purchased supplies, and evaluated lodging for the field season.

Noteworthy Observations

Four records of the yellow banded bumble bee (*Bombus terricola*) were confirmed, which is proposed for listing as a federally endangered species. The yellow banded bumble bees were observed in Becker, Clay, Clearwater,

and Morrison counties during the 2018 field season, and the data were shared with the DNR's Endangered Species Coordinator, Rich Baker.

Final Report Summary:

Bees were surveyed in 38 counties during the duration of this proposal, across three field seasons (2016-2018) using hand netting of bees from flowers at 93 sites and bowl trapping at 70 sites (Figure 1). These survey efforts resulted in a total of 22,897 specimens. In total, nearly 41,000 specimens have been collected through the Minnesota Bee Survey (Figure 2). These efforts have also yielded expanded county-level records for many species, thus gaining knowledge about the distribution of bee species within Minnesota (Figure 3).

Approximately 85% of the identifiable specimens collected to date have been confirmed and entered into the MNDNRs bee database, including many difficult genera, such as *Ceratina*, *Coelioxys*, *Pseudopanurgus*, and *Megachile*. Multiple new state records were found, including the rare and poorly known species *Pseudopanurgus renimaculatus* and *Dianthidium pudicum*. Species in the genus *Lasioglossum* subgenus *Dialictus* are particularly difficult to identify, and yet over 50% of these specimens have been confirmed. From these confirmations, there are two new state records: *Lasioglossum coreopsis* and *Lasioglossum trigeminum*. The total state bee species list is now at 470. Some bee taxa including groups like *Melissodes* and *Nomada* are essentially impossible for anyone, including trained taxonomists, to identify to species, including the specimens of these groups collected during this project. These specimens will remain identified to the lowest possible taxonomic rank until further identification keys are available. Specimens are continually being accessioned into the University of Minnesota Insect Collection in St. Paul following identification confirmation, database edits, and applying a barcode using the U of M Specify database system.

We continue to update the database, with plans to soon launch formats to access these data online. One format will be a species list and county maps app, similar [MNTaxa](#) that was developed for plants. The app will list animals, including bees surveyed through this project, with species listed for each county. In the meantime, we have filled public data requests from partners for county-level bee species data on an individual basis.

ACTIVITY 2: Continuation of Pollinator Education and Outreach

Description:

The Minnesota Biological Survey will continue to develop summary documents on native bees and collaborate with state pollinator partners to enhance information exchange among agencies, professionals, nonprofit organizations, and private citizens. Documents will include an updated state species list of bees and dedicated DNR webpages. Outreach activities will include collaborative bee identification workshops that increase technical expertise and foster networking among bee researchers. MBS will also conduct presentations for school groups, nonprofit organizations, and other community groups.

Approach:

Publications, presentations, and web-based products will be developed to provide information to a variety of audiences. A webpage on wild bees will continue to be supported 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, and link to the MNDNR Nongame Wildlife Program and other external websites that feature bees. Bee identification workshops will be organized in collaboration with the University of Minnesota and other partners. The project's coordinator will respond to inquiries about bees and requests to participate in symposia, give presentations, and provide information for news reports and articles.

Summary Budget Information for Activity 2:

ENRTF Budget: \$ 35,290

Amount Spent: \$ 35,290
Balance: \$ 0

Outcome	Completion Date
1. Compile data and develop summary products and graphics on wild bees	December 2018
2. Collaborate with state pollinator partners to host bee identification workshops	March 2019
3. Conduct public outreach activities	Ongoing

Activity Status as of February 21, 2017:

A draft version of the Minnesota state species list of bees was released in August 2016. This living document is continually updated as new state records are confirmed. It is available as a PDF on the project's webpage.⁴ Maintenance for this webpage and other DNR pollinator webpages is ongoing.^{5⁶7}

Pollinator information was communicated to the Governor's Committee on Pollinator Protection, the Interagency Pollinator Protection Team, and the DNR's pollinator listserv. Technical guidance was provided for the Environmental Quality Board's *Pollinator Report* and the DNR's *Minnesota Native Pollinator Action Plan*. Permit applications were reviewed for pollinator projects conducted by external collaborators and other researchers on state-administered lands.

Communication with the public is ongoing. The DNR's Native Plant Suppliers webpage⁸ was updated in response to feedback from the Minnesota Department of Agriculture's Pollinator Summit. Bee identification workshops were discussed with potential collaborators.

Research Collaborations

- Provided guidance to three other pollinator research projects and/or accepted specimens of Minnesota bees:
 - Three Rivers Park District, 2016 pollinator surveys
 - Minnesota Department of Agriculture, bycatch from 2016 agricultural pest surveys
 - Washington County Parks Division, 2016 bumble bee survey
- Provided technical guidance for MnDOT's project concerning rusty patched bumble bee (*Bombus affinis*) in roadsides
- Acted as project manager for DNR's Technical Advisory Panel for Dr. Emilie Snell-Rood's recommended project concerning pollinators in roadsides (M.L. 2017-152f *Optimizing the Nutrition of Roadside Plants for Pollinators*)
- Participated in conversations related to monitoring pollinators through the *Minnesota Prairie Conservation Plan* and the DNR's habitat monitoring project (M.L. 2016-4a *Statewide Monitoring Network for Minnesota's Changing Habitats*)

Technical Guidance

⁴ MN-DNR. *Native Bees of Minnesota's Grasslands*. <http://www.dnr.state.mn.us/mbss/grasslandbees.html>

⁵ MN-DNR. *Minnesota's Pollinators*. <http://www.dnr.state.mn.us/pollinators/index.html>

⁶ MN-DNR. *Minnesota Pollinator Resources*. http://www.dnr.state.mn.us/pollinator_resources/index.html

⁷ MN-DNR. *Pollinator Resource Values for Upland & Wetland Prairies*.

http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf

⁸ MN-DNR. *Minnesota Native Plant Suppliers and Landscapers*.
<http://www.dnr.state.mn.us/gardens/nativeplants/suppliers.html>

- Helped MBS herpetologist Carol Hall obtain identifications for fly specimens from turtle nests, October 2016
- Responded to 1 request for an informational/career guidance interview: 1-13-17
- Coordinated donation of a historical insect collection from the Brainerd area to UMN, 7-29-16
- Provided technical guidance for DNR's Pollinator License Plate Committee, ongoing
- Provided general technical guidance about invertebrates by phone and email for the public, ongoing

Presentations and Outreach Events

- Timespan: 7/1/16 – 3/9/17
- Offered guidance for 5 events
- Gave presentations at 9 events:
 - Pollinator Party in the Minneapolis Parks, 7-28-16
 - Presentation to homeschooled group, 9-26-16
 - TriCounty Beekeepers Association, 10-4-16
 - Goodhue Elementary School (through Skype), 11-16-16
 - TNC Brown Bag Lunch Series, 1-19-17
 - DNR Commissioner's Advisory Committee Meeting, 2-1-17
 - EQB's Environmental Congress, 2-3-17
 - Bemidji State Wildlife Club (through Skype), 2-28-17
 - Indigenous Farming Conference, 3-3-17

Articles and Interviews

- Daily Globe, "[Ride with mom leads to lessons on bees, porcupine grass](#)," 7-28-16
- Minnesota Lottery video, "[Minnesota Lottery Proceeds Help Native Bee Populations](#)," 8-15-16
- Responded to interview questions for the DNR's career pamphlet, August 2016
- Provided information for UMN's annual entomology newsletter, December 2016
- Drafted article about wasps for Minnesota Conservation Volunteer, January 2017
- KTPP Rochester, "[Endangered: Saving the Rusty Patched Bumble Bee and Other Pollinators](#)," 2-7-17
- WTIP North Shore Radio, 3-9-17
- Drafted research update for DNR's Scientific and Natural Areas newsletter, February 2017
- Drafted letter about pollinator habitat for Metropolitan Council, February 2017
- Provided content for MBS updates and SNA/Nongame facebook pages, ongoing

Conferences and Meetings

- EQB's Results-Based Accountability Workshop, 9-9-16
- UMN Soybean Aphids and Prairie Butterflies Symposium, 11-15-16
- Monarch Joint Venture Annual Meeting, 11/17-18/16
- LCCMR Pollinator Meet & Greet, 12-7-16
- TNC Science Slam, 12-15-16
- UMN and Minnesota Bee Atlas Data Meeting (M.L. 2015-11a *Minnesota Native Bee Atlas: A Citizen Science Project*), 1-20-17
- EQB Environmental Congress, 2-3-17
- MBS Habitat Monitoring Planning Meeting (M.L. 2016-4a *Statewide Monitoring Network for Minnesota's Changing Habitats*), 3-1-17

Activity Status as of October 31, 2017:

A draft of the Minnesota state species list of bees is available as a PDF on the project's webpage.⁹ This living document is continually updated as new state records are confirmed. Maintenance for the project webpage and other DNR pollinator webpages is ongoing.¹⁰¹¹¹²

Communication with the public is ongoing. Planning has begun for two bee identification workshops, in partnership with the University of Minnesota Bee Lab and other researchers.

Research Collaborations

- Provided guidance to two other pollinator research projects and/or accepted specimens of Minnesota bees:
 - Minnesota Department of Agriculture, bycatch from 2017 pest surveys
 - USFWS exploration of regional pollinator monitoring, October 2017
- Compiled data on native bees and thistles for Xerces Society publication, [Native Thistles: A Conservation Practitioner's Guide](#), March 2017
- Provided data for USFWS's Species Status Assessment for the yellow banded bumble bee (*Bombus terricola*), July 2017
- Submitted analysis of survey efforts and data gaps to the Minnesota Bee Atlas (M.L. 2015-03g *Minnesota Native Bee Atlas: A Citizen Science Project*), August 2017
- Compiled data on abnormal wing venation for publication by Gene Scarpulla, August 2017
- Acted as project manager for DNR's Technical Advisory Panel for Dr. Emilie Snell-Rood's recommended project concerning pollinators in roadsides (M.L. 2017-152f *Optimizing the Nutrition of Roadside Plants for Pollinators*), ongoing
- Served as DNR representative for MnDOT's research on rusty patched bumble bees in roadsides, ongoing
- Served as DNR liaison to USFWS rusty patched bumble bee team and 2 subteams (Habitat and Year 1 Actions), ongoing

Technical Guidance

- Responded to 4 requests for an informational/career guidance interviews: 5-15-17, 8-2-17, 8-5-17, 9-27-17
- Served as team member of Minnesota Prairie Conservation Plan Review Team, November 2016 – March 2017
- Reviewed permit applications for Scientific and Natural Areas and Parks & Trails, spring 2017
- Participated in compiling information, writing text, and incorporating edits for the [Minnesota State Agency Pollinator Report](#), August 2016 – August 2017
- Acted as project manager for DNR's Pollinator Action Plan, through September 2017
- Provided technical guidance for DNR's Pollinator License Plate Committee, ongoing
- Provided general technical guidance about invertebrates by phone and email for the public, ongoing

⁹ MN-DNR. *Native Bees of Minnesota's Grasslands*. <http://www.dnr.state.mn.us/mbs/grasslandbees.html>

¹⁰ MN-DNR. *Minnesota's Pollinators*. <http://www.dnr.state.mn.us/pollinators/index.html>

¹¹ MN-DNR. *Minnesota Pollinator Resources*. http://www.dnr.state.mn.us/pollinator_resources/index.html

¹² MN-DNR. *Pollinator Resource Values for Upland & Wetland Prairies*.

http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf

Presentations and Outreach Events

- Timespan: 3/10/17 – 10/10/17
- Offered guidance for 3 events
- Gave presentations at 10 events:
 - Twin Ports Climate Coalition, 3-21-17
 - DNR Information Center Training, 3-30-17
 - DNR Fire Management Training, 4-5-17
 - Governor's Committee on Pollinator Protection Meeting, 4-27-17
 - Metropolitan Mosquito Control District Pesticide Applicator Training, 7-27-17
 - Pollinator Party in the Minneapolis Parks, 7-27-17
 - DNR Senior Management Team Meeting, 8-28-17
 - Pollinator Summit at Minnesota Landscape Arboretum, 9-15-17
 - Federal Aid Coordinators Meeting, 10-3-17
 - Little Falls High School, 10-10-17
 - MBS Annual Meeting, 10-19-17

Articles and Interviews

- Timespan: 3/10/17 – 10/31/17
- Responded to 7 requests for articles or interview
 - SNA Nature Notes, "[Bee-watching Across Minnesota](#)," March 2017
 - WTIP North Shore Radio, "[Specialist Discusses Future of North Shore Bees](#)," 3-12-17
 - Met Council PlanIt Training Series article, "[Pollinators for Comprehensive Plans](#)," 4-5-17
 - Two Harbors Community Radio, not available online, April 2017
 - Minnesota Conservation Volunteer, "[Wonderful Wasps](#)," May 2017
 - Rochester Post, "[Bees Abuzz in Southeast Minnesota](#)," 8-1-17
 - KAXE Radio Grand Rapids, "[Plant Local Native Wildflowers](#)," 8-8-17
- Provided content for MBS updates and SNA/Nongame facebook pages, ongoing

Conferences and Meetings

- Pollinator Summit at Minnesota Landscape Arboretum, 9-15-17

Activity Status as of March 31, 2018:

A draft of the Minnesota state species list of bees was updated in March 2018. The living document is continually updated as new state records are confirmed, and it is available as a PDF on the project's webpage.¹³ Maintenance for the project webpage and other DNR pollinator webpages is ongoing.^{14¹⁵16}

Pollinator information was communicated to the Governor's Committee on Pollinator Protection, the Interagency Pollinator Protection Team, and the DNR's pollinator listserv. Communication with the public is ongoing. Two bee identification workshops were hosted in partnership with the University of Minnesota Bee Lab and other researchers. The workshops included 35 participants from 12 states and 2 Canadian provinces. They also included four public outreach events, reaching more than 120 people.

¹³ MN-DNR. *Native Bees of Minnesota's Grasslands*. <http://www.dnr.state.mn.us/mbs/grasslandbees.html>

¹⁴ MN-DNR. *Minnesota's Pollinators*. <http://www.dnr.state.mn.us/pollinators/index.html>

¹⁵ MN-DNR. *Minnesota Pollinator Resources*. http://www.dnr.state.mn.us/pollinator_resources/index.html

¹⁶ MN-DNR. *Pollinator Resource Values for Upland & Wetland Prairies*.

http://files.dnr.state.mn.us/natural_resources/npc/pollinator_booklet.pdf

Research Collaborations

- Accepted specimens of Minnesota bees from one other pollinator research project: Minnesota Department of Agriculture, bycatch from additional 2017 pest surveys
- Submitted analysis of survey efforts and data gaps to the Minnesota Bee Atlas (M.L. 2015-03g *Minnesota Native Bee Atlas: A Citizen Science Project*), February 2018
- Compiled data on abnormal wing venation for publication by Gene Scarpulla, February 2018
- Followed up on data about honey bee specimens and pesticide residue submitted to Dr. Da Chen for publication, February 2018
- Provided data to DNR's Endangered Species Coordinator, Rich Baker, about the yellow banded bumble bee (*Bombus terricola*), February 2018
- Acted as project manager for DNR's Technical Advisory Panel for Dr. Emilie Snell-Rood's project concerning pollinators in roadsides (M.L. 2017-152f *Optimizing the Nutrition of Roadside Plants for Pollinators*), through December 2017
- Served as DNR representative for MnDOT's research on rusty patched bumble bees in roadsides, through February 2018
- Served as DNR liaison to USFWS rusty patched bumble bee team and 2 subteams (Habitat and Year 1 Actions), through February 2018

Technical Guidance

- Responded to 1 request for an informational/career guidance interview: 11-8-17
- Reviewed permit applications for Scientific and Natural Areas and Parks & Trails, spring 2018
- Provided general technical guidance about invertebrates by phone and email for the public, ongoing

Presentations and Outreach Events

- Timespan: 10/11/17 – 3/31/18
- Offered guidance for 2 events
- Gave presentations at 3 events:
 - Faribault's River Bend Nature Center, 11-15-17
 - St. Paul Academy, 11-17-17
 - Presbyterian Clearwater Forest, 2-24-18

Conferences and Meetings

- LCCMR Pollinator Meet & Greet, 3-9-18

Activity Status as of October 31, 2018:

Research Collaborations

- UMN and Minnesota Bee Atlas Data Meeting (M.L. 2015-11a *Minnesota Native Bee Atlas: A Citizen Science Project*), 9-18-18
- Field season update with Dr. Emilie Snell-Rood's project concerning pollinators in roadsides (M.L. 2017-152f *Optimizing the Nutrition of Roadside Plants for Pollinators*), 9-13-18
- Research coordination with project lead, Hannah Texler (MNDNR) regarding interactions between pollinators and the plant community (M.L. 2016 004-A *Statewide Monitoring Network for Minnesota's Changing Habitats*), ongoing

Technical Guidance

- Reviewed the USFWS Species Status Assessment for the yellow banded bumble bee (*Bombus terricola*) September, 2018
- Reviewed the Interagency Pollinator Protection Team, 2018 Annual Report, October, 2018

Presentations and Outreach Events

- Pollinator Party in Minneapolis Parks, 7-26-18

Conferences and Meetings

- Pollinator Summit, 10-12-18

Activity Status as of March 31, 2019:

Research Collaborations

- Accepted specimens of Minnesota bees from one other pollinator research project: Minnesota Department of Agriculture, bycatch from additional 2018 pest surveys
- Served as DNR representative for MnDOT's research on rusty patched bumble bees in roadsides

Technical Guidance

- Pollinator information was communicated to the Governor's Committee on Pollinator Protection, the Interagency Pollinator Protection Team, and the DNR's pollinator listserv.
- Provided general technical guidance about invertebrates by phone and email for the public, ongoing
- Updated the DNR website, '[Wild Bees in Minnesota](#)' to include an [updated state species list of bees](#) and a project [informational handout](#).
- Provided guidance to DNR projects related to long-term bee monitoring methods.

Presentations and Outreach Events

- The Nature Conservancy Science Slam, 1-17-19
- The Minnesota Wildlife Society meeting, 2-21-19

Articles and interviews

- Fergus Falls Journal, "[Native bees in Minnesota](#)", 12-2-18

Conferences and Meetings

- Best Practices for Pollinators Summit, 3-7-19

Final Report Summary:

Two bee identification workshops were supported with this funding, successfully training 35 individuals to identify bees. Many articles, presentations and outreach events were produced throughout the duration of the funding. In particular, the staff supported through this funding acted as taxa experts for the rusty-patched bumble bee species status assessment and recovery planning workshops facilitated by the U.S. Fish and Wildlife Service. We continue to maintain and update the various websites pertaining to the Minnesota Wild Bee Survey, including updating the state species list and reports.

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. It will be linked to other databases within the MNDNR and will be shared with our partners working on separate bee and pollinator projects.

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, 2014 ENRTF 146-F)
- Minnesota Pollinator Partnership (Pheasants Forever, 2014 ENRTF 072-C)
- Protecting Bees by Understanding Systemic Insecticides (UM, 2014 ENRTF 151-F)
- Minnesota Native Bee Atlas: A Citizen Science Project (UM, 2015 ENRTF 011-A)
- Effects of Grazing Versus Fire for Prairie Management (UM, 2015 ENRTF 009-A)
- Prairie Butterfly Conservation, Research and Breeding Program (MN Zoological Garden and MNDNR, 2014 ENRTF 017-A and 2016 ENRTF 017-A)
- Statewide Monitoring Network for Minnesota's Changing Habitats (MNDNR, ENRTF 2016 004-A)
- Data Driven Pollinator Conservation (UM, 2016 ENRTF 003-A)
- Bee Pollinator Habitat Enhancement (UM, 2016 ENRTF 155-F)
- Measuring Prairie Fragment Connectivity: Pollen and Seed Dispersal (UM, 2016 ENRTF 162-F)
- Seeding Between the Lines: Permanent Habitat Within Rowcrops (Science Museum of Minnesota, 2016 ENRTF 154-F)

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. Data associated with plant county records will be reported to MNDNR's checklist of vascular plant species, MNTaxa.

Status as of February 21, 2017:

Bee specimen data continues to be added to databases. DNR staff and volunteers have collaborated with Dr. Marla Spivak and Joel Gardner (M.L. 2014-6f *Enhancing Pollinator Landscapes*) to finish databasing 25,900+ historical specimens housed at the University of Minnesota Insect Collection. Quality control for this dataset is ongoing. In 2016, over 7,600 bee specimens were pinned, labelled, and databased. Identification work is ongoing. Specimens are in the process of being accessioned at the University of Minnesota Insect Collection. Please see Activity 1 for more details about data management and voucher specimens of insects and plants.

The project coordinator responded to numerous inquiries about bees and pollinators, including requests from the Governor's Committee on Pollinator Protection, Interagency Pollinator Protection Committee, and Environmental Quality Board. Please see Activity 2 for more details about research collaborations, technical guidance, presentations, outreach events, articles, interviews, conferences, and meetings.

Status as of October 31, 2017:

Bee specimen data continues to be added to databases. In 2017, an estimated 5,600 bee specimens were collected. Processing and identification work is ongoing, and specimens are being accessioned at the University of Minnesota Insect Collection. Please see Activity 1 for more details about data management and voucher specimens of insects and plants.

The project coordinator responded to numerous inquiries about bees and pollinators, including requests from the Governor's Committee on Pollinator Protection, Interagency Pollinator Protection Committee, and Environmental Quality Board. Please see Activity 2 for more details about research collaborations, technical guidance, presentations, outreach events, articles, interviews, conferences, and meetings.

Status as of March 31, 2018:

Bee specimen data continues to be added to databases. In 2017, approximately 3,500 bee specimens were collected and pinned. Processing and identification work is ongoing, and specimens are being accessioned at the University of Minnesota Insect Collection. Quality control for datasets also continues, including for 25,900+

historical specimens housed at the University of Minnesota Insect Collection and databased by DNR staff and volunteers in collaboration with Dr. Marla Spivak and Joel Gardner (M.L. 2014-6f *Enhancing Pollinator Landscapes*). Please see Activity 1 for more details about data management and voucher specimens of insects and plants.

The project coordinator responded to numerous inquiries about bees and pollinators, including requests from the Governor's Committee on Pollinator Protection, Interagency Pollinator Protection Committee, and Environmental Quality Board. Please see Activity 2 for more details about research collaborations, technical guidance, presentations, outreach events, articles, interviews, conferences, and meetings.

Status as of October 31, 2018:

Bee specimen data continues to be added and compiled into a single, relational database so that a final species list can be created during the next reporting period. The nearly 4,000 specimens collected and pinned over the last reporting period are now being entered into a database and identified to species. Coordination with the University of Minnesota Insect Collection staff continues to support seamless transfer of specimens and associated data including facilitating their new system of specimen barcoding. MNIT has created a bee data app and testing is underway.

Status as of March 31, 2019:

Bee specimen data continues to be added and compiled into a single, relational database so that a final species list can be created during the next reporting period. The nearly 4,000 specimens collected and pinned over the last reporting period are now entered into a database and identified to genus or species. Coordination with the University of Minnesota Insect Collection staff continues to support seamless transfer of specimens and associated data including facilitating their new system of specimen barcoding.

Data on all *Bombus* collected was shared with USFWS to assist in conservation and management actions specifically tied to rusty-patched bumble bee conservation. As part of our permit requirements, a single rusty-patched bumble bee collected in a pan trap, identified in 2018 and confirmed by several experts, was sent to the USDA Bee Lab in Logan, Utah.

Final Report Summary:

Throughout the duration of this project we have collaborated with many partners listed at the onset of the workplan section. Bee specimens have been accessioned into the Insect Collection at the University of Minnesota. Data associated with bee specimens will be stored in the MNDNR Observation Database. Data have been shared through individual requests and will continue to become more accessible through a web app similar to MNTaxa.

VI. PROJECT BUDGET SUMMARY:

A. Preliminary ENRTF Budget Overview: *This section represents an overview of the preliminary budget at the start of the project. It will be reconciled with actual expenditures at the time of the final report.

Budget Category	\$ Amount	Overview Explanation
Personnel:	\$ 414,115	1 project manager at 100% FTE each year for 3 years (\$210,000); 1 data manager at 5% FTE each year for 3 years (\$13,000); 1 entomologist at 50% FTE each year for 3 years (\$87,000); 1 botanist at 50% FTE each year for 3 years; 1 graphics/web designer at 5% FTE each year for 3 years (\$13,000).
Professional/Technical/Service Contracts:	\$ 26,885	1 contract for workshop instructor TBD through competitive bid. 1 contract for a biologist and 1 contract for MNIT.
Equipment/Tools/Supplies:	\$ 23,156	Field supplies needed to conduct surveys, including GPS units, maps, data recorders, cameras, traps, nets, collecting containers, and first-aid and safety equipment (~\$8,000). Specimen preparation and storage supplies, including pins, pinning boards, specimen driers, cabinets, drawers, unit trays, and microscopes (~\$20,656). Data compilation and storage, including Fleet lease of computers and external hard drives (~\$4,500).
Printing:	\$ 1,200	Printing of handouts, workbooks, and identification guides for workshops and outreach presentations.
Travel Expenses in MN:	\$ 100,000	Travel to conduct field surveys of bees. Mileage: \$57,000. Lodging: \$15,000. Meals: \$28,000.
Other:	\$ 34,644	Direct and necessary costs: HR Support (~\$11,786); Safety Support (~ \$2,778); Financial Support (~\$9,418); Communication Support (~ \$1,236); IT Support (~\$8,382); Planning Support (~\$829); and Procurement Support (~\$235) necessary to accomplishing funded programs/projects.
TOTAL ENRTF BUDGET:	\$ 600,000	

Explanation of Use of Classified Staff: N/A

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

Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation: 6.3 FTEs

Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation: N/A

B. Other Funds:

Source of Funds	\$ Amount Proposed	\$ Amount Spent	Use of Other Funds
-----------------	--------------------	-----------------	--------------------

Non-state	N/A	N/A	N/A
State			
General Fund	\$9,500	\$ 9,000	MBS Animal Survey Supervisor -- project management guidance and support.
TOTAL OTHER FUNDS:	\$9,500	\$ 9,000	

VII. PROJECT STRATEGY:

A. Project Partners:

MBS will partner with Dr. Marla Spivak's lab, the new pollinator professor Dr. Dan Cariveau, and other staff at the University of Minnesota to co-lead bee identification workshops (Activity 2). The University of Minnesota may contribute grant funds towards the workshops, if received. This request does not include funding for the following partners: MNDNR Fish and Wildlife, MNDNR Parks and Trails, University of Minnesota (including Department of Entomology, Insect Collection, and Cedar Creek Natural History Area), and The Nature Conservancy. This request complements pollinator proposals submitted by Dr. Marla Spivak and Dr. Dan Cariveau.

B. Project Impact and Long-term Strategy:

This timeframe will produce results that can stand alone or act as the beginning phase of a long-term monitoring program. Alone, this project's duration is insufficient to account for yearly fluctuations of insect populations, but it will serve as the foundation on which to build such a data set. Continuation of surveys in prairie-grasslands and expansion of surveys into forested habitats will enable analysis of wild bee distribution within a landscape context. Additionally, extending bee surveys to the Laurentian Mixed Forest would further increase our knowledge of the state's bee fauna.

C. Funding History:

Funding Source and Use of Funds	Funding Timeframe	\$ Amount
Environment and Natural Resources Trust Fund – M.L. 2014, Ch. 226, Sec. 2, Subd. 05(i): Appropriation of cash funds used to conduct previous native bee surveys in the prairie region.	July 1, 2014 – June 30, 2016	\$ 370,000
RIM Critical		\$24,000

VIII. FEE TITLE ACQUISITION/CONSERVATION EASEMENT/RESTORATION REQUIREMENTS:

A. Parcel List: N/A

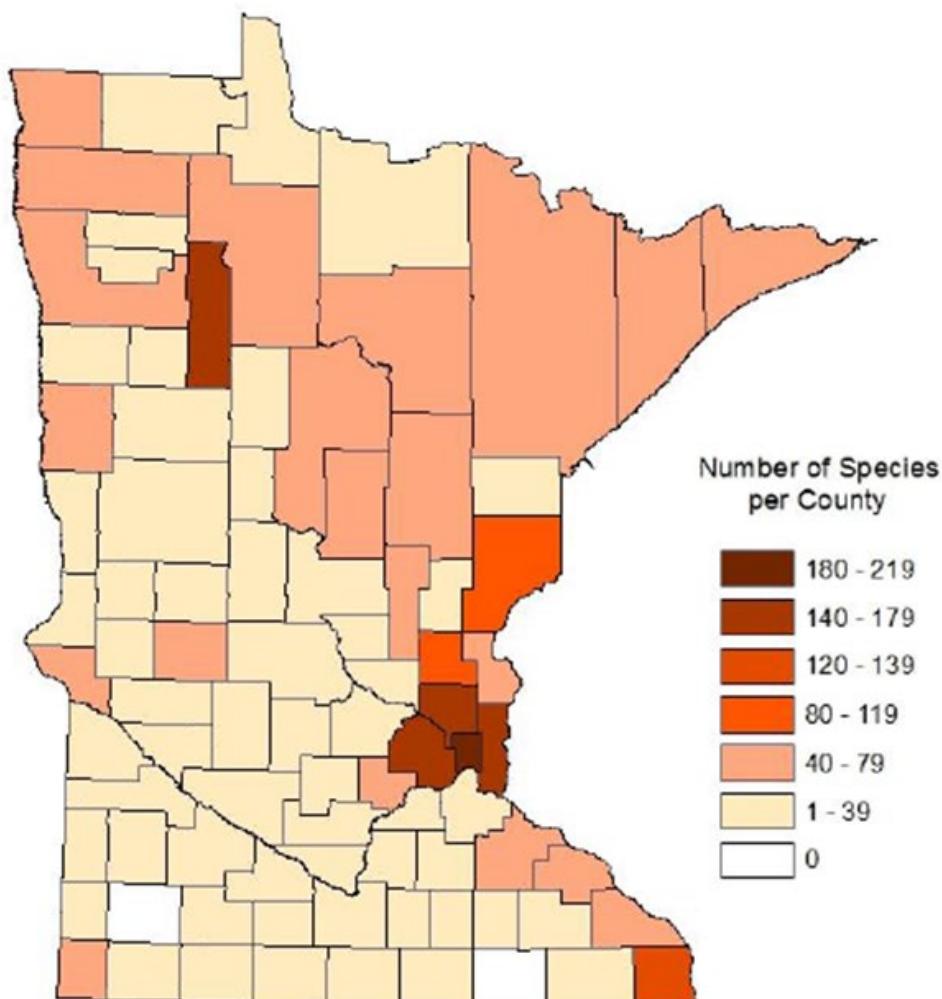
B. Acquisition/Restoration Information: N/A

IX. VISUAL COMPONENT or MAP(S):

**Number of bee species recorded per county,
based on museum specimens as of January 1, 2015**

Number of collections represented: 1

Total number of specimens examined: ~27,000



These data were compiled by the DNR's Minnesota Biological Survey through the grant M.L. 2013-6a "Wild Bee Surveys in Prairie-Grassland Habitats."

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).



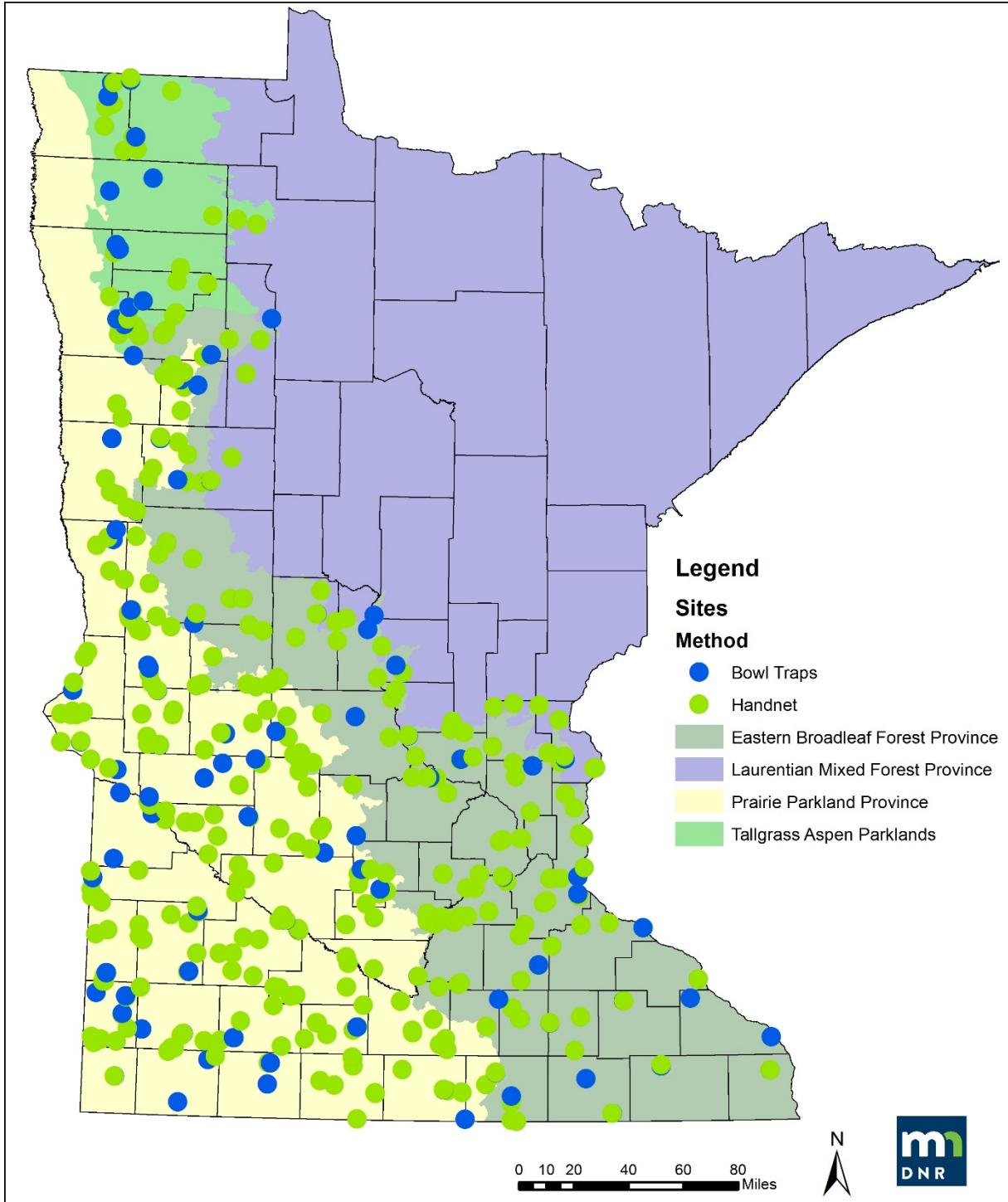


Figure 1. Sites, showing bowl trap collections in blue circles and hand net collections in green circles within the three ecological provinces surveyed to date: Eastern Broadleaf Forest, Tallgrass Aspen Parklands, and Prairie Parkland.

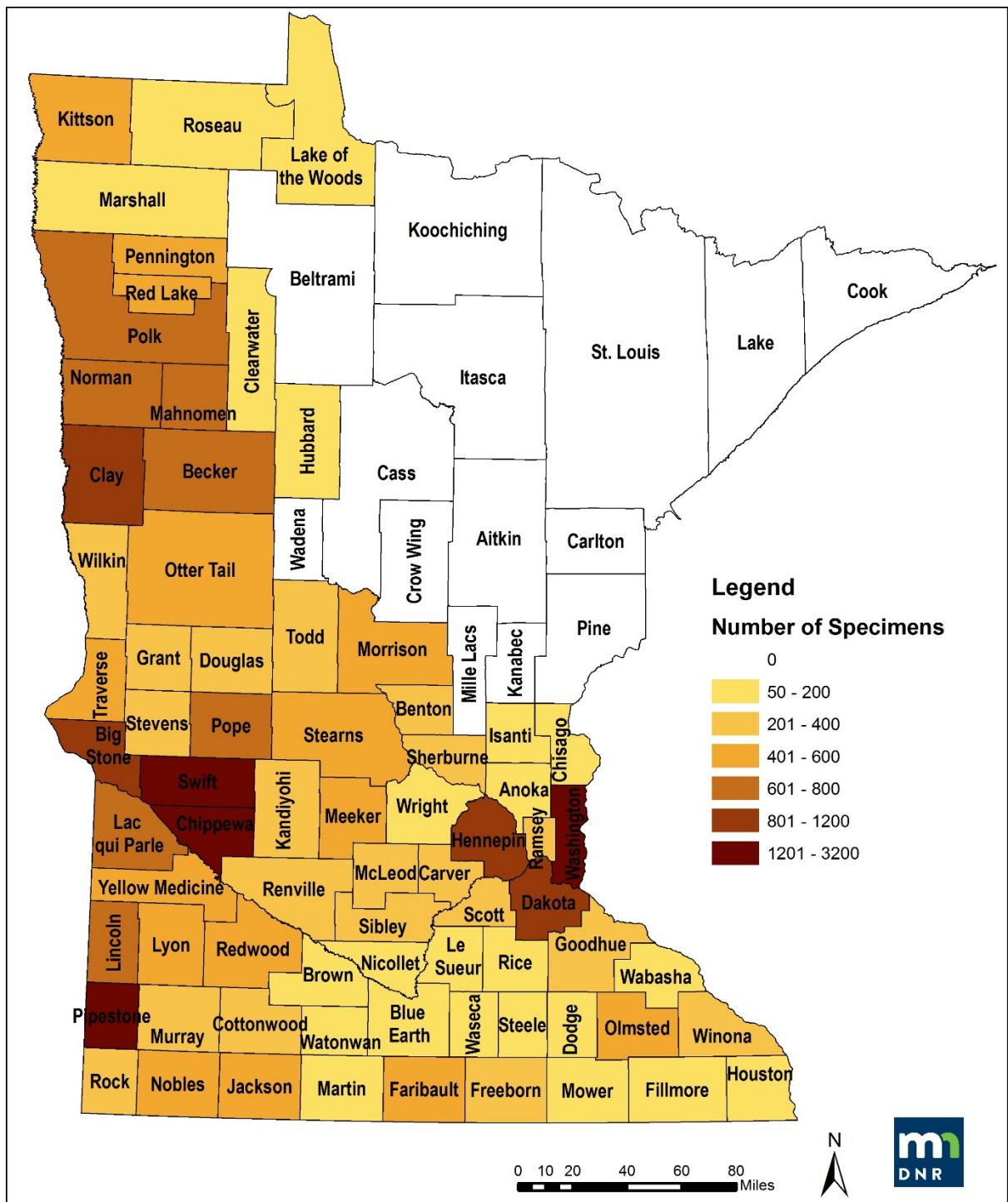


Figure 2. Map of Minnesota counties showing the number of bee specimens collected for each county by the Minnesota Bee Survey.

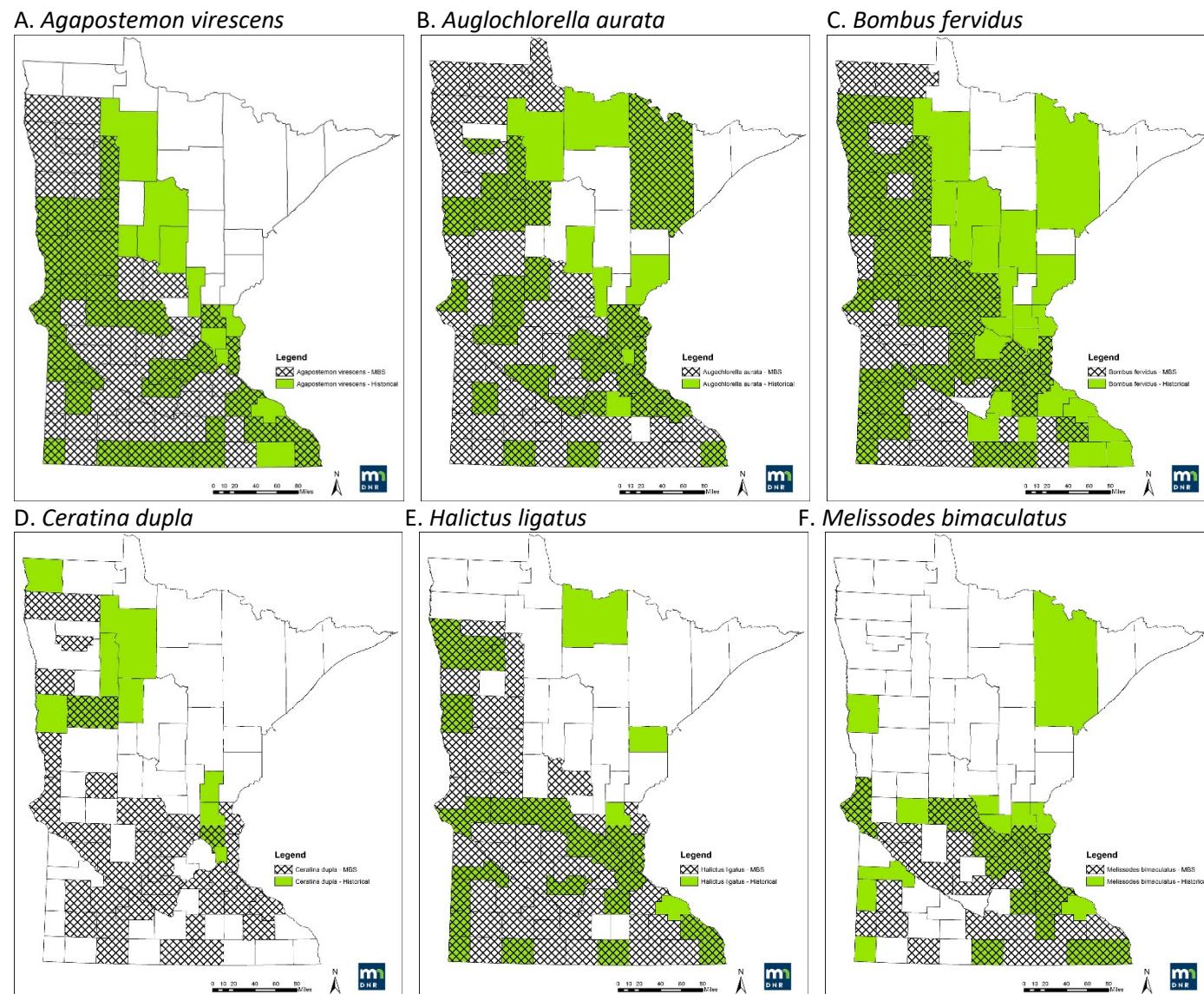


Figure 3. State map of Minnesota with counties shaded as historical specimens from museums (green) and specimens collected through the Minnesota Bee Survey (black crosshatch) for various species A. *Agapostemon virescens*, B. *Augochlorella aurata*, C. *Bombus fervidus*, D. *Ceratina dupla*, E. *Halictus ligatus*, and F. *Melissodes bimaculatus*, indicating an increased understanding of species distributions through this project.

X. RESEARCH ADDENDUM: N/A

XI. REPORTING REQUIREMENTS:

Periodic work plan status update reports will be submitted no later than October 2017, March 2018, October 2018, and March 2019. A final report and associated products will be submitted by September 2019.

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

Project Title: Native Bee Surveys in Minnesota Prairie and Forest Habitats

Legal Citation: M.L. 2016, Chp. 186, Sec. 2, Subd. 03b

Project Manager: Jessica Petersen

Organization: Minnesota Department of Natural Resources

M.L. 2016 ENRTF Appropriation: \$ 600,000

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

Date of Report: August 16, 2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Activity 1 Budget 8/5/2019	Amount Spent	Activity 1 Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	\$422,836	\$422,326	\$511
Zoologist/Project Manager: \$210,000 (81% salary, 19% benefits); 100% FTE each year for 3 years			
1 Zoology Data Manager: \$13,000 (70% salary, 30% benefits); 5% FTE each year for 3 years			
1 Entomologist: \$87,000 (70% salary, 30% benefits); 50% FTE each year for 3 years			
1 Botanist: \$87,000 (70% salary, 30% benefits); 50% FTE each year for 3 years			
1 Graphics/Web Design Specialist: \$13,000 (70% salary, 30% benefits); 5% FTE each year for 3 years			
Professional/Technical/Service Contracts			
TBD (competitive bid): Classroom instructor to lead native bee identification workshops.			
DNR Service Level Agreements with biologists for technical services. (Amy Arndorfer FY19)	\$2,500	\$2,500	\$0
DNR Service Level Agreements with MN.IT for data and database technical services.	\$8,800	\$8,720	\$80
Contracts with UMN per DNR-UMN Master Contract terms for entomological technical services.	\$11,672	\$11,672	\$0
Equipment/Tools/Supplies			
Field supplies needed to conduct surveys, including GPS units, maps, data recorders, cameras, traps, nets, collecting containers, first-aid and safety equipment (~\$8,000). Specimen preparation and storage supplies, including pins, pinning boards, specimen drier, cabinets, drawers, unit trays, and microscopes (~\$20,656). Data compilation and storage, including Fleet lease of computers and external hard drives (~\$4,500). Outreach supplies needed to conduct public presentations, including specimen boxes, magnifying glasses, tabletop displays, and education kits (~\$2,000).	\$22,085	\$22,085	\$0

Printing			
Printing of handouts, workbooks, and identification guides for workshops and outreach			
Travel expenses in Minnesota			
Travel to conduct field surveys of bees. Mileage: \$57,000. Lodging: \$15,000. Meals: \$28,000.	\$64,252	\$63,145	\$1,107
Other			
Direct and necessary costs: HR Support (~\$11,786); Safety Support (~ \$2,778); Financial Support (~\$9,418); Communication Support (~ \$1,236); IT Support (~\$8,382); Planning Support (~\$829); and Procurement Support (~\$235) necessary to accomplishing funded programs/projects.	\$32,565	\$32,565	\$0
COLUMN TOTAL	\$564,710	\$563,013	\$1,698



ENVIRONMENT
AND NATURAL RESOURCES
TRUST FUND

Activity 2 Budget 8/5/2019	Amount Spent	Activity 2 Balance	TOTAL BUDGET	TOTAL BALANCE
\$21,002	\$21,002	\$0	\$443,838	\$511
\$11,885	\$11,885	\$0	\$11,885	\$0
			\$2,500	\$0
			\$8,800	\$80
			\$11,672	\$0
\$0	\$0	\$0	\$22,085	\$0

\$324	\$324	\$0	\$324	\$0
			\$64,252	\$1,107
		\$0		
\$2,079	\$2,079	\$0	\$34,644	\$0
\$35,290	\$35,290	\$0	\$600,000	\$1,698