

Michigan Bumble Bee Atlas

Participant Handbook



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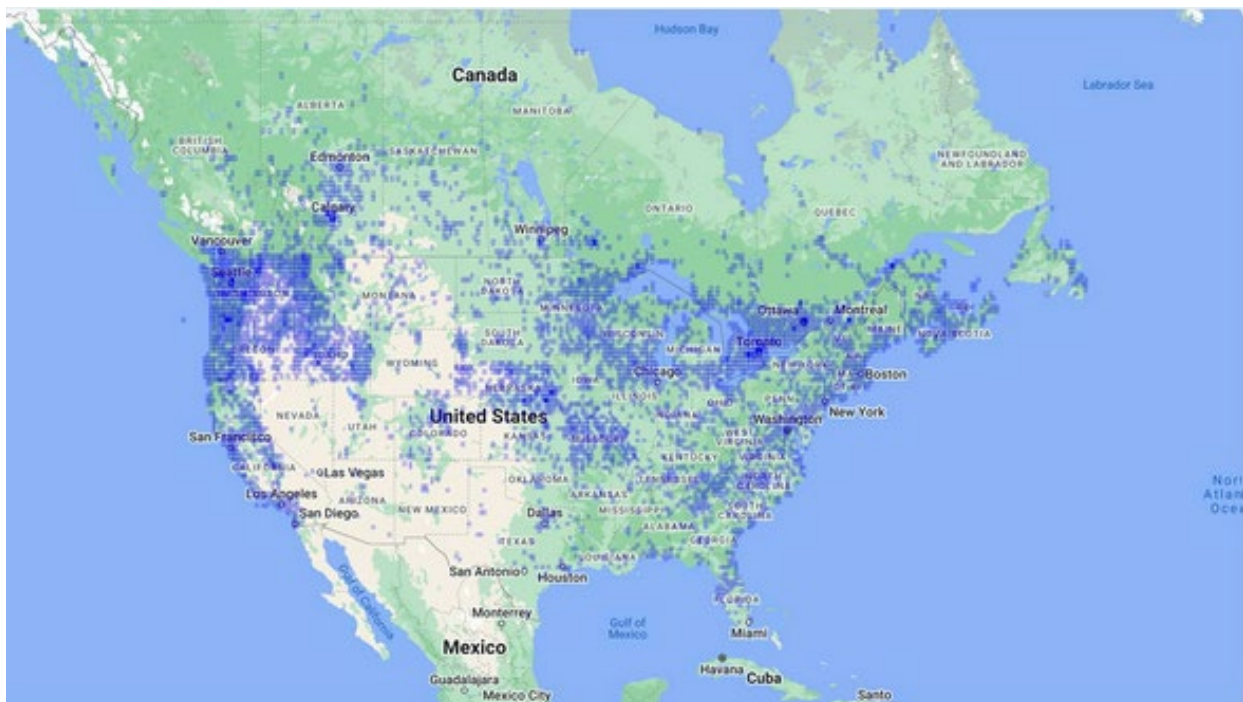


Contents

Project Overview	3
How to Participate	4
Bumble Bee Biology	5
Foraging Behavior	6
Bumble Bee Conservation in Michigan.....	7
Bumble Bee Identification	8
Michigan Bumble Bee Inventory Project Design	14
Creating a Bumble Bee Watch Account	15
Survey Conditions	16
Types of Bumble Bee Surveys	17
Point Surveys	17
Rapid Habitat Assessments.....	18
Data Sheets for Bumble Bee Community Survey and Associated Rapid Habitat Assessment	19
Submitting Bumble Bee Survey and Rapid Habitat Assessment Data to Bumble Bee Watch.....	21
Incidental Observations.....	25
How To Submit an Incidental Observation.....	25
Keeping Up With Your Records.....	27
Planning a Survey.....	27
Equipment To Bring During Your Survey	27
Field Guide Recommendations	28

Project Overview

The Michigan Bumble Bee Atlas (MBBA) was developed by the Michigan Natural Features Inventory (MNFI) and Michigan State University Extension (MSUE) to inform a broader understanding of bumble bee biology, diversity, and population trends for species of bumble bees in Michigan. The MBBA is a statewide community science project where participants are encouraged to actively collect bumble bee occurrence data and associated habitat data to inform bumble bee conservation across the state. Multiple states and larger regional bumble bee community science initiatives exist across the United States (see photo below). The Xerces Society for Invertebrate Conservation has been a leader in coordinating community-based bumble bee survey efforts across the country. Participants in Michigan will not only be able to contribute to state-level bumble bee conservation but will have the opportunity to inform conservation of bumble bees throughout the US by collecting similar bumble bee and habitat data as in other regions of the US.



Current distribution of bumble bee occurrence records submitted to the bumble bee watch community science platform. Bumble bee community science data is current as of Spring 2023. Photo captured from the Bumble Bee Atlas main website (www.bumblebeeatlas.org).

Community members of all backgrounds and skill level are encouraged to participate in the MBBA. Community collected scientific-quality data in Michigan will directly contribute to bumble bee conservation in addition to being an excellent opportunity to get out in nature and learn more about bumble bees and their habitats. Training is provided to equip you with the necessary resources, skills, and confidence to conduct your own bumble bee surveys as a community scientist. Additional resources are provided on the Michigan Natural Features website and webpages dedicated to the Michigan Bumble Bee Atlas project (<https://mnfi.anr.msu.edu/programs/michigan-bumble-bee-atlas>). If you have any questions while reading through any of the training materials, reviewing the available videos, or

collecting data in the field, please reach out to one of the project coordinator, Logan Rowe (roweloga@msu.edu), or Danielle Dorsen (dadorsen@oakland.edu).

How to Participate

Regardless of your current bumble bee knowledge, it is easy to participate in the MBBA project. First, developing a general understanding of bumble bee biology, identification, and conservation will allow for an easier entry into collecting valuable bumble bee and habitat data. Learning more about the MBBA survey protocols will help you select the survey that is best suited for your skill set and interest in data contribution. In 2024, Michigan Natural Features Inventory provided introductory webinars to familiarize participants with the project and to provide resource and tools that will guide you on your journey into bumble bee community science.

Here are the specifics you'll need to participate in the Michigan Bumble Bee Atlas:

1. Attend a webinar-based MBBA introduction or review the recorded webinars on the MNFI website: <https://mnfi.anr.msu.edu/programs/michigan-bumble-bee-atlas>
2. If possible, attend an in-person training event. Training events will be held annually. More information on in-person training opportunities can be found on the website
3. [Sign up](#) on the MBBA website and adopt a grid cell (optional but encouraged if planning to complete bumble bee community and habitat surveys)
 - a. This can be alone or with a small group of people
4. Conduct 2 formal surveys within the grid cell between June and September. A formal survey includes a bumble bee survey and a habitat survey, each following the standardized protocol
5. Submit bumble bee and habitat data using Bumble Bee Watch community science platform <https://www.bumblebeewatch.org/>

What you will need to participate:

1. A camera or a smartphone capable of taking high quality photos
2. Reliable transportation to get to and from bumble bee survey locations
3. Access to a computer or smartphone where you can upload photos and bumble bee data to Bumble Bee Watch and track your progress

What is helpful to participate:

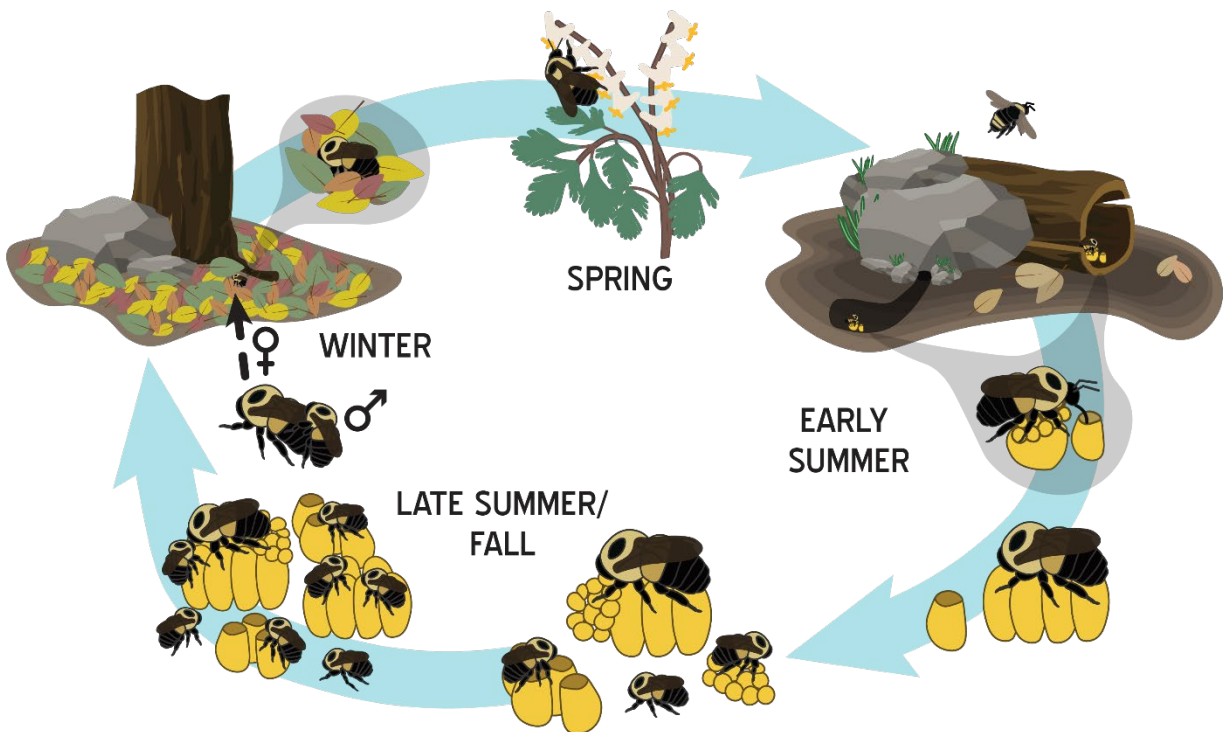
1. An insect net and vials. These items are recommended if you are planning to complete a bumble bee community and habitat survey
2. Basic knowledge of wildflower identification and where to find patches of wildflowers in Michigan
3. Local plant identification guides
4. Bumble bee field guides

For a list of workshop events, online training material, purchasing links, and more, visit:

<https://mnfi.anr.msu.edu/programs/michigan-bumble-bee-atlas>

Bumble Bee Biology

Most species of bumble bees are social insects that form colonies with a single queen. Colonies can be small (50ish individuals) to quite large (500+ individuals). However, compared to a honey bee colony, which can have over 10,000 individuals, bumble bee colonies are relatively small. The individuals within a bumble bee colony divide up specialized tasks to keep the colony functioning during the summer months. Queens are primarily responsible for mating and starting the colony by laying the first batch of offspring and collecting spring pollen and nectar resources to feed these offspring during development. As the colony develops, she will no longer leave the nest and is solely responsible for laying eggs. Worker bumble bees (females) are the primary pollen and nectar foragers during the duration of colony activity. They also assist the queen by caring for developing offspring. Males usually leave the colony once developed in search of a mate of the same species from a different colony. Males are also generally produced later in the colony life cycle. The life cycle of a bumble bee colony follows an annual cycle, with only the newly emerged queens living through the winter.



The annual life cycle of a bumble bee colony can be broken into 4 main periods: 1) Spring, 2) Early Summer, 3). Late Summer/Fall, 4) Winter. Illustration by Jeremy Hemberger.

During spring, a queen bumble bee will emerge from winter hibernation and immediately begin searching for foraging resources (pollen and nectar) and a location to start her nest. In Michigan, early spring foraging resources include a mix of blooming trees, shrubs, and spring ephemeral forbs. A queen searching for a nesting site generally displays a few characteristic behaviors. In most instances, the queen will fly low to the ground, examining potential nest locations, moving slowly across the landscape to find the best nesting location. If you watch her for long enough, you may even see her land and crawl down under the cover of ground materials (grassy mounds, leaves, rodent holes in grounds, etc.) and

assess the internal structure of a nesting location. Typical nest sites are small holes in the ground or above the ground in piles of grass, with nest preference varying among species. Bumble bees have been discovered nesting in abandoned bird and rodent nests, rolled up carpets, insulation, underground cavities, wood piles, clumps of grass, and underneath sidewalks. Once a queen selects a nest site, she will begin building a wax pot for storing nectar resources. At the same time, she'll begin forming the first pollen balls (usually mixed with nectar) where she will lay the first clutch of eggs. While the eggs are developing, the queen continues to collect pollen and nectar from the foraging landscape. Once the eggs develop into adults (after about 4-5 weeks) the queen will switch entirely to egg laying, relying on her first female offspring to continue the collection of nectar and pollen during the lifespan of the colony.

In early summer, female bumble bee workers drive the collection of pollen and nectar resource to feed developing offspring. In addition to collecting foraging resources, workers are responsible for raising the offspring and defending the nest. At this time, the queen does not leave the colony and is primarily responsible for laying eggs. As summer progresses, the colony switches gears, and the queen begins producing males and new queens. A queen can produce 100+ offspring during her lifespan. The total number of individuals produced depends on a number of factors, including the availability of resources in the wild, the threat of anthropogenic stressors, and the location of the colony (secluded from potential predators and harmful environmental conditions). Males become more abundant during visual surveys in August in Michigan, but it depends some on the species and overall progression of the colony during the season.

During the late summer/ early fall, males and newly produced queens will leave the colony where they will search for mates from other colonies. The male's sole responsibility is to locate newly emerged queens and mate before they die. Queens will sometimes mate with multiple males while simultaneously foraging to build up energy reserves in preparation for winter. After mating, the newly mated queens will search out suitable overwintering locations, which are usually located underground in debris or just under cover of ground. Many will dig a small cavity a few centimeters below the ground surface and settle in until the following spring.

Foraging Behavior

Bumble bees will forage on a wide variety of plant species during the life of a colony. Individual workers may specialize on a plant resource, or a patch of abundant resources (such as pockets of wild bergamot in Michigan). The variability in foraging plants selected is partially due to the differences in tongue lengths of different bumble bee species. Some species have long tongues and prefer to nectar from plants with longer corolla tubes, while others have short tongues and are more readily found on flowers with an open floral structure, such as sunflower and coneflower. Most locations with abundant flowering resources are good locations to search for bumble bees, but the bumble bee species found may vary depending on multiple factors. A recent study from Michigan Natural Features Inventory found bumble bees foraging from over 135 species of flowers in Michigan between 2020-2022! Flowering species that seem to be highly attractive to bumble bees include wild bergamot (*Monarda fistulosa*), purple coneflower (*Echinacea purpurea*), Shrubby St John's Wort (*Hypericum prolificum*), Partridge Pea (*Chamaecrista fasciculata*), and even the invasive species Spotted Knapweed (*Centaurea stoebe*). Therefore, it's good practice to look for bumble bees on multiple flower species and in multiple locations at a survey site.



Black and gold bumble bee (left), Golden northern bumble bee (middle), Yellow banded bumble bee (right)

Bumble Bee Conservation in Michigan

Historically, Michigan contained approximately 20 unique species of bumble bees, while recent statewide assessments place the current number of species closer to 16. Six species are currently tracked by MNFI Biologists due to their decreasing population trends across the state (see Table 1 below). One species, the Rusty-patched bumble bee, has not been seen in the state in over 20 years.

Table 1. Bumble bee species in Michigan actively tracked by Michigan Natural Features Inventory. Global Rank, State Rank, and State Status of each species is included. Declines estimates from Wood et al. 2019.

Species	Common Name	Global Rank	State Rank	State Status	Estimated Decline in Michigan
<i>Bombus affinis</i>	Rusty patched bumble bee	G2	SH	State Endangered	100%
<i>Bombus auricomus</i>	Black-and-gold bumble bee	G4G5	S2	SC	64%
<i>Bombus fervidus</i>	Golden northern bumble bee	G3	S3	SC	65%
<i>Bombus pensylvanicus</i>	American bumble bee	G3G4	S1	State Endangered	98%
<i>Bombus sandersoni</i>	Sanderson's bumble bee	G4G5	S2S3	SC	NA
<i>Bombus terricola</i>	Yellow banded bumble bee	G3G4	S2S3	SC	71%

The possible causes of these declines include habitat loss, climate change, pesticides, and pests and pathogens. As generalist foragers, bumble bees need access to abundant and diverse floral resources. Managing landscapes to maximize season long availability of floral resources is necessary for colony health and reproduction. These actions may include protecting associated natural communities, planting wildflower plots, and incorporating prairie species into habitat management programs. Minimizing ground disturbance in occupied habitats is necessary to help provide adequate nesting locations. Species have diverse nesting habitats, with some species preferring open areas and others nesting within or along forest edges. Nests found in Michigan may be particularly sensitive to ground management actions, such as disking, tilling, and herbicide applications. Therefore, daytime applications of pesticides (herbicides, insecticides, fungicides) should be avoided, if possible. If applications are required, apply in the evening when bumble bee activity is low, or do not apply in occupied habitat. Many species of bumble bees may be particularly sensitive to climate change. Take climate action by using clean energy, planting trees and grasslands, supporting regenerative agriculture, promoting

regulation of polluting industries, and supporting smaller, local businesses. By working to make the landscape and the world around us more bee-friendly, we can keep our bumble bees buzzing.

Bumble Bee Identification

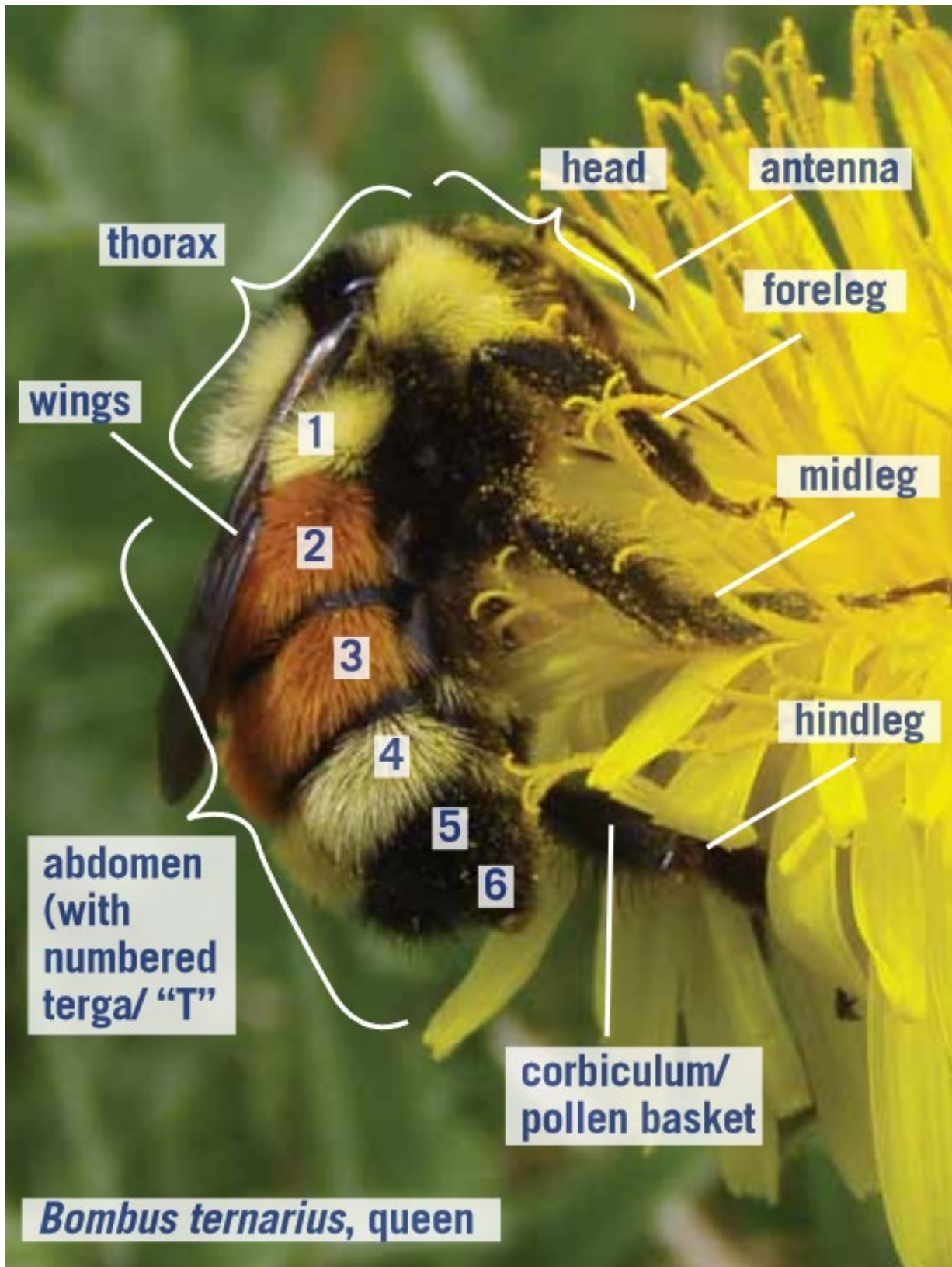
Identifying bumble bees can be tricky. At first glance, most species in Michigan may seem to look very similar, but closer examination of the hair colors on the head, thorax and the abdomen can generally be used to differentiate species. Most species even have some variability in coloration when compared to others of the same species! The best resource available to determine a species in Michigan is the book [Bumble Bees of North America](#) by Paul Williams, Robbin Thorp, Leif Richardson, and Sheila Colla. An additional free PDF guide titled [Bumble Bees of the Eastern United States](#) by Sheila Colla, Leif Richardson, and Paul Williams provides some additional species level detail for the bumble bees found in Michigan and can be used to determine the species of a bumble bee.

From photographs, bumble bees are best identified by examining the coloration of different body parts. The main body parts to examine closely when attempting to identify to species include the head, thorax, and abdomen. Females and males of a species can generally be separated from each other by 1) looking for a stinger (female only) and 2) looking for pollen on the corbicula, or what you might think of as the knees on the back leg (female only).

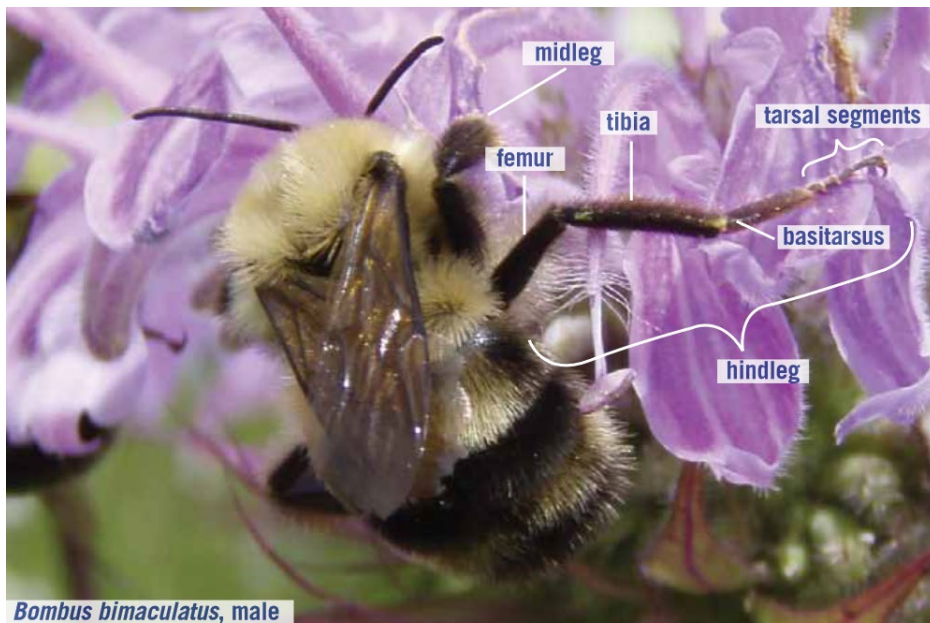
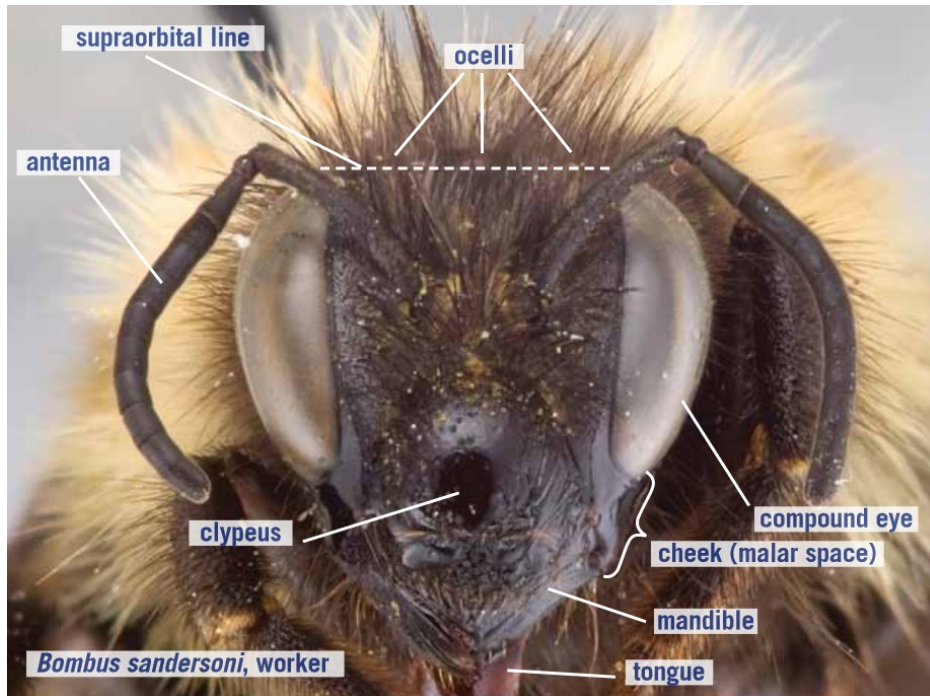
Identification pointers:

- 1) Pay close attention to the colors of hairs on the vertex (top of head) and the face (between and below the antennae).
- 2) A bumble bee's thorax will generally be yellow or a mix of yellow and black. The amount and location of yellow/black hair on the thorax can help determine the identification of a species. The colors of hair on the sides of the thorax (below the wing joints) can also help determine the species.
- 3) The abdomen contains 6 (or 7 for males) horizontal segments called terga. Determining the color of each segment (T1, T2, T...) is the best way to identify most species from photos.

For more information on Identifying bumble bee species in Michigan, please view our Michigan Bumble Bee Identification Guide on the website.

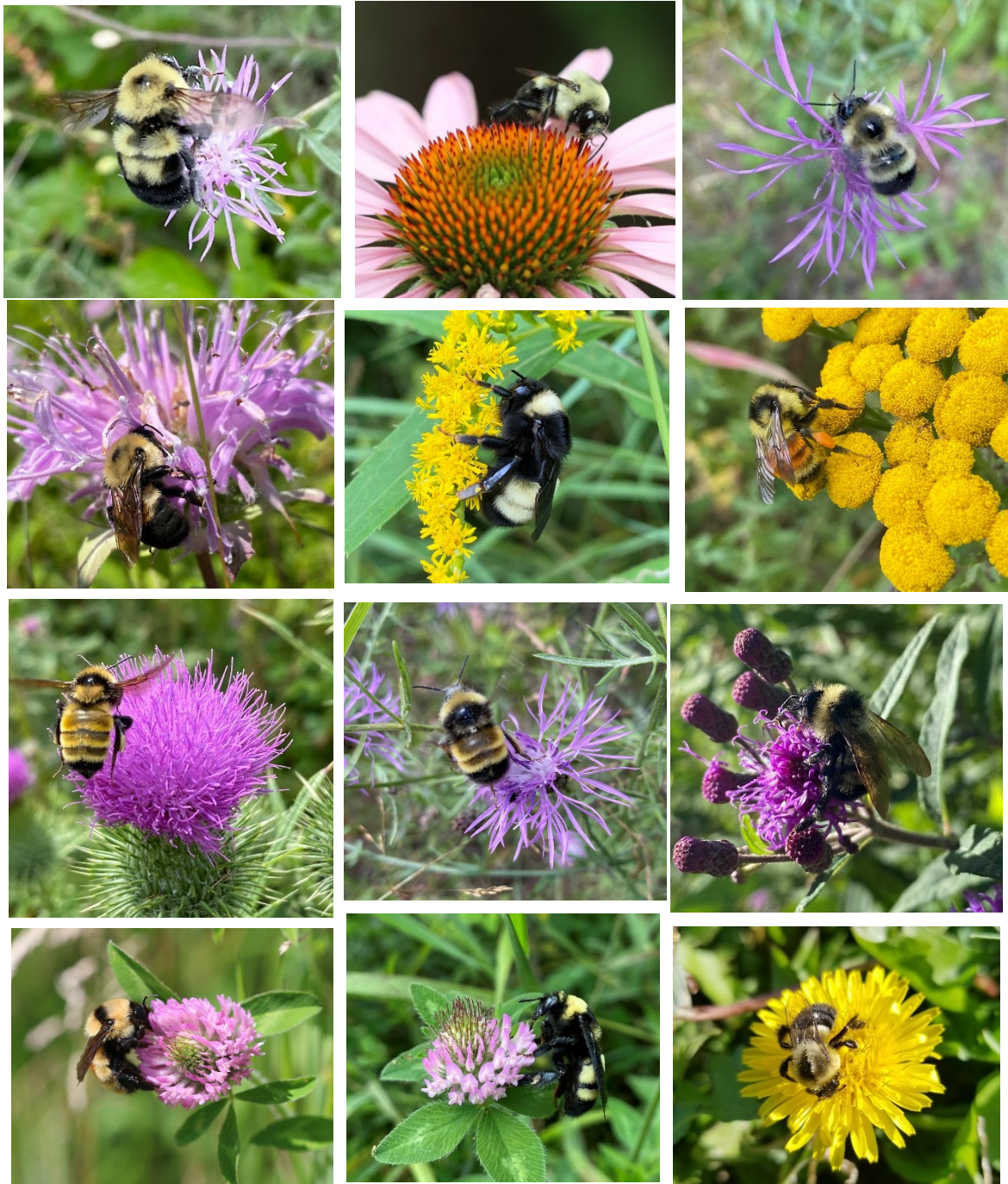


Bumble bee morphology useful for species identification. Photo from Bumble Bees of Eastern United States, 2011



Additional examples of morphological characteristics used for species identification. Photos from Bumble Bees of Eastern United States, 2011.

Examples of good bumble bee photos for photo identification:

























From top to bottom (reading like a book): *Bombus bimaculatus*, *B. griseocollis*, *B. vagans*, *B. griseocollis*, *B. terricola*, *B. ternarius*, *B. borealis*, *B. terricola*, *B. citrinus*, *B. fervidus*, *B. auricomus*, *B. impatiens*.

A quick reference for Michigan bumble bee identification developed by Kalamazoo College is below:

BUMBLE BEES OF MICHIGAN - FEMALES

Created by Nikoli Nickson and Ann Fraser <https://swmbees.kzoo.edu>
Kalamazoo College, Department of Biology

Yellow-Banded Abdomen:	Brown on Mid-Abdomen:
 <i>B. auricomus</i> Black-and-gold bumble bee S 3	 <i>B. griseocollis</i> Brown-belted bumble bee A 1
 <i>B. pensylvanicus</i> American bumble bee S 3	 <i>B. affinis (worker)</i> Rusty-patched bumble bee S 4
 <i>B. terricola</i> Yellow banded bumble bee N 3	
Mostly Black Abdomen:	Miscellaneous:
 <i>B. bimaculatus</i> Two-spotted bumble bee A 1	 <i>B. ashtoni</i> 5 Gypsy cuckoo bumble bee
 <i>B. citrinus</i> Lemon cuckoo bumble bee S 3	 <i>B. fernaldae</i> 5 Fernald's cuckoo bumble bee
 <i>B. impatiens</i> Common eastern bumble bee A 1	
Red on Abdomen:	
 <i>B. rufocinctus</i> Red-belted bumble bee S 2	 <i>B. frigidus</i> 5 Frigid bumble bee
 <i>B. ternarius</i> Tri-colored bumble bee N 1	 <i>B. fraternus</i> 5 Southern Plains bumble bee
Mostly Yellow Abdomen:	
 <i>B. affinis (queen)</i> Rusty-patched bumble bee S 4	 <i>B. insularis</i> 5 Indiscriminate cuckoo bumble bee
 <i>B. borealis</i> Northern amber bumble bee S 3	 <i>B. rufocinctus</i> Red-belted bumble bee S 2
 <i>B. fervidus</i> Yellow bumble bee S 2	
 <i>B. perplexus</i> Confusing bumble bee S 2	
 <i>B. sandersoni</i> Sanderson's bumble bee S 2	
 <i>B. vagans</i> Half-black bumble bee A 1	

KEY

Range	S Southern MI	
	N Northern MI	
	A All MI	
Abundance	1 Common	
	2 Uncommon	
	3 Conservation Concern	
	4 Federally Endangered	
	5 Possibly Extirpated	

Bumble bee illustration used with permission from artist Elaine Evans: University of Minnesota; <http://www.befriendingbumblebees.com>

BUMBLE BEES OF MICHIGAN - MALES

Created by [Nikolij Nickson](#) and Ann Fraser, Kalamazoo College, Department of Biology

<https://swmbees.kzoo.edu/>

Mostly Black to Half Black Abdomen:



B. bimaculatus
Two-spotted bumble bee

A 1



B. impatiens
Common eastern bumble bee

A 1



B. vaagens
Half-black bumble bee

A 1



B. rufocinctus
Red-belted bumble bee

S 2



B. sandersoni
Sanderson's bumble bee

S 2

Brown on Abdomen:



B. griseocollis
Brown-belted bumble bee

A 1



B. pennsylvanicus
American bumble bee

S 3

Mostly Yellow Abdomen:



B. borealis
Northern amber bumble bee

A 3



B. citrinus
Lemon cuckoo bumble bee

S 3



B. fervidus
Yellow bumble bee

S 2



B. perplexus
Confusing bumble bee

S 2

Yellow-Banded Abdomen:



B. auricomus
Black-and-gold bumble bee

S 3



B. terricola
Yellow banded bumble bee

N 3

Red on Abdomen:



B. ternarius
Tri-colored bumble bee

N 1



B. rufocinctus
Red-belted bumble bee

S 2

Miscellaneous (rare/endangered)



B. affinis
Rusty-patched bumble bee

S 4



B. ashtoni
Gypsy cuckoo bumble bee

5



B. fernaldae
Fernald's cuckoo bumble bee

5

B. fraternus
Southern Plains bumble bee
[no illustration available]

5



B. frigidus
Frigid bumble bee

5



B. insularis
Indiscriminate cuckoo bumble bee

5

Location/Status

- S Southern MI
- N Northern MI
- A All MI
- 1 Common
- 2 Uncommon
- 3 Conservation Concern
- 4 Federally Endangered
- 5 Possibly Extirpated

KEY

Bumble bee illustrations with permission from artist Elaine Evans: University of Minnesota; <http://www.befriendingbumblebees.com>

Michigan Bumble Bee Atlas Project Design

The primary goal of the MBBA is to collect quantitative data on bumble bee species' distributions, floral preferences, and habitat associations in Michigan. There are multiple types of surveys that can be completed, including point surveys and incidental observations. In order to diversify the areas of Michigan that will be surveyed, volunteers can adopt a grid cell to prioritize and focus their survey efforts. Grid cells were created to prioritize sampling areas throughout the state based on known bumble bee distributions and to gather data in relatively under-surveyed locations or in ecologically rich habitats. Michigan contains 92 grid cells, which are variable in size and distributed across the state.

The survey methodology, which was developed by the Xerces Society for Invertebrate Conservation, is standardized, meaning that consistent data will be collected across Michigan. Since multiple states have their own bumble bee community science projects, it is even consistent across a much broader region of the US! It is the responsibility of each community science member to focus their survey efforts on publicly accessible lands, or private lands with prior approval. If adopting a grid cell, it is recommended that community scientists adopt cells with habitats that can be visited at least two times per year. Grid cells can be adopted and surveyed by an individual or a group of individuals. Grid cells should be adopted prior to completing any point surveys in the field.

Prior to the field season, volunteers should create a Bumble bee Watch account (<https://www.bumblebeewatch.org/account/register/>), [register for the MBBA project](#) and review the materials available on the MNFI [website](#). After completing the training, participants can practice their identification skills by completing the available [identification quiz](#). In person workshops are also provided to help train community scientists on the MBBA survey protocols. Surveys are carried out during Michigan's peak bumble bee season, June-September. Participants can conduct surveys anywhere within their grid cell (or elsewhere), on any date, and at any time during the survey window. Ideal survey conditions are provided in this document to assist participants with choosing the best survey date and location. Surveys must be conducted in public-access areas or in areas where participants are permitted to enter.

After surveys are conducted, community scientists will upload data and photographs to [BumbleBeeWatch.org](#). All submitted observations will be verified by experts at the end of each survey season and a summary of findings will be posted on the Michigan Natural Features Inventory website and distributed to project participants. The collected data will assist Michigan Natural Features Inventory, land managers, and policymakers alike refine current bumble bee conservation practices using evidence-based recommendations.

All New Volunteers: We encourage you to adopt a priority grid cell to help meet the project's objective. However, grid cell adoption is not required to collect bumble bee data.

If you cannot adopt a grid cell but still want to participate, we encourage you to download the Bumble Bee Watch app (Apple or Android or website) and submit your observations. Desktop contributions are also encouraged and required for bumble bee community and habitat surveys.

Creating a Bumble Bee Watch Account

1. Go to the Bumble Bee Watch website (<https://www.bumblebeewatch.org/>)
2. Click Your Account -> Register in the top right corner of the web page

Home / Register

Username* Email*

Password* Password confirmation*

• Your password can't be too similar to your other personal information.
• Your password must contain at least 8 characters.
• Your password can't be a commonly used password.
• Your password can't be entirely numeric.

Enter the same password as before, for verification.

First name* Last name*

Province* City* Zipcode*

Project*
Bumble Bee Atlas

I have read and agree to the terms and conditions.*
[Read Terms and Conditions](#)

Register

3. Enter the required information on the user sign up page. You will need to enter a username, password, and an email address. Please remember these for future logins
4. We will be contributing to the Bumble Bee Atlas project, so in the Project list, please select Bumble Bee Atlas
5. Click Sign Up

At this point you should have access to your personal homepage on the Bumble Bee Watch website. Feel free to add any additional information that you think would be valuable to your profile.

Survey Conditions

Surveys should be completed on days when bumble bees are most likely to be active. In Michigan, queens are primarily active during May through early June, while workers are primarily active June through end of September. Depending on the timing of each survey, you may encounter different species, so it's important to aim to collect data at different periods throughout the general flight of bumble bees. For example, the two-spotted bumble bee (*B. bimaculatus*) tends to emerge earlier than the common eastern bumble bee in Michigan, and an earlier season survey may capture more two spotted bumble bees in the data compared to a later season survey. Bumble bees are more likely to be active on calm sunny days when the temperature is between 60°F and 90°F with winds under 15mph. Bumble bees tend to be less active when the conditions are much hotter or cooler. Surveys should not be conducted when it's raining or just after a rain. A good way to tell if bumble bees might be active is to check for moisture on a few flowers. If they are wet, it's better to wait until they are dry before starting a survey. Please keep an eye on the radar when planning and conducting a survey. Thunderstorms can appear suddenly in Michigan. If you anticipate the potential for storms, please wait for a day more suitable for bumble bees.



Examples of ideal bumble bee and habitat survey locations and conditions.

Types of Bumble Bee Surveys

Point Surveys

Point surveys are the standard bumble bee surveys for the MBBA project and will best contribute standardized data for bumble bees across the state. Each point survey should take place in an area that is approximately 1 hectare (2.5 acres). A complete point survey will have two aspects: a bumble bee community survey and an associated habitat assessment. Habitat assessments are described in more detail below in the habitat assessment survey section of the handbook. Each bumble bee survey will last a total of 45 person-minutes. Therefore, if two people are completing the survey, it will last a total of 22.5 minutes.

The first step is to determine where you will conduct the survey. A survey area can be a large open field, a matrix of smaller openings, a publicly accessible right of way corridor, etc. Most public spaces are fair game as long as they meet the minimum requirement of 1 hectare. Upon arrival, the first step is to collect the coordinates of the center of the survey area using a GPS enabled device. Google maps or Apple maps (or any other map-based phone application) are generally accurate tools for collecting this information. Use the bumble bee survey data sheet to fill out the required information, which includes survey date, start time, surveyor information, location, and basic weather information. For collecting weather information, you can use any weather app on your phone.

After this initial data has been collected, you can begin the formal bumble bee survey. Remember to use a timer to make sure the survey lasts a total of 45 person-minutes. Begin walking the habitat, focusing efforts on areas with flower patches. While the survey is conducted, walk at a pace that allows you to cover the entire survey area. Focus efforts on all species of flowering plants, since you might find certain bumble bee species only foraging from particular plants. When you encounter a bumble bee, capture the bee in the net and place it in a vial. Make sure to take note of the plant species that the bee was foraging from, since this is valuable information for identifying the flowers that bumble bees prefer. If you are unsure of the plant species, take a few photos for later identification. Phone apps such as iNaturalist or Seek are excellent resources for identifying plant species based on flower photos in the field. After the bee is safely in the vial, place the vial in a chilled cooler for later photos and identification. Note: stop the stopwatch after each bumble bee capture and restart the stopwatch once the vial is placed in a cooler. This will ensure that the 45-minute survey is focused on observing and collecting bumble bees instead of the time it takes to collect the bumble bee and place in a cooler.

Continue walking the habitat for the entire duration of the survey and continue collecting bumble bees and recording associated flowers. One way to keep track of data as you collect it is to label each vial #1 through x and record the flowering plant for each associated vial on the data sheet. If you run out of vials, stop the timer and continue to bumble bee photos and processing.

After bumble bee collections for the point survey are complete it is time to photograph collected bees. Be sure that each bumble bee has been on ice for enough time to slow down movement prior to attempting a photo. Usually, 10 minutes on ice is enough time for each bumble bee. Remove each bee individually, place on the provided grid sheet, and take up to 5 photos to document the various aspects of the bee (multiple photos of each bee will help confirm species identification) using a camera with a lens capable of up-close photography. A camera with a macro lens works best, but if you do not have one, take up close photos with a cell phone. Try to make sure photos are not blurry since it will make

identifications difficult without a clear picture. Make sure each photo is referenced to the correct bumble bee in the data sheet. This will be helpful when uploading photos to Bumble Bee Watch. Bumble bees can be released once photos are taken and referenced in the data sheet. After all of the bumble bees have been photographed, you can begin the rapid habitat assessment. Note: if bumble bees are still active when you begin photographing, begin your habitat assessment form early and let them rest on ice for a few minutes longer. The habitat form will provide a snapshot of the available foraging habitat and an idea of nesting resources available to bees in or near the survey area. Detailed instructions for completing the rapid habitat assessment form are provided in the next section.

It is generally good practice to go over the full data sheet prior to leaving the site to make sure that all the relevant data has been recorded. Submitting data is described in more detail below, in the data submission section of the handbook.

Rapid Habitat Assessments

After completing a bumble bee community survey you will need to complete the associated rapid habitat assessment data sheet. This data is valuable, as it allows us to better understand the foraging and nesting resources available to bees at the survey site. First, complete the site level information, and make sure this information matches that of the bumble bee survey form. For example, site names and GPS coordinates should match. This will allow us to connect the habitat data with the bumble bee survey data. For each point survey, you will be completing a single habitat assessment.

The second section of the data sheet is for identifying the type of habitat that was surveyed. Check one box associated with the habitat option that best describes the survey area. The third section pertains to the surrounding landscape. Select the first, second, and third option that best describes the surrounding habitat. You can assess the surrounding habitat both visually and using a map, such as Google or Apple maps. In most cases, assessing the surrounding habitat both visually and with the help of a map will be the best option. After completing the surrounding habitat section, you'll estimate the percentage of available floral habitat. This only includes flowers that are relatively fresh, providing pollen and/or nectar resources to foraging bumble bees. Similarly, identify the nesting resources (bunch grasses, rodent holes, leaf litter, etc). Sometimes you may see these while completing the bumble bee surveys, so it's a good idea to keep track of them while surveying and checking the boxes when you complete the survey. Lastly, identify any management activities that may be impacting the local bumble bee community that you just surveyed. Record these in the final section of page 1 of the habitat assessment form. Lastly, we want to document the diversity and abundance of flowering resources at this survey site. Please record all of the plant species that you saw during the bumble bee survey. If you are unsure of a flowering plant species, you can take a photo and use an identification assistant app (iNaturalist or Seek) to help with identifications. If you don't know that name of a species, you can use a code or a common name to help with identifications. You will also be able to submit these photos for each survey site and they can be identified later by an expert.

Data Sheets for Bumble Bee Community Survey and Associated Rapid Habitat Assessment
 Data sheets can be downloaded directly from the Bumble Bee Atlas [website](#).

BUMBLE BEE ATLAS DATA SHEET									
Complete this form at every visit to a site on which you conduct a point or roadside bumble bee survey									
Site Information									
Site Name:		BBA Grid Cell ID:	Date:						
Latitude: N		Longitude: —	W (Use Decimal Degrees)						
# Observers:	Observer Names:								
Bumble Bee Survey Information:			Survey Method: I captured all bees, different bees, or a combination of methods:						
Survey Type: Point Roadside	Survey Area (Approx., in HA):		All Different Combination						
Survey Start Time:	Survey End Time:	Survey Minutes (Survey time x # Observers):							
Weather Information									
Temp: F	Cloud Cover: %	Wind Speed: mph							
Habitat Information									
Survey Area Circle the most appropriate habitat type (CHOOSE 1).	Habitat Types	Examples	Surrounding Area (Visible) From the Habitat Types, list (up to) the top three habitat types visible from most to least abundant.						
	Grassland / Meadow	Meadow, open, grasses dominant							
	Woodland / Forest	Trees dominant, and in the over-story							
	Shrub / Scrub	Arid, shrubs present, and abundant							
	Agricultural Lands	Crops, pasture, orchard, etc.							
	Riparian Areas	Along lake or stream							
	Developed / Roadside	Sub/urban areas; parks/gardens; roadsides							
Wetland	Bogs; marsh; saturated earth	3							
How much of the survey area has flowering resources available? (Circle one - closest match)									
0	10%	20%	30%	40%	50%	60%	70%	80%	>=90%
Nesting Habitat	Choose which of the following features you see in or near the survey area:								
	<input type="checkbox"/> Bunch grasses				<input type="checkbox"/> Leaf litter				
	<input type="checkbox"/> Evidence of rodent holes/tunnels				<input type="checkbox"/> Pine needle duff layer				
	<input type="checkbox"/> Brush piles				<input type="checkbox"/> Rock piles				
	<input type="checkbox"/> Bare soil				<input type="checkbox"/> Mulch				
Management	I see evidence of, or know that the following have occurred in or near the survey site:								
	Mowing	Yes	No	Suspect					
	Livestock grazing (animals, cow pies, hoof prints)	Yes	No	Suspect					
	Native grazing (animals, deer/elk scat, hoof prints)	Yes	No	Suspect					
	Agriculture	Yes	No	Suspect					
	Insecticide use	Yes	No	Suspect					
	Herbicide use	Yes	No	Suspect					
	Fire (either controlled burning or wildfire - circle)	Yes	No	Suspect					
Honey bee hives (inc. number of boxes _____)	Yes	No	Suspect						
Notes:									
Plants	How many different species of flower (incl. trees and shrubs) are in bloom in the survey area (whether they were visited by bumble bees or not)?								

BUMBLE BEE ATLAS DATA SHEET

Complete this form at every visit to a site on which you conduct a point or roadside bumble bee survey



Plant Species in Bloom

Document each species of currently blooming plant that you see in the survey area – including trees and shrubs that WERE NOT observed being visited by bumble bees. Use plant identification field guides, and take pictures of the flowers and leaves of each species. If you are uncertain, give the plant a generic name, and be sure to photo document for later identification. Use a second sheet if needed.

List the scientific name of each plant to the best of your ability – if you only know the common name, list that.

1.	6.	11.
2.	7.	12.
3.	8.	13.
4.	9.	14.
5.	10.	15.

Bumble Bee Observations

BBW	Sex Q/W/M/F	Bumble Bee Species	Host Plant	Photo Numbers
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
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<input type="checkbox"/>				
<input type="checkbox"/>				
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<input type="checkbox"/>				
<input type="checkbox"/>				

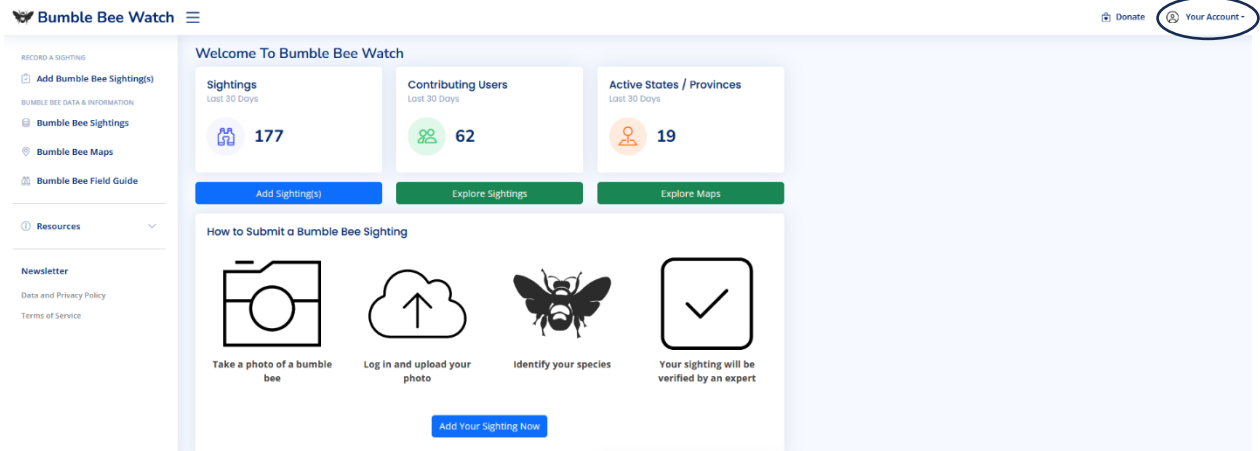
Volunteer Data

What time did you start and stop volunteering on the day of this survey? Include planning, taking photos, recording data, driving, etc.	Start time:	Stop time:
How many miles, roundtrip, did you drive to conduct your survey?	miles	
How many hours did you spend organizing your data? Photo organization, entering data in Bumble Bee Watch, etc.	hours	

Submitting Bumble Bee Survey and Rapid Habitat Assessment Data to Bumble Bee Watch

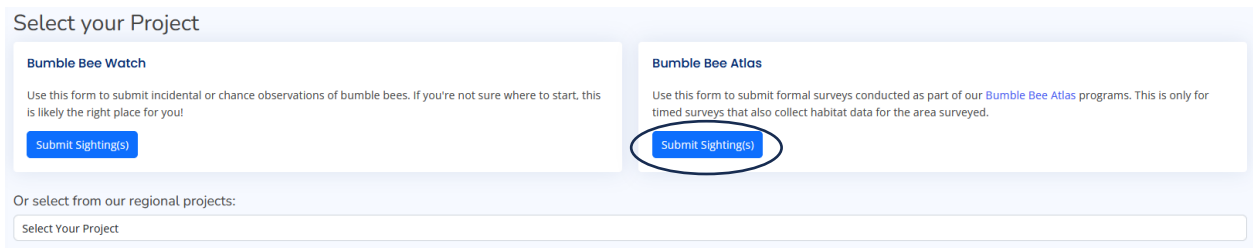
Note: This section is for submitting formal survey efforts, which include a timed survey and rapid habitat assessment. For incidental observations, see the next section.

1. Log into your created profile in Bumble Bee Watch.



2. Click Add Your Sighting Now.

3. Select the Project Bumble Bee Atlas



4. Enter the survey information using the online entry tool

- a. If this is a location that you have previously surveyed and have entered data for, you will be able to choose that location. If this is a new survey location, you will need to add a new location to the database.
- b. Survey type: Point surveys are the general bumble bee and habitat surveys.

Note: It's okay to visit the same location multiple times. If this is the case, you can select your saved location by searching for previous locations in the locations text box. Multiple surveys in the same location may reveal unique species at different times of the year!

Location*

Choose from Your Locations ▼

Add a New Location ▼

How accurate is this location (in meters)*

Select an accuracy ▼

Date of Sighting*

mm / dd / yyyy 📅

Must be in the past or today.

Survey type*

----- ▼

Collection Method*

----- ▼

Approximately how many hectares was your survey area?*

1 ⬆️⬇️⬆️

1 ha is the standard size of an Atlas survey and is approximately the length of a football field squared or the area inside a standard (400m) track.

Number of Surveyors*

⬆️⬇️⬆️

5. Enter surveyor information and weather data

6. Enter the associated habitat data for the survey

- a. You will need to refer to the habitat information section on the Habitat Data Sheet for this information.
- b. Surrounding habitat(s)
- c. Amount of flowering resources
- d. Available nesting resources
- e. Evidence of different management on the landscape

How much of the survey area has flowering resources available?*

Nesting resources*

Brush piles

Bunch grasses

Leaf litter

Loose bare soil

Mulch

Pine needle duff

Rock piles

Rodent holes/Tunnels

None of the above

Evidence Of Mowing* Evidence Of Livestock Grazing* Evidence Of Native Grazing*

Evidence Of Agriculture* Evidence Of Insecticide Use* Evidence Of Herbicide Use*

Evidence Of Fire* Evidence Of Honey Bees* Management Notes

If so, please include type of fire and other details in Management Notes below.

If so, please include the number of hives, proximity to survey site, and other details in Management Notes below.

Number of Flower Species*

How many different species of flower (including trees and shrubs) were in bloom in the survey area (that were not visited by bumble bees during your survey)?

7. **If flowering plants observed, enter the species information for each encountered during the survey effort. If you know the scientific name as well, it is beneficial to include that information.**
 - a. Flowering plant lists will appear after selecting the number of flowering species in the drop-down box above.
8. **Click Submit once you have entered all of the relevant survey information. You will be directed to the next page to enter bumble bee occurrences during the survey.**

9. Enter information for each bumble bee species encountered during the survey

- a. Upload photos from computer
- b. Select species or use the species identification tool
- c. Number observed/collected
- d. Flower host information
- e. Click Add sighting to move on to the next species

Home / Editing Checklist: 2024-03-05 | Michigan | roweloga

Editing Checklist: 2024-03-05 | Michigan | roweloga

Photos*
Drop files here to upload
or select files below

Select Photo(s)

Species*
[Dropdown menu]

Include species not typically in this region:

Identification Tool

Count*
1

Reference ID
[Text input]
Optional external sighting ID.

Sex*
Not Determined

Floral Host
Floral host scientific name...
Floral host notes...

Observation Notes
[Text area]

Private
Checking this field will make the location and sighting information private and inaccessible to public view.

Add Sighting Cancel

10. After adding the sighting, you will see the checklist of occurrences for the site. Now you can either add additional species/sightings to this survey or edit previously entered sightings.

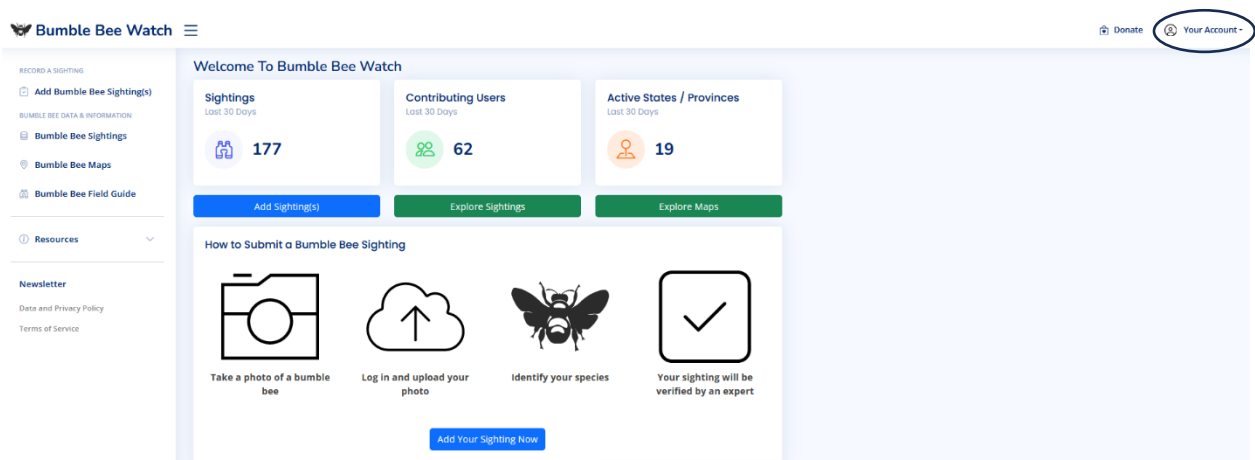
Incidental Observations

Incidental observations do not require a formal survey effort and are an opportunity to document bumble bee species and flower associations when you come across them during everyday life. Therefore, they do not require the use of a data sheet or the need to complete a rapid habitat assessment form. Furthermore, they are an excellent way for new volunteers to participate as they develop their skillset.

Incidental observations can be submitted using the desktop online submission form on the Bumble Bee Watch website or using the Bumble Bee Watch phone app. Be sure to upload high quality photos and 1-5 photos for each bumble bee observed. Details on how to upload incidental observations to Bumble Bee Watch are provided below.

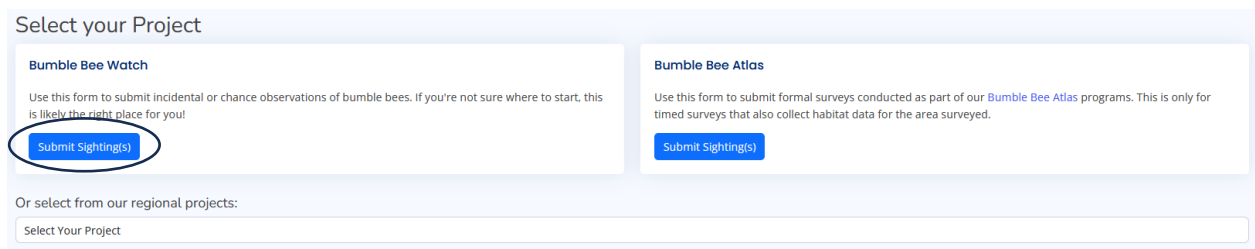
How To Submit an Incidental Observation

1. Log into your created profile in Bumble Bee Watch.



2. Click Add Your Sighting Now.

3. Select the Project Bumble Bee Watch



4. Step 1: Enter bumble bee sighting location

- a. If this is a location that you have previously surveyed and have entered data for, you will be able to choose that location. If this is a new survey location, you will need to add a new location to the database.

Note: It's okay to visit the same location multiple times. If this is the case, you can select your saved location by searching for previous locations in the locations text box. Multiple surveys in the same location may reveal unique species at different times of the year!

- b. Enter the bumble bee sighting locational accuracy and the date of the sighting.

Location*

Choose from Your Locations

Add a New Location

How accurate is this location (in meters)*

Select an accuracy

Date of Sighting*

mm / dd / yyyy

Must be in the past or today.

Submit

Step 2: Upload bumble bee photo(s) and add species and floral host information if known.

- a. Upload photos from computer
- b. Select species or use the species identification tool
- c. Number observed/collected
- d. Flower host information
- e. Click Add sighting to move on to the next species

Note: After adding the sighting, you will see the checklist of occurrences for the site. Now you can either add additional species/sightings to this survey or edit previously entered sightings.

Keeping Up With Your Records

Bumble Bee Watch allows users to keep track of their bumble bee contributions and survey efforts. Just click on “My Profile” in the top right-hand corner of the main page after logging in.

Planning a Survey

Surveyors should study their adopted grid cell to identify potential bumble bee and habitat survey locations. Since grid cells represent large areas, identifying areas within the cell that are publicly accessible will be important to successfully implementing a bumble bee and habitat survey. You can survey anywhere within the grid cell, as long as it is on public property (or within a right-of-way roadside), or written approval is provided by a landowner. The best resource to use when selecting a survey site is a map application such as Google or Apple maps that has aerial imagery, which can help locate open areas suitable for surveys. Being familiar with sites will make data submission easier later on during data submission. Many areas in Michigan are rural with limited cellular service, so planning before heading out to conduct a survey is crucial. Bringing printed or downloaded maps can be extremely helpful when traveling with limited connectivity. Always feel free to connect with us as you are planning a survey if you would like additional guidance on selecting a site or planning a survey event.

Ideal locations for surveys:

1. Public parks (county, township parks)
2. State and Wildlife Recreation Areas
3. National and State Forests
4. Wildlife Conservation Lands (Public Land Conservancies, The Nature Conservancy, Michigan Nature Association Public Areas)
5. Roadsides

Where not to survey:

1. National and State Parks
2. National Wildlife Refuges
3. Wildlife Management Areas
4. Private Property

*National and State Parks, national wildlife refuges, and national and state parks all require a permit in order to conduct research. Within these areas, it is okay to photograph bees, but collecting is prohibited.

Equipment To Bring During Your Survey

It's important to have a checklist of materials prior to traveling to conduct a survey. Here we provide a list of required and suggested materials to bring along on your survey:

What to bring:

1. Bumble bee survey and rapid habitat assessment data sheets

2. Something to write with. A pencil is preferred in case you need to make changes on the datasheet
3. A camera with macro-photography capabilities
4. A clipboard
5. A stopwatch. Most smartphones have built in stopwatches that will work
6. Aerial net for collecting bumble bees ([purchase link](#))
7. Cooler with crushed ice for storing bumble bees before being processed
8. Vials or insect storage containers ([purchase link](#))
9. Field guides for Michigan plants and bumble bees
10. A hat
11. Extra water and sunscreen

As you plan for a survey, be sure to pay attention to the local weather. Many excellent survey locations are off the beaten path and may be on dirt roads, which can become harder to access after a recent rain.

Field Guide Recommendations

1. Bumble Bees of North America: An Identification Guide (2014)
by Williams, Thorp, Richardson and Colla; Princeton University Press
Book: <https://press.princeton.edu/books/paperback/9780691152226/bumble-bees-of-north-america>
2. Bumble Bees of the Eastern United States (2012)
by Colla, Richardson and Williams; USDA Forest Service and Pollinator Partnership
PDF: https://www.xerces.org/sites/default/files/2018-05/12-052_01_Eastern_Bumble_Bee.pdf
3. Wildflowers of Michigan Field Guide (2000)
By Stan Tekiela; Adventure Publications
Book: <https://www.amazon.com/Wildflowers-Michigan-Wildflower-Identification-Guides/dp/1885061919>
4. Michigan Shrubs and Vines: A Guide to Species of the Great Lakes Region (2016)
By Barnes, Dick, and Gunn; University of Michigan Press
Book: <https://www.amazon.com/Michigan-Shrubs-Vines-Species-Region/dp/0472036254>
5. Michigan Trees: A Guide to the Trees of the Great Lakes Region (2004)
By Barnes and Wagner Jr.; University of Michigan Press
Book: <https://www.amazon.com/Michigan-Trees-Revised-Updated-Region/dp/0472089218>