



PACIFIC NORTHWEST BUMBLE BEE ATLAS

Participant Handbook - 2022



Resources Available Online at: www.PNWBumbleBeeAtlas.org

Project Coordinators:

Rich Hatfield

Senior Conservation
Biologist
**The Xerces Society for
Invertebrate
Conservation**
628 NE Broadway, Suite 200
Portland, OR 97221
Phone: (503) 232-6639 x115
rich.hatfield@xerces.org

Taylor Cotten

Conservation Assessment
Section Manager
Wildlife Diversity Division
**WA Department of Fish &
Wildlife**
Wildlife Program
PO Box 43141
Olympia, WA 98504-3200
phone: (360) 701-8787
t.cotten@dfw.wa.gov

Joel Sauder

Regional Wildlife Biologist
Wildlife Diversity Program
**Idaho Department of Fish
and Game**
3316 16th St,
Lewiston, ID 83501
Phone: (208) 750-4223
joel.sauder@idfg.idaho.gov

Laura Tesler

Willamette Wildlife Mitigation Program
Coordinator
Oregon Department of Fish & Wildlife
4034 Fairview Industrial Ave SE
Salem OR 97302
Phone: (971) 600-8336
Laura.Tesler@state.or.us

Julie Combs

Pollinator Species Lead
Washington Department of Fish & Wildlife
Wildlife Diversity Division
1111 Washington Street SE
Olympia, WA 98504
Phone: 206-888-7256
Julie.Combs@dfw.wa.gov



Support for this project is provided by the [U.S. Fish and Wildlife Service - Wildlife Sport Fish Recovery Program](#). Additional support is provided by The New-Land Foundation, Inc., The Edward Gorey Charitable Trust, the U.S. Forest Service, the Bureau of Land Management, the [Oregon Conservation Recreation Fund](#), and the WDFW Watchable Wildlife Fund.

Cover photo: *Bombus occidentalis* on *Solidago* sp. Photo by Rich Hatfield, the Xerces Society.

Contents

Introduction	4
Bumble Bee Biology	5
Project Design	6
How to Participate	7
Step 1: Register	7
Step 2: Adopt a Grid Cell	7
Step 3: Get Familiar With Project Protocols.....	8
Step 4: Conduct a Survey	8
Step 5: Submit Your Data	10
Survey Methods	13
Point Surveys	13
Roadside Surveys.....	16
Rapid Habitat Assessment	17
Alternative Survey Options	18
Resources	19
Data Sheets and Field Guides.....	20



@pnwbumblebees



@pnwbumblebees



groups/pnwBumbleBeeAtlas

Introduction

Bumble bees are charismatic and easily recognizable pollinators thanks to their large size and distinctive striped patterns, usually of black and yellow, but often with stripes of red, orange, or white. They play an incredibly important role in keeping our environment healthy by pollinating flowers in natural areas and by contributing to successful harvests on farms.

In recent years, the importance of pollinators and their contribution to the agricultural economy has been recognized, as has their vulnerability, in large part because of widespread losses of bees. Declines of pollinator populations are alarming, and the media has paid particular attention to the plight of the introduced European honey bee and Colony Collapse Disorder. Equally important, but less well understood or publicized, is the parallel decline of native bee populations, particularly bumble bees. A recent study led by the IUCN Bumble Bee Specialist Group, supported by studies led by Dr. Sydney Cameron, and a status review by Dr. Robbin Thorp and the Xerces Society, demonstrate that several of North America's nearly fifty species of bumble bees are undergoing dramatic population declines. Two species, Franklin's bumble bee (*Bombus franklini*) and the rusty-patched bumble bee (*B. affinis*), may already be on the brink of extinction.

The causes of these declines are not fully understood, but the following are likely playing a role: loss and fragmentation of habitat, pesticide exposure, climate change, overgrazing, competition with honey bees, low genetic diversity, and perhaps most significant, the introduction and distribution of bee pathogens into the environment from commercial pollinators. Regardless of the ultimate cause of bumble bee declines, protecting existing habitat and creating and maintaining new habitat are some of the most immediate and productive steps that can be taken to conserve these important pollinators. This will require widespread participation and collaboration by landowners, agencies, and scientists. The Xerces Society and others have already begun this effort, but more work is needed.

In addition to habitat, we need a better understanding of where these animals are living in order to conserve them, and to protect habitat in the best places. While there is a gross understanding of bumble bee distributions in the Pacific Northwest, more detailed and current information will generate better conservation recommendations. Idaho, Oregon and Washington are home to nearly 30 species of bumble bees, and several of them face an uncertain future. The Western Bumble Bee has declined dramatically - especially in the western portion of its range, Franklin's Bumble Bee has not been detected since 2006, and species like Morrison's Bumble Bee and the Suckley Cuckoo Bumble Bee appear to be in decline.

The Idaho Department of Fish and Game, Washington Department of Fish and Wildlife, Oregon Department of Fish and Game, and the Xerces Society have partnered to support bumble bee conservation through a region wide project to collaborate with community scientists and collect current information on bumble bee species distribution. The missing partner is you - become a community scientist and join us! Washington, Idaho, and Oregon are large and wild, so we need a team of trained scientists equipped with cameras spread through the region. Then, we can cover all three states quickly, collect high quality data, and contribute to the global understanding of bumble bee distributions.

We invite community scientists to join in the project:

1. [Familiarize yourself with our protocols](#). The best way to do this is by attending a training workshop, or viewing our online videos.
2. [Adopt a grid cell](#) - you can do this alone, or with a group of friends or family (Bumble Bee Watching is more fun with friends!).
3. Visit a location within that grid cell two times (at a minimum - more sampling is welcome, if you are willing) a year during the bumble bee season and use our standardized protocol (see Pages 8-14) to sample for bumble bees and characterize the surrounding habitat. To meet this requirement, you can visit two different locations on the same day, or revisit the same location on two different days. If travel time is not a concern, the preferred method is to visit the same site on different days (ideally separated by ~3 weeks).
4. Submit your to [Bumble Bee Watch](#).

What you will **need** to participate:

1. A curiosity for insects and flowers.
2. Transportation to your grid cell (or choose an area in which you live or work).
3. A smartphone or camera to take high quality pictures.
4. Access to a computer or smart phone where you can upload photos to [Bumble Bee Watch](#) and track your progress.

What is helpful to participate:

1. An insect net and vials (glass jars from home work well).
2. Basic knowledge of wildflower identification and where to find them!
3. Local plant identification field guides
4. Bumble bee field guides ([Bumble Bees of North America](#))

Bumble Bee Biology

Bumble bees are social insects that live in colonies like honey bees, although the colonies are much smaller (50-500 members, compared with over 10,000) and their life cycle is different. Honey bee colonies are perennial, with the colony surviving the winter by consuming stored honey reserves and the queen living several years. In contrast, bumble bee colonies are annual, with only the newly produced queens living through the winter. The queens emerge from hibernation in the early spring and immediately start foraging for pollen and nectar and begin the search for a nest site. Nests are often located underground in abandoned rodent nests, or above the ground in tufts of grass, old bird nests, or cavities in dead trees or under rock piles.

After the queen finds a nest site, she constructs waxen pots and begins the process of provisioning these with pollen mixed with nectar on which she lays her eggs. Once hatched, the larvae develop into adults in 4-5 weeks, during which time the queen is busy gathering pollen and incubating the developing larvae. The newly emerged adults become the colony's worker force to gather pollen and nectar. The queen now stays in the nest, where her sole responsibility is to lay eggs and rear offspring.

At some point, depending on the species and habitat conditions, the colony switches from producing workers to rearing reproductive members of the colony, the new queens and the males (which are called drones). As soon as males reach adulthood they leave the colony in search of a mate, and usually do not return. New queens remain with the nest until the season is over. At that time, the new queens leave the nest in search of an overwintering site. Once she finds her site, she will dig down a few centimeters, usually in soft earth, form an oval cavity, and settle in until the following spring. The remainder of the colony, including the foundress, dies before winter.

In general, bumble bees forage on a diverse group of plants, though individual species preferences in plants vary due to differences in tongue length. Some species have long tongues and preferentially forage on plants such as penstemon and monkshood that have longer corolla tubes. Species with short tongues forage on flowers with an open structure, such as sunflower and asters. In addition, short-tongued bumble bees will engage in "nectar-robbing" from flowers with a long corolla tube by biting holes at the base of the corolla and drinking the nectar from the outside of the flower. This practice is called nectar-robbing because the bee does not touch the anthers or stigma when accessing the nectar, thus taking the reward without contributing to the plant's pollination needs.

Studies of flight distance show that different species of bumble bees vary in how far they forage from the nest, with estimates ranging from 275m (900 ft) to 750m (2,460 ft, nearly 1/2 mi.), considerably further than most other native bees. Between species, body size and colony size are good predictors of flight distance. There is also recent evidence that bumble bee foraging distances decrease with nearby high quality foraging habitat. This agrees with optimal foraging theory, which suggests that bumble bees should seek to reduce their flight distances; longer flights require more energy expenditure, and thus increased time foraging for nectar, meaning fewer resources for offspring.

Compared to other bees, bumble bees are large in size and covered in dense fur. They also are able to generate heat and regulate their body temperature. This ability to thermoregulate is uncommon among insects and allows bumble bees to fly at colder temperatures than most other bees. Because of this, bumble bees thrive in northern climates and high elevation areas. The Pacific Northwest is ripe with many of these habitats and thus we are blessed with a diverse native bumble bee fauna. The purpose of this project is to help us get a better understanding of our native fauna, the habitats on which they depend, and the resources that they need.

Project Design

To continue the bumble bee atlas in OR, WA and ID we have divided the states up into approximately 50 km by 50 km (31 mi by 31 mi) grid cells. There are 528 cells in all three states, 174 in Idaho, 159 in Washington, and 195 in Oregon. On top of those grid cells we have identified High Potential Zones (HPZs). The purpose of the HPZs is to target areas where we may encounter (and therefore learn more about) our Species of Greatest Conservation Need (SGCN). The SGCN for this project are: Western Bumble Bee (*Bombus occidentalis*), Morrison's Bumble Bee (*B. morrisoni*), the Suckley Cuckoo Bumble Bee (*B. suckleyi*), and Franklin's

Bumble Bee (*B. franklini*). These HPZs are based on recent, and historic, detections of these four species, and their ability to travel through different habitat types from those localities. As such, these surveys are our priority:

1. Surveys within HPZs ([colored blobs on the map](#)).
2. Surveys in grid cells that are under surveyed ([light gray on the map](#)).
3. Continue long-term monitoring throughout our region ([in dark gray cells on the map](#)).

How to Participate

Step 1: Register

The first thing you will need to participate is a Bumble Bee Watch account. It is easy to set up online and takes about 5 minutes.

1. If you already have one, all you need is to head over to Bumble Bee Watch (www.BumbleBeeWatch.org) and register for the PNW Atlas Project. This is pretty easy: once you've logged in, click on your user name at the top of the page "Welcome, username". This will take you to your profile page. In the upper left of that page, click "edit". Here you can edit your contact information, email address and other details. At the bottom of the page you can also select a project. In that box, select **PNW Bumble Bee Atlas**, and then click save. You are all set!
2. If you do not yet have a Bumble Bee Watch account, please [create an account](#). When registering for an account, please be sure to select PNW Bumble Bee Atlas as your project at the bottom of the page. This will help us keep track of user participation and data for the project, and will give you access to the portal where you will submit your data.

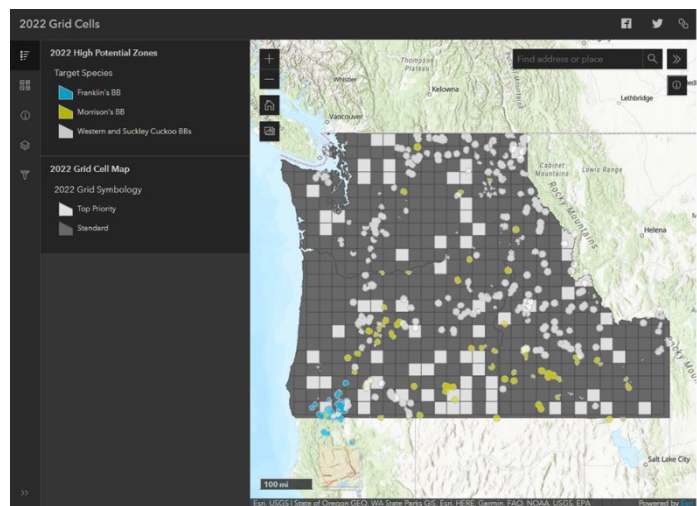


Figure 1: Grid Cell Map for the Pacific Northwest Bumble Bee Atlas.

Step 2: Adopt a Grid Cell

After you have established a Bumble Bee Watch account and selected a username you can adopt one or more grid cells. Adopting a grid cell means that you have agreed to be an integral part of this project, and plan on surveying for bumble bees using our standardized protocols. This means, at a minimum, you will visit a location within that grid cell two times year during the bumble bee season and use our standardized protocol to sample for bumble bees as well as the surrounding habitat. To meet this requirement, you can visit two different

location on the same day, or revisit the same location on two different days. The preferred protocol is to visit the same site on a different day (ideally three weeks or more later), but we understand that sometimes travel circumstances, etc. prevent this from being practical/possible.

The best way to adopt a grid cell is online using the project map. That way, you'll be able to see which grid cells are already adopted, and which ones need attention. You can find the information on adopting a grid cell at:

<https://www.pnwbumblebeeatlas.org/instructions.html>.

Step 3: Get Familiar With Project Protocols

Visit our website to find a training workshop:

<https://www.pnwbumblebeeatlas.org/live-events.html>.

If you cannot attend a training, we will make as much of the workshop available via webinar/video as possible. Stay tuned to the website once our 2021 training workshops have aired.

Step 4: Conduct a Survey (See Survey Methods for more details)

Plan your visit

Take some time to investigate the grid cell that you've adopted. The grid cells are large with varied habitat, terrain and land ownership. You can survey anywhere in the grid cell for bumble bees (we prefer you survey in HPZs), but taking some time to select potential locations and access routes will decrease travel time, and maximize the time you can dedicate to bumble bee surveys. We suggest you start with the project map, or Google Maps (or similar) with aerial photography to flag potential sites and plan travel routes. Getting familiar with your sites using maps will also help you when it comes time to submit your data; accurate locations are important! Many areas of all three states are remote, with limited travel routes - and potentially with limited cellular service. When surveying, please follow all rules, regulations and posted signs; respect private property and take all necessary safety precautions. You can find some helpful videos for this process here:

<https://www.pnwbumblebeeatlas.org/key-resources.html>.

It is possible that you will find when you arrive at a pre-selected site that survey conditions for bumble bees may not be optimal. We encourage folks to be flexible, and opportunistic, but to stay within their assigned grid cell (and ideally within an HPZ). As such, bring resources with you to navigate, including printed maps as cell service is not available in many parts of the Pacific Northwest.

Resources to help you plan your trip (**note:** we do not guarantee the reliability of any of these resources, just provide them as tools for you to help plan your trip. These, to our knowledge are some of the best, and most reliable mapping resources available, though there are certainly alternatives):

- [Google Maps with Overlaid Grid and HPZs](#) (you will be able to find the grid number of your adopted cell to help you plan a trip)
- [Idaho Trails Map](#): trails.idaho.gov
- [Washington Trails Association](#): wta.org
- [Oregon Hikers Trail Guide](#): oregonhikers.org/field_guide/Main_Page
- Green Trails Maps (OR, WA) - available from many outdoor retailers and online
- USGS Topo Maps - available from many outdoor retailers and as downloads
- DeLorme State Atlas & Gazetteer Paper Maps

Considerations:

- Ideally you will survey in an open area with lots of flowers
- Unless you have explicit permission from the landowner, stay on public lands and public rights-of-way (e.g. roadsides)
- Good choices for surveys - be sure to follow all regulations.
 - State Parks
 - State Wildlife Areas
 - Your Backyard
 - U.S. Forest Service land
 - BLM land
 - Local parks
 - Natural Areas
 - Your School
 - Roadside
- National Parks and Monuments, Washington State Parks, and Washington Department of Natural Resource Natural Areas often have many great locations for bumble bee surveys, but research in those parks requires a permit. There is no reason you cannot photograph a bumble bee on a flower in these areas, but you may not capture wildlife in a net or vial without appropriate research permits. **We have obtained permits to survey in many National Parks for 2022, but you must be named on our permit. If you are interested, please contact us at pnwbumblebeeatlas@xerces.org.**
- Consult with local resources about road surfaces and do not always rely on GPS or Google/Apple Maps for travel planning. Many roads on Forest Service lands are dirt, often with logging truck traffic with limited turn around and site distances; they may also require high clearance vehicles, and additional travel time, please use caution.
- Let someone know your travel plans, including expected return time/date.
- **Remember to follow all local regulations. Make sure that you have permission to conduct a survey (if needed). Just because an area is within an HPZ DOES NOT mean that you have permission to survey there.**

What to Bring:

- Paper Maps
- Camera (ideally with macro capacity) and/or smart phone
- Extra batteries and/or charger
- Insect net
- [Data sheets](#) and pencil/pen
- Small cooler with ice/ice packs - or just a bag of ice
- Vials or insect viewing jar
- Field guides (plant and bumble bee)
- Timer
- GPS Unit or similar Smartphone App
- Hat
- Drinking water
- Sunscreen
- Field notebook
- Hand lens
- Friends!

Step 5: Submit Your Data

You will be submitting all data using the community science website Bumble Bee Watch. You must submit data survey data using our [online application](#). The instructions below are for submitting data from a survey. If you are submitting data from an incidental sighting choose Bumble Bee Watch as your **Project in number 4 below**.

Enter the Site information - See Figure 2

1. Gather your datasheets, curate your photos, and gather your data.
 - a. Make sure you know which photos belong to which individual bee. All of this information should be on your datasheet, so have that nearby.
 - b. Each observation can include 5 photos - ideally pick your best three (it is fine if you have fewer than 3), and then use the last two photos to include a photo of the plant on which it was seen (if applicable)!
 - c. Make sure you know at which site each bee was caught (exact location within a site is not important, just the site if you have more than one survey you've conducted)
 - d. Have your field datasheet and/or notebook nearby
2. Login to [Bumble Bee Watch](#).
3. Choose Record a Sighting -> Bumble Bee Sighting.
4. If you are submitting survey data, choose **PNW Bumble Bee Atlas as your Project** (see Figure to the right for more details). If you are submitting an incidental observation, select Bumble Bee Watch for your Project.
5. Use the **map interface or your previous locations** to select a site, and provide that **site with a name**.
6. If you prefer, you can add the site by typing in the **latitude and longitude**. You MUST use decimal degrees, AND include the leading negative sign in the longitude. Also select the correct state.
7. Select the **accuracy of the location** (if you surveyed a hectare, select 25-50 m here).
8. Select the **date of your survey**.

The screenshot shows the 'Bumble Bee Sighting' form, step 1: location. The form is titled 'Bumble Bee Sighting' and includes a subtitle 'This form is for submitting a bumble bee sighting'. Below the title is a 'Project*' dropdown menu with 'PNW Bumble Bee Atlas' selected. The 'Location' section features a map of the world with a search bar and a 'Location' label. To the right of the map is a 'Select a Previous Location' section with a 'Your Locations' list, a 'Search for Previous Location' input, and a 'Type in a previously used Site Name to generate coordinates from recently submitted location' input. Below these are fields for 'Site name*', 'Latitude*', 'Longitude*', 'Province/State*', 'How accurate is this location (in meters):*', and 'Date of Sighting:'. The 'Date of Sighting' field is highlighted in green.

Figure 2: Screenshot of site information.

Enter the Survey Information (All of these fields transfer directly from the data sheet) - See Figure 3

Survey Type* <input type="text"/>		Approximately how many hectares was your survey area?* <small>1 ha is approximately the length of a football field squared or the area inside a standard (400m) track.</small> <input type="text"/>	
Collection Method* <input type="text"/>			
Number of Surveyors* <input type="text"/>	Survey Start Time* <input type="text"/>	Survey End Time* <input type="text"/>	Survey Minutes* <small>Including all surveyors, what is the total number of person-minutes for your survey?</small> <input type="text"/>
Temperature* <input type="text"/>	Cloud Cover* <input type="text"/>	Wind Speed*: <input type="text"/>	Weather Notes <input type="text"/>
Habitat type of SURVEY AREA* <small>Please choose one. You can add more details in the Notes if needed.</small> <input type="text"/>		Habitat type of SURROUNDING AREA* <small>Please choose the most abundant habitat type of the surrounding area.</small> <input type="text"/> <small>If there is more than one surrounding habitat type, please select the second most abundant habitat type of the surrounding area.</small> <input type="text"/>	
How much of the survey area has flowering resources available?* <input type="text"/>		Which of the following features do you see in or near the survey area? <input type="checkbox"/> Bunch grasses <input type="checkbox"/> Rodent holes/Tunnels <input type="checkbox"/> Brush piles <input type="checkbox"/> Loose bare soil <input type="checkbox"/> Leaf litter <input type="checkbox"/> Pine needle duff <input type="checkbox"/> Rock piles <input type="checkbox"/> Mulch <input type="checkbox"/> None of the above	
I see evidence of, or know that the following have occurred in or near the survey site(s): <small>If you said yes or suspect to Fire or Honey Bees, please include more details in the notes below (type of fire, number of honey bee hives observed and how close to the survey site).</small>			
Mowing* <input type="text"/>	Livestock Grazing* <input type="text"/>	Native Grazing* <input type="text"/>	Agriculture* <input type="text"/>
Insecticide Use* <input type="text"/>	Herbicide Use* <input type="text"/>	Fire* <input type="text"/>	Honey Bees* <input type="text"/>
Management Notes <input type="text"/>			
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)?* <input type="text"/>			

Figure 3: Screenshot of habitat entry form.

1. Enter the survey information, including the survey type, collection method (did you capture all bumble bees, target "different" bumble bees, or use a combination of methods?), size of survey area (in hectares), number of surveyors, start and end time, survey minutes (number of "person-minutes" that was the target time for the survey window, weather data, and habitat types.
2. Enter the Nesting Habitat data.
3. Enter the Management data.
4. Enter the floral data (from the second page of the datasheet).

Enter the volunteer data (if applicable) - See Figure 4

Was this survey a volunteer effort?
Yes

What time did you start volunteering on the day of your survey (include planning and driving time)?
--:--

What time did you stop volunteering on the day of your survey (include planning and driving time)?
--:--

How many hours did you spend organizing and entering your data (what you're doing now)?*
Time spent organizing is required.
[Text Box]

How many miles did you drive to conduct your survey (roundtrip)?*
[Text Box]

Did you use our online resources for training purposes?
Yes

On what day did you use the resources?*

Pick the day where you spent the most time (it is okay if the date is not exact).
[Text Box]

How many hours did you spend watching videos or reading the materials?*

Do your best to approximate the amount of time you spent. An estimate is fine.
[Text Box]

By typing your name below, you agree that all information provided above is correct and accurate to the best of your knowledge.*
[Text Box]

Next

Figure 4: Screenshot of volunteer data entry form.

1. If this was a **volunteer effort**, choose yes (options seen above will appear).
2. Include the **start time and stop time on the date of your survey**; the **number of miles (roundtrip) that you drove to conduct your survey**; and **whether or not you used online resources for training** (these do NOT include live webinars).
3. **Also include the hours you spent organizing and entering your data** (this part).
4. Click **NEXT**

Enter your bumble bee data (see Figure 5)

1. If you observed zero bumble bees during your survey, your data entry is complete, you may exit the page.
2. You **may enter up to 5 photos**. Please try to use up to 3-4 photos for each bee, and 1-2 photos for the host plant.
3. Enter **the bee species and host plant information**.
4. If you'd like, **use our Identification Tool to help you ID the species**.
5. Click **SAVE**.
6. If you have another bee to add, click **"Add another"**. You will NOT have to add the survey/site information again.
7. Repeat 1-6 as needed for all observed bumble bees.
8. When you are finished, click **SAVE**.

The screenshot shows a web form for entering bumble bee data, divided into two steps: 'step 1: location' and 'step 2: record(s)'. The 'step 2' section is active. It contains several input fields: 'Species' (a dropdown menu showing 'sp. / Bumble bee'), 'Floral Host' (a text input with 'Add floral host...' placeholder), 'Floral host notes...' (a text area), 'Observation Notes' (a text area), and a 'Private' checkbox. To the left of these fields is an 'Images' section with a 'Drop photos here to upload' area and a 'Choose Files' button. To the right of the 'Species' dropdown is an 'Identification Tool' button. Below the input fields is an 'Add another' button. At the bottom of the form is a large blue 'Save' button. Below the 'Save' button is a status message: 'This checklist was last saved on Apr 26th, 2021 @ 11:51 AM. You may continue editing if necessary. The checklist ID is: 66680'. Below the status message is a 'View Checklist' button.

Figure 5: Bumble bee data entry page.

Survey Methods

Survey Timing and Conditions

Bumble bees are generally active from April (or earlier depending on your location) through September depending on the habitat, species, and weather. Some species may be active earlier, and some may be active later. But, since the goal of this project is to get a better understanding of the distribution of all species in Oregon, Washington, and Idaho, we're targeting the middle of the season: **June, July, and August**. In some locations it may be appropriate to survey earlier, or later than that, but most places will be best June - August. If you have adopted a grid cell where we will encourage early or late sampling (outside of the official survey window), we will contact you. Otherwise, please restrict surveys to June 1 - August 31st. Bumble bees prefer warm sunny days to forage, and thus these are the best days on which to conduct surveys. As such, please survey on sunny (or mostly sunny days) between 60°F and 90°F. Conditions much hotter, much cooler, and/or much cloudier will likely result in reduced bumble bee activity. The best sites will be open with an abundance and diversity of flowering resources.

Point Surveys

Point surveys are our standard surveys and will provide high quality bumble bee data from any survey area. These surveys are 45-person-minutes and will need to take place in an area

around the size of a hectare (~2.5 acres). This means that if you are alone you will survey for 45 minutes. If you brought one friend, you will survey for 22.5 minutes, and if you brought two friends, you will survey for 15 minutes, etc. You will also need to plan for time to conduct a rapid habitat assessment to gather habitat information about the site that you surveyed, and the surrounding area.

Phase 1: Plan your survey area

Surveys should cover approximately one hectare or 2.5 acres (100m x 100m or 328' x 328'). This does not have to be a square, but could be 20 m x 500 m along a roadside or any other similar area configuration. Mark the center of your location on a map (either paper or smartphone app). **This will be very important later for data submission, please document the location of each survey accurately! See the videos on our website to help you get the latitude and longitude information. These will need to be as accurate as possible.**

Phase 2: Fill out the top of your data sheet

This will include date, time, surveyors, location, and basic weather information (approximate temperature, cloud cover, wind, etc.). See the data sheets (Starting on Page 20) for more detail.

Phase 3: Begin your survey

Note the start time of your survey, start the timer and begin searching for bumble bees. While looking for bumble bees you should wander through the entire survey area, focusing on plants that are flowering. Focus on ALL flowering plants, not just those that are most abundant or showy. Different bumble bees are sometimes attracted to different species of flower. When you find a bumble bee, capture it into a vial (either directly or using an insect net). If applicable, take a photo of the flower the bee was captured on. A good way to do this is to number each vial, and then take a photo of the vial next to the plant of interest (see



Figure 6: Numbered vials help document which bee was found on which plant when collecting data.

Figure 6). Please take a picture of each plant (include flowers and leaves) to include with your data. Idaho, Oregon and Washington all have wildflower smartphone apps that can help you in the field, and there are many other resources available (see <https://www.pnwbumblebeeatlas.org/key-resources.html>) to help you ID the plants. Place the vial with the bee into a cooler with ice for later documentation. Continue in this fashion for 45-person-minutes (count only time searching for bumble bees), or until you have run out of vials. If you run out of vials, stop the timer and continue to Phase 4, and then return to Phase 3 for the remaining amount of time. When your time is complete, note the end time of your survey.

Phase 4: Document each bumble bee
PLEASE DO THIS STEP CAREFULLY! IF WE GO THROUGH ALL OF THIS EFFORT, BUT DON'T GET GOOD PHOTOS, MUCH OF YOUR VALUED EFFORT WILL NOT GO TO BEST USE!

After bees are cooled for a period of time (several minutes), they will slow enough to allow you to photograph them. You can do this directly on a flat surface (see Figure 6). Using a camera or smartphone take clear, in-focus pictures of the each bees' head, thorax, and top and bottom of the abdomen (maximum of 3 photos for each bee - see photo tips and tricks here:

<https://www.pnwbumblebeeatlas.org/photo-tips.html>). Be sure to document how many

photos you take of each bee, and note the file names on the [data sheet](#). Also, make note of the species of flower on which the bumble bee was captured, or note otherwise (e.g. nest searching, patrolling), and include the photo numbers of the plant (or the vial number for later data collation). After you photograph the bumble bee it may still be a bit sluggish and may take some time to warm up. Place in the shade and it will slowly acclimate and be on its way. Continue in this fashion until you have documented each individual bumble bee. If you have time remaining on your survey, return to Phase 3, otherwise continue to Phase 5.

Phase 5: Collect Habitat Information

Spend some time walking around your site collecting the data for the Rapid Habitat Assessment (see Page 17). Take photos of each plant and write down the photo numbers for each, as well as a photo overview of the overall habitat.

Pro Tip: If you bumble bees have not yet finished cooling, you can do your Rapid Habitat Assessment.

Phase 6: Complete Documentation

Ensure that all data sheets are complete and that you have collected all necessary habitat information. While it might be tempting to leave some of this information for later, or when you get home, taking the time to do it while on site will reduce errors and increase the quality of the data you collect.

Phase 7: Submit your data

See Page 10 above for detailed instructions. You can also see the guidance on our website: <https://www.pnwbumblebeeatlas.org/help.html>

Phase 8: Sanitize your survey equipment

The last thing that we want to do while conducting surveys is endanger the animals that we're trying to protect. For best practice, it is a good idea to sanitize your survey equipment (especially your jars) in between each location. The best way to do this is with isopropyl alcohol, alcohol wipes, or with a diluted (10%) bleach solution. Apply the sanitizing liquid and

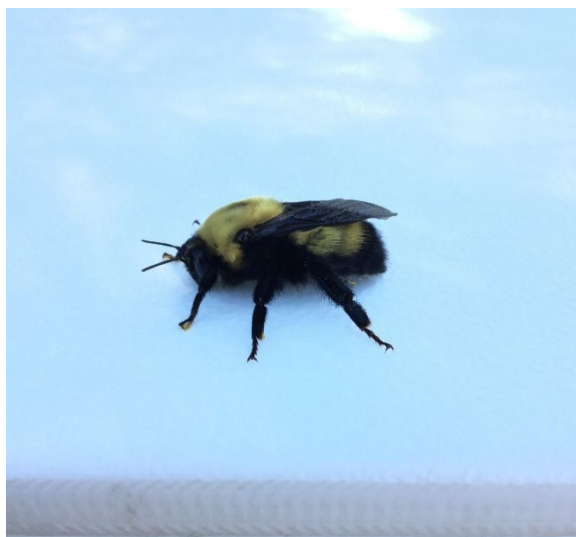


Figure 7: Photo documenting a chilled bumble bee.

let it dry completely. An alternative is to soak your jars in warm soapy water, and let them dry completely. Avoid using sanitary wipes or soaps with any sort of fragrance, etc.

Roadside Surveys

Roadside surveys are a common way to document bumble bee abundance and species richness, and have been used in a standardized way in other regions on the country (MN, VT, ME). They are also a great way for most anyone to participate, as they often do not require walking long distances or over uneven terrain, and can usually be completed along the public right of way along roadsides. However, roadside surveys are also not perfect (no method is) as each individual survey is shorter, and our roadsides tend to have non-native plants. As one of the goals of this project is to better understand the needs of our SGCN bumble bees, finding which native plants they are using is a priority. Roadside surveys may not be a perfect format to learn that specific information, but will still contribute to our understanding of bumble bee distribution and habitat needs. Roadside surveys can be conducted en route (or in return) from a formal survey site, or on their own, but should take place within a grid cell that has been adopted by someone in your party. Again, be sure to follow posted signs and regulations; please respect private property and if necessary obtain permission from the landowner.

Phase 1: Plan your route

Select a stretch of road that is at least 10 miles long. Ideally, the stretch of road would have several obvious open patches when looking at aerial photos/maps. See videos on our website to help with the planning process: <https://www.pnwbumblebeeatlas.org/key-resources.html>.

Phase 2: Begin survey

Once you arrive on your selected route stop at the first patch of available flowers that you observe (park carefully and follow local regulations and general safety precautions). Before you begin the survey, fill out the top of the datasheet (site and weather information). Be sure to include the start and stop times. **An individual roadside survey is 15 min. long and a complete roadside survey consists of 5 15-minute surveys.** Start your timer and capture bumble bees into vials. While looking for bumble bees you should wander from flower patch to flower patch in the roadside area. Focus on ALL flowering plants, not just those that are most abundant or showy. Because of many reasons, different bumble bees are sometimes attracted to different species of flower. If applicable, take a photo of the flower the bee was captured on. A good way to do this is to number each vial, and then take a photo of the vial next to the plant of interest (see Figure 6). Please take a picture of each plant (include flowers and leaves) to include with your data.. Place each bee into a chilled cooler.

Phase 3: Document each bumble bee

PLEASE DO THIS STEP CAREFULLY! IF WE GO THROUGH ALL OF THIS EFFORT, BUT DON'T GET GOOD PHOTOS, MUCH OF YOUR VALUED EFFORT WILL NOT GO TO BEST USE!

After bees are cooled for a period of time (several minutes), they will slow enough to allow you to photograph them. You can do this directly on a flat surface (see Figure 6). Using a camera or smartphone take clear, in-focus pictures of the each bees' head, thorax, and top and bottom of the abdomen (maximum of 3 photos for each bee - see photo tips and tricks here: <https://www.pnwbumblebeeatlas.org/photo-tips.html>). Be sure to document how many photos you take of each bee, and note the file names on the [data sheet](#). Also, make note of the species of flower on which the bumble bee was captured, or note otherwise (e.g. nest

searching, patrolling), and include the photo numbers of the plant (or the vial number for later data collation). After you photograph the bumble bee it may still be a bit sluggish and may take some time to warm up. Place in the shade and it will slowly acclimate and be on its way. Continue in this fashion until you have documented each individual bumble bee.

Phase 4: Collect habitat data

Spend some time walking around your site collecting the data for the Rapid Habitat Assessment (see Page 17). Take photos of each plant and write down the photo numbers for each, as well as a photo overview of the overall habitat.

Pro Tip: If you bumble bees have not yet finished cooling, you can do your Rapid Habitat Assessment.

Phase 5: Repeat

Drive at least 1 mile down the road and then find another patch of flowering plants at which to conduct a survey and go back to Phase 2. **Each Roadside Survey should consist of five fifteen minute surveys within a ~10 mile stretch of road.**

Phase 6: Submit your data

See Page 10 above for detailed instructions. You can also see the guidance on our website: <https://www.pnwbumblebeeatlas.org/help.html>.

Phase 7: Sanitize your survey equipment

The last thing that we want to do while conducting surveys is endanger the animals that we're trying to protect. For best practice, it is a good idea to sanitize your survey equipment (especially your jars) in between each location. The best way to do this is with isopropyl alcohol, alcohol wipes, or with a diluted (10%) bleach solution. Apply the sanitizing liquid and let it dry completely. An alternative is to soak your jars in warm soapy water, and let them dry completely. Avoid using sanitary wipes or soaps with any sort of fragrance, etc.

Rapid Habitat Assessment

At each location that you conduct a bumble bee survey (Point or Roadside) you will need to conduct a Rapid Habitat Assessment. This information will help us to understand what kinds of landscape features are important for bumble bees. The habitat survey should take between 10 and 30 minutes to complete (depending on the complexity of the site, and your familiarity with native plants). Habitat surveys will be longer for point surveys where each individual survey area is larger. Each roadside habitat survey will be a bit shorter.

Phase 1: Fill out the site and weather information

Use a GPS device and/or smartphone to gather weather information and locality. If you don't have access to weather in the field, you can gather weather from a nearby weather station later. See <https://www.pnwbumblebeeatlas.org/other-resources.html> for guidance.

Phase 2: Gather Habitat Information

1. Choose a primary habitat type of the survey area from the list provided, as well as (up to) the top three habitat types of the surrounding area (what you can see from your survey area).
2. Walk the entire survey area and estimate how much of the survey area has blooming plants.

3. Count the number of blooming species of plants (include trees and shrubs) you observe.
4. Look for habitat features noted on the datasheet - these are often associated with bumble bee nesting locations.
5. Do your best to assess the management activities in the area.

Phase 3: Document the species of plant in bloom.

Document each species of blooming plant, and include a photo of each.

Phase 4: Submit your data.

See Page 10 of this guide for detailed instructions.

<https://www.pnwbumblebeeatlas.org/key-resources.html>

<https://www.pnwbumblebeeatlas.org/help.html>

Alternative Survey Options

Incidental Observations

In addition to the formal surveys described above, incidental surveys or bumble bee observations can also help to our understanding of bumble bee distributions in the Pacific Northwest. They are more casual, and could occur anywhere, and at any time, even outside of the survey window. These surveys are also appropriate for National Parks, and other areas where capturing bumble bees without a permit is prohibited—follow local regulations. You might be in your adopted grid cell, or 100 miles away from it. Nevertheless, you may observe bumble bees visiting flowers and decide to stop and take a picture. These observations will not take the place of formal surveys, but they will help fill in information gaps in Oregon, Washington, and Idaho.

Incidental observations/photos can either be in situ (directly on a flower) or in a vial/photo chamber. Submit only photos that are in-focus with enough detail to determine the species in the photo (see <https://www.pnwbumblebeeatlas.org/photo-tips.html>). Please remember that all observations for the project need to be photo documented to count. Including information (and a photo if possible) about the plant on which you observed the bee is also very helpful.

Considerations:

- With incidental observations, you do not need to submit an observation of every bee you take at each location. Include only the best photos of each species (but see bullet point below). If you are not sure if photos are different species or not, error on the side of including too many observations.
- Include observations of the same species of bee visiting different species of flowers - that is great information to have.
- Do your best to identify the species of flower that the bumble bee was visiting. See <https://www.pnwbumblebeeatlas.org/other-resources.html> for resources.
- If you have a smartphone you can enter these observations directly into [Bumble Bee Watch using the app](#).

- Follow the same rules about location, private property, and general respect for others experience when collecting incidental observations.

Resources

Books and Literature:

Hatfield R, Jepsen S, Mader E, Black SH, Shepherd M. 2012. Conserving Bumble Bees. Guidelines for Creating and Managing Habitat for America's Declining Pollinators. Available from http://www.xerces.org/wp-content/uploads/2012/06/conserving_bb.pdf (accessed August 28, 2014).

Koch JB, Strange JP, Williams PH. 2012. Bumble Bees of the Western United States. USDA Forest Service and the Pollinator Partnership.

Williams, P.H., R.W. Thorp, L.L. Richardson, S.R. Colla. 2014. Bumble Bees of North America: An Identification Guide. (Princeton Field Guides). Princeton University Press. 208pp.

Project Websites:

Pacific Northwest Bumble Bee Atlas: pnwBumbleBeeAtlas.org

Idaho Department of Fish and Game: idfg.idaho.gov

The Oregon Bee Project: oregonbeeproject.org

Washington Department of Fish and Wildlife: wdfw.wa.gov

The Xerces Society for Invertebrate Conservation: xerces.org

Oregon Department of Fish and Game: dfw.state.or.us

Other websites:

- [Google Maps with Overlaid Grid](#) (you will be able to find the grid number of your adopted cell to help you plan a trip)
- [Idaho Trails Map](http://trails.idaho.gov): trails.idaho.gov
- [Washington Trails Association](http://wta.org): wta.org
- [Oregon Hikers Trail Guide](http://oregonhikers.org/field_guide/Main_Page): oregonhikers.org/field_guide/Main_Page

Social Media:

Join our Facebook Group: facebook.com/groups/pnwBumbleBeeAtlas/

Our Flickr Group: flickr.com/groups/pnwbumblebees/

Follow us on Twitter: twitter.com/pnwbumblebees

Follow us on Instagram: instagram.com/pnwbumblebees/

Data Sheets and Field Guides

PACIFIC NORTHWEST BUMBLE BEE ATLAS RAPID HABITAT ASSESSMENT FORM



PACIFIC NORTHWEST
BUMBLE BEE ATLAS

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

Site Information

Site Name:	PNW BBA Grid Cell ID:	Date:
Latitude: N	Longitude: —	W (Use Decimal Degrees)
# Observers:	Observer Names:	

Bumble Bee Survey Information:

Survey Type: Point Roadside		Survey Area (Approx., in HA):	Survey Method: I captured all bees, different bees, or a combination of methods: 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)		
	Grassland / Meadow	Meadow, open, grasses dominant	From the Habitat Types , list (up to) the top three habitat types visible from most to least abundant. 1 2 3		
	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			
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"/> Evidence of rodent holes/tunnels <input type="checkbox"/> Brush piles <input type="checkbox"/> Bare soil		<input type="checkbox"/> Leaf litter <input type="checkbox"/> Pine needle duff layer <input type="checkbox"/> Rock piles		
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:					

PACIFIC NORTHWEST BUMBLE BEE ATLAS RAPID HABITAT ASSESSMENT FORM

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



PACIFIC NORTHWEST
BUMBLE BEE ATLAS

Plant Species in Bloom

How many different species of flower (incl. trees and shrubs) are in bloom in the survey area ? (Circle closest match)				
1-2		2-5	5-10	>10
Document each species of currently blooming plant that you see in the survey area – including trees and shrubs. 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 second sheet if needed.				
Bumble Bee Visited?	Plant Common Name	Plant Scientific Name	Photo Numbers	
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<input type="checkbox"/>				
<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	

PACIFIC NORTHWEST BUMBLE BEE ATLAS BUMBLE BEE SURVEY DATA SHEET



Complete this form for every site that is surveyed

Date Data Entered: _____ By: _____

Survey/Weather Information

Site Name:		PNW BBA Grid Cell ID:	Date:	Survey Type: Roadside	Point	Temp:
Latitude: N		Longitude: — W (Use Decimal Degrees)				Wind Speed: mph
Observers:					Total # Observers _____	Cloud Cover: %
Start Time:	End Time:	Survey Minutes:		Total Person Minutes: (# Obs. X Survey Min.)		
Primary Survey Method:	<input type="checkbox"/> Captured all observed bumble bees <input type="checkbox"/> Focused on capturing bumble bees that looked different than those already caught					
Notes:						

Bumble Bee Observations

[illegible]

PACIFIC NORTHWEST BUMBLE BEE ATLAS BUMBLE BEE SURVEY DATA SHEET



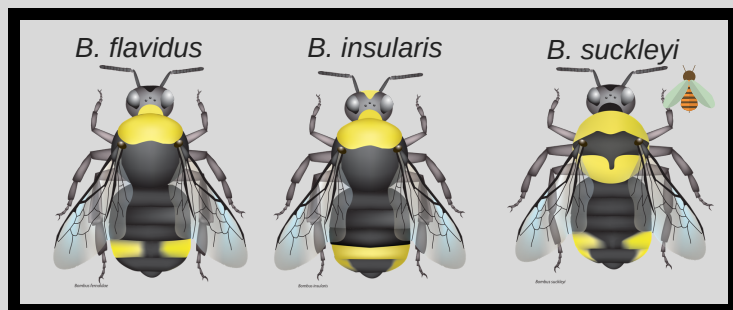
Complete this form for every site that is surveyed

Date Data Entered: _____ By: _____

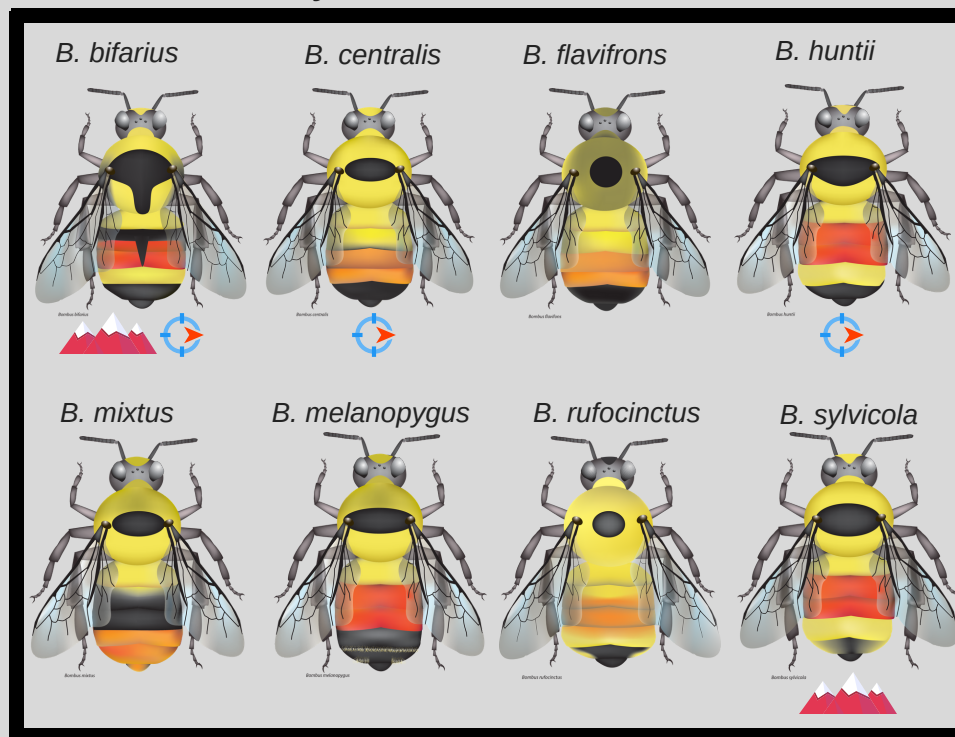
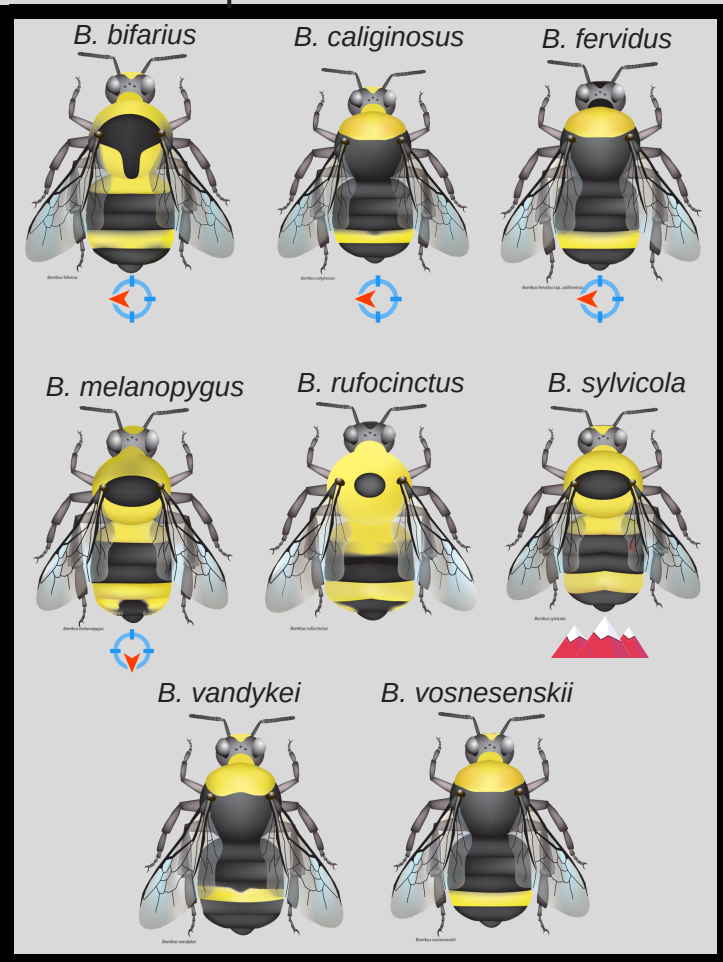
[illegible]

Red on the Body?

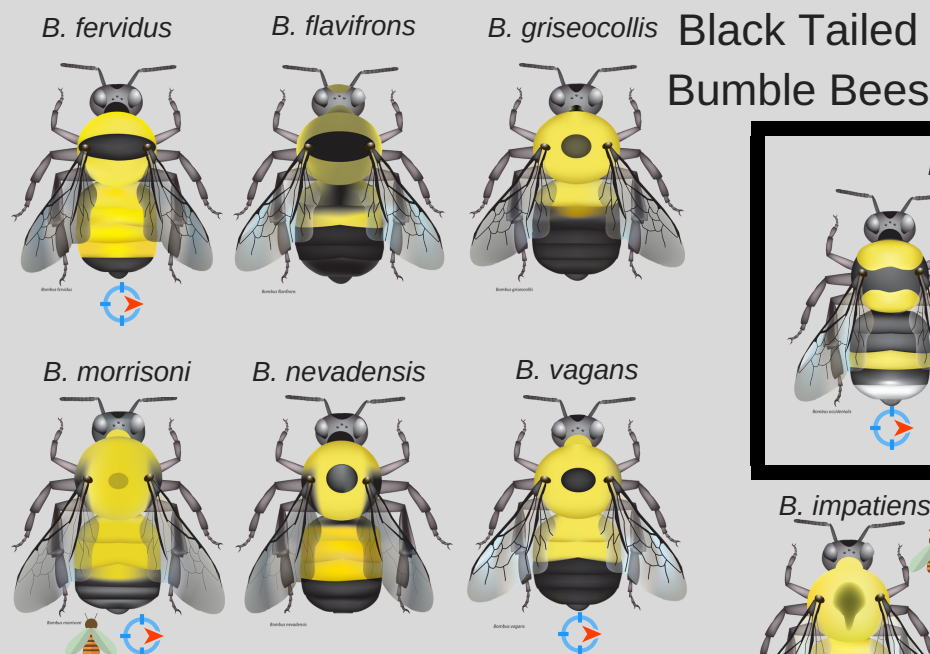
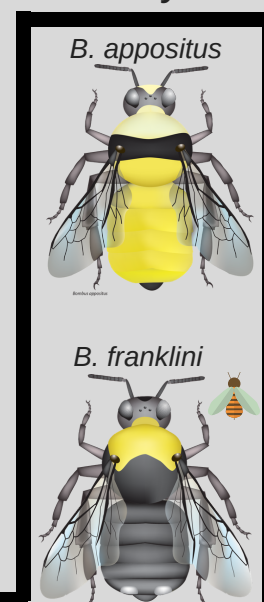
Cuckoo Bumble bees



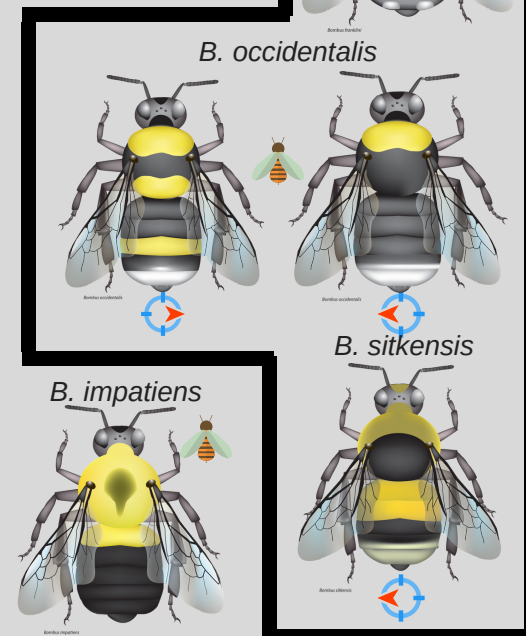
Striped Bumble Bees



White on the
body?



Black Tailed Bumble Bees



Identifying Bumble Bees in the Pacific Northwest

1. After determining that it is a bumble bee (and not a fly, wasp, carpenter bee, or other native bee) you must identify if it is a male or female bumble bee (see Figure 1).
2. Next, you need to determine if you have a true bumble bee, or a cuckoo bumble bee (see Figure 2). The photos below are from a true bumble bee female (left) and cuckoo bumble bee female (right). Note the concave, hairless, corbicle on the true bumble bee (for collecting pollen) and the convex, hairy leg on the cuckoo bumble bee (who does not collect pollen). Legs of males are more difficult to tell apart, but generally, cuckoo male legs are hairier than true male bumble bee legs.
3. Next, you can start to look at color patterns. The groups on the front of this page will help you to make a determination, or at least provide a starting point. **Color patterns are not 100% reliable and should only be used as a guide.** Note that male color patterns are not shown on the front, and in many cases DO differ from the females. Consult a field guide for more information.
4. Beyond color patterns, some of the features that you will find helpful are: cheek length (the ratio of length to width, see Figure 4); and sternal hairs (see Figure 3).



Figure 2: Hind legs tibial segment of true (left) vs. cuckoo (right) bumble bees. Photos by Sam Droege, USGS Bee Inventory and Monitoring Lab.

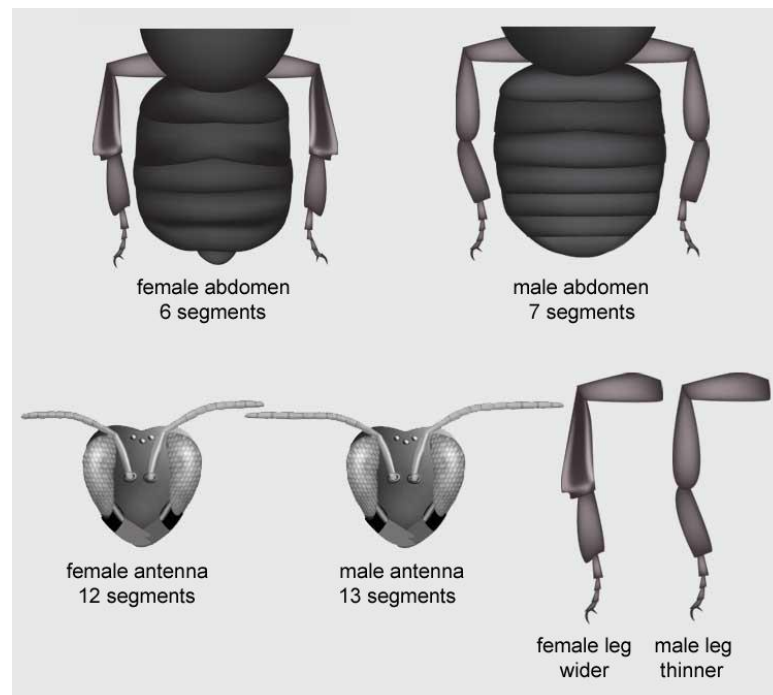


Figure 1: Characteristics of male vs. female bumble bees. Illustrations by Elaine Evans, the Xerces Society

Figure 4: Cheek Length. The bee on the left has a long cheek and the bee on the right has a short cheek. Photos by Rich Hatfield, the Xerces Society.



Figure 3: Note the yellow hairs on the sternal (underside of the abdomen) segments. Similar species have black hairs in that location. Photo by Rich Hatfield, the Xerces Society.





PACIFIC NORTHWEST BUMBLE BEE ATLAS

pnwBumbleBeeAtlas.org



Washington
Department of
**FISH and
WILDLIFE**



**XERCES
SOCIETY**
for Invertebrate Conservation

Supported by:

