

Vermont Bumblebee Survey

Discovering and Conserving Pollinator Biodiversity



MANUAL FOR PARTICIPANTS

Sponsors and Supporters

The Vermont Bumblebee Survey (VTBees) is sponsored by the **Vermont Center for Ecostudies** (VCE) with financial support from the Binnacle Family Foundation and the Riverledge Foundation.

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Vermont Bumblebee Survey

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Project Overview

The Vermont Bumblebee Survey (VTbees) aims to document the relative abundance and distribution of bumblebees (*Bombus*) as well as the Eastern Carpenter Bee (*Xylocopa virginica*) across Vermont. The results, in the form of data tables and distribution maps for each species encountered in the project, will be published and available free of charge on the Internet. Field work will rely heavily on volunteers, for whom this manual has been prepared. Participants need little experience to join the survey—only an interest in bees.

Bumblebees, familiar and flashy insects, are silent messengers of environmental conditions. They respond to changing land use practices and other human-induced pressures. Yet we know so little about the bumblebees of Vermont. There is no statewide data bank, no atlas of their distribution, no scientific assessment of the threats they face, and no conservation concept for bee species statewide. With this in mind, the Vermont Center for Ecostudies (VCE) initiated the Vermont Bumblebee Survey in 2012. The project's major objectives are to:

- ◆ Publish on the Internet maps and data about the historic and present distribution of Vermont bumblebees.
- ◆ Obtain a baseline of bumblebee distribution at the beginning of this century for comparison in the future.
- ◆ Assess the conservation status and needs of Vermont bumblebee species.
- ◆ Identify habitats of statewide and regional importance.
- ◆ Educate and involve more people in the discovery and protection of Vermont's natural heritage.

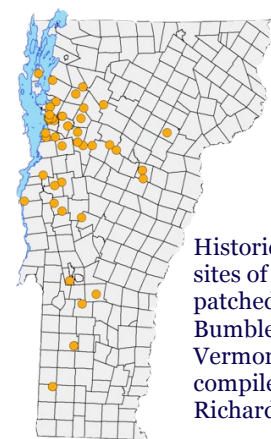
The survey will make essential data available to landowners, land-use planners, policy-makers, municipalities, and other individuals or organizations making conservation and management decisions. VTBees is closely modeled after the recently completed Vermont Butterfly Survey. Our results will allow direct comparisons among states, with scientific and conservation implications extending throughout the Northeast. In short, this project offers the opportunity for individuals, either professional or amateur, to make a significant contribution to the greater understanding Vermont's natural heritage.

Vital Pollinators

Pollination services provided by native insects, mostly bees, are estimated at \$3 billion per year in the United States. For some crops native bumblebees pollinate more effectively than European honeybees, in part because they fly in cooler temperatures and lower light levels. Bumblebees are “buzz” pollinators. The bee grabs the stamen and vibrates her wing muscles causing pollen to fall. This is highly effective for the cross-pollination of tomatoes, peppers, cranberries, and blueberries. Losses of native bees can have far-ranging ecological impacts due to their role as pollinators. In Britain and the Netherlands, where several bee species have gone extinct, there is evidence of a decline in the abundance of insect-pollinated plants.

Bumblebees are silent messengers of environmental health. Because individual species may have specific habitat requirements, bumblebees can speak volumes about the state of the environment. There is widespread understanding that pollinators are at serious risk or in decline due to habitat change and loss, pollution, and climate change. Pollinators are critical for both wild and cultivated plants. Bumblebees are highly sensitive to pesticides and even climate change. Despite the ecological and economic importance of bumblebees and our dependence on them, we have little baseline information on distribution, rarity, and habitat needs in Vermont.

In the late 1990s, biologists noticed a decline in the abundance and distribution of bumblebee species worldwide. In the Northeast, there appeared to be a sudden, range-wide population decline of several species. For example, the Rusty-patched Bumblebee (*Bombus affinis*), a pollinator of wildflowers, cranberries, and other crops, was commonly collected by University of Vermont students as recently as the early 1990s. Not a single specimen has been found in Vermont since the



Historic collection sites of Rusty-patched Bumblebee in Vermont. Data compiled by Leif Richardson.

late 1990s. What was among the most common bumblebee of fields, farms, and gardens, has disappeared from our state in the span of a decade or less.

There is hope. Small numbers of Rusty-patched Bumblebees have recently been found in isolated areas primarily in the northern part of the species' range. Can we still find remnant, isolated populations in Vermont to conserve and even perhaps restore the species?

Survey Instructions

What follows in this manual are step-by-step instructions for participation in the Vermont Bumblebee Survey. Before beginning any work, you should read this manual carefully, particularly advice on accurate record-keeping. You'll find three options for contributing to the survey. Many of you will use all of these options:

- ◆ **Option 1: Site Survey** – This option involves your choosing one or more specific sites to survey once or, preferably, more regularly from spring through fall. It requires three steps:
 1. Choosing survey site(s), preferably in a priority block.
 2. Visiting your site(s) and vouchering the bumblebee species found there.
 3. Submitting your data to the VCE.
- ◆ **Option 2: Roadside Census** – Participants that adopt a priority block complete roadside surveys within the block. Each survey route is 4.5 miles long with stops at 0.5-mile intervals or greater (10 survey sites or stops in total) along secondary roads within a priority block. The observer will map out a route that zig-zags throughout a priority block.
- ◆ **Option 3: The Casual Survey** – This option allows you to document bumblebees on a more casual basis. Rather than choosing a specific site to monitor regularly, the Casual Survey allows you report bumblebee presence on an incidental basis—while gardening or walking your dog for example, or even on your way to work. VTBees provides a special form (included with this package of materials) for these spontaneous encounters with bumblebees.

Option 1. Site Survey

This is one of the most active ways to participate in the Vermont Bumblebee Survey. You visit your own survey sites throughout the season on your adopted block, or just once if it is far away, to document bumblebee species and abundance.

Step 1: Choosing a Block Map and Survey Site(s)

VTBees will gladly accept bumblebee records from anywhere in Vermont—your front yard, your workplace, or a remote spruce bog. But to make sure we survey bumblebees evenly and systematically across the state, the project has adopted a grid mapping system. The system relies on the 184 U.S. Geological Survey 1:24,000 topographic maps (“7½-minute maps”) that cover Vermont. We’ve divided each of these maps into six blocks of equal size (roughly 3 miles x 3 miles) and numbered them according to the example diagram below. That’s a total of 1,104 survey blocks (184 maps x 6 blocks per map = 1,104 blocks).

Since we don't have the person-power to sample for bumblebees in each and every block, VTBees has randomly selected 184 of these blocks (one per USGS map) for the focus of our work. We call these blocks "**priority blocks**" (you'll be hearing a lot about them). The 184 priority blocks make up a representative sample of the Vermont landscape; they're the minimum number of blocks that must be surveyed in order to obtain a statistically valid sample of bumblebees for the entire state. (They're the same blocks used by the Vermont Butterfly Survey.)

Although data on any bumblebees anywhere in the state are important, VTBees prefers that you survey regularly in one of the 184 priority blocks. No one in Vermont is far from a priority block. Contact us and tell us where you'd like to survey. We'll assign you your very own a priority block. You can then visit the VTBees web site to download a map of your block.

Of course, you may survey for bumblebees outside of a priority block. Perhaps your home or favorite place is not located in one of the priority blocks. In those instances, you'll still need to determine the block in which you are surveying. To do this, obtain the United States Geological Survey (USGS) 1:24,000 topographic map (“7½-minute map”) that covers your survey area. These are available free to download from the USGS store:

[http://store.usgs.gov/b2c_usgs/usgs/maplocator/\(xcm=r3standardpitrex_prd&layout=6_1_6_1_48&uiarea=2&ctype=areaDetails&carearea=%24ROOT\)/.do](http://store.usgs.gov/b2c_usgs/usgs/maplocator/(xcm=r3standardpitrex_prd&layout=6_1_6_1_48&uiarea=2&ctype=areaDetails&carearea=%24ROOT)/.do)

Carefully divide your map into six equal blocks and number them according to the diagram to the right. These represent the six VTBees blocks for that particular map. So, in this example, if you're surveying in the upper right corner of this map, you'd be in the KNOX MOUNTAIN-4 block.

| USGS Map KNOX MOUNTAIN | |
|---------------------------|---|
| 1 | 4 |
| 2 | 5 |
| 3 | 6 |

For this particular map, the priority block happens to be KNOX MOUNTAIN-3. To locate the priority block for any USGS map in Vermont, consult Appendix II. It tells you which of a map's six blocks is the priority block. The map title (which you'll need to look up in Appendix II) is at your map's upper right corner.

Selecting Your Survey Sites

Once you've chosen or been assigned a block and have a map, you are ready to choose specific **Survey Sites** within that block. Topographic maps provide considerable information about potential sites in a block. Before visiting a block, look over the map and note the location of forest openings and other sunny areas (often in white); these tend to have higher flower diversity and potentially more bumblebees. **A survey site is generally defined as an area of similar habitat bound by physical features.** Potential sites include: a wetland, an overgrown field, a flower garden, woodland clearing, woods road or trail, a recreation path, and other defined areas.

Some blocks may offer only one or two potential sites, others many more. Don't feel you must survey every potential site within a block. If you survey two or more sites within a block, try to select different habitats for

each. It's best to visit various sites and habitats because you will find a greater diversity of species. But it's up to you to hunt down all the bumblebee species that may be present in the block.

The **site visits** are the heart of your survey work. (It's also the fun part.) Here are some suggestions on when to go surveying:

- ◆ **Pick a Nice Day** – Bees are solar-powered creatures, most active between 10 a.m. and 4 p.m. They're inactive and hard to find on cold, rainy, heavily overcast, or extremely windy days.
- ◆ **Visit throughout the season** – Since different species are active during different periods of the year, try to make regular trips to your survey site(s). Every month from April through September would be ideal, but even one time in mid summer will provide valuable data.
- ◆ **Get Permission** – Consult the landowner before visiting private property. If you explain the survey, you'll probably get permission to visit. For town or city property get permission before your visit. Some private land—reserves owned by The Nature Conservancy, for example—are fragile and require permits or permission to visit. When in doubt, contact our office. If you intend to survey on state or federal land, other than the Green Mountain National Forest, you must obtain permission from the proper management agency.

Walk your site and find bumblebees, keeping careful track of every bumblebee you encounter whether you capture and identify it or not. You'll be using the **Site Visit Form** to record information about your site (site name, site location, date of visit, time at the site, etc.) and to keep a count of the bumblebees you encounter.

The Site Visit Form allows you to describe a site and note all bumblebees you encounter there. Complete a separate form every time you visit a site. Below is an explanation of the Site Visit Form. (A sample form is on the next page.)

USGS Quad Name: Enter the proper USGS quadrangle map name, which should be on the priority block map we provide you or at the upper right corner of any USGS topographic map that you use.

Town: The town where the site is located (check a map if necessary).

Land Owner: Write in the name if you know it.

Latitude and Longitude: Please report this in decimal degrees. It should look something like 42.1234 and -72.1234. Finding these is relatively easy. You can use a GPS unit or even your smart phone in most locations.

| Vermont Bumblebee Survey SITE VISIT FORM | | Site Name (Use the same name for each visit) | | Temperature | |
|---|--|--|--|---------------------------|-------------|
| Return To: Vermont Bumblebee Survey PO Box 420 Norwich, VT 05055 vbs@vinsweb.org | | USGS Quad | | Cloud Cover | |
| | | Block # (1-6) | | | |
| ID Codes V = Visual P = Photograph or Video S = Specimen | | Town | | Observer(s) | # Observers |
| | | Latitude/ Longitude (decimal degrees) | | | |
| Habitat Codes Circle Those That Apply | | Park or Protected Area Name | | Date (Format: 4 Jul 2012) | |
| Old or Regenerating Fields 1.1 - Barren (little vegetation) 1.2 - Grass/Herbs (no shrubs) 1.3 - Few Shrubs 1.4 - Shrubland (shrubs > grass) 1.5 - Brush-hogged | | Landowner | | Start Time | End Time |
| Agricultural 2.1 - Active Crop Land 2.2 - Pasture or Hayfield 2.3 - Orchard or Vineyard | | Species | | Number | ID Code(s) |
| Other Openings 3.0 - Power Line Right-of-Way 4.1 - Alpine Meadow 4.2 - Rock Outcrop | | | | | |
| Forest Gaps 5.1 - Natural (blowdown, etc.) 5.2 - Forestry (log landing, etc.) 5.3 - Regenerating Area 5.4 - Woods Road or Trail 5.5 - Ski Slope | | | | | |
| Forest Type 6.1 - Deciduous Dominated 6.2 - Coniferous Dominated 6.3 - Mixed Woods | | | | | |
| Wetlands 7.1 - Sedge/Grass 7.2 - Cattail/Reed 7.3 - Shrub 7.4 - Beaver Pond 7.5 - Wooded 7.51 - Deciduous 7.52 - Coniferous 7.53 - Mixed 7.6 - Bog/Fen | | | | | |
| Road/Roadside 8.1 - Dirt 8.2 - Paved 8.3 - Road-killed | | | | | |
| Residential 9.1 - Lawn 9.2 - Garden 9.3 - Urban | | | | | |
| Shoreline 10.1 - Natural Lake 10.2 - Pond 10.3 - Reservoir 10.4 - River (>10 feet wide) 10.5 - Stream (<10 feet wide) | | | | | |
| 11 - Other (describe on back) | | | | | |

Or you can also find the location once you are back home using Google Earth (<http://www.google.com/earth/index.html>) or iTouch Map at <http://itouchmap.com/latlong.html>.

Cloud Cover and Temperature: Record the amount of cloud cover and the temperature while you were surveying.

Observer(s): Include the names and total number of all people actively observing bumblebees. If someone along is not helping, do not record that person's name.

Date: Fill in the date of the site visit using the format: day month year (Example: 4 Jul 2012). **Don't use numerals for the month (so we don't confuse days and months during data entry).**

Time Start/Finish: Record the time you begin observing, and the time you finish (in 24-hour format, i.e., 13:15 for 1:15 p.m.).

Species: Record all the bumblebees you observe. If you are not able to identify an individual, record it as such - Bombus or Bombus 1, Bombus 2, etc. Use either the common or scientific name from the Vermont Bumblebee List included in this manual.

– Record the number of individuals for that species. Don't write "many" or "too many to count". If you can't really count them, give your best estimate.

ID Code(s) – Record the method you used to identify the species (V=Visual, P=Photo/Video, S=Specimen). These codes are listed on the form.

Habitat Code(s) – Circle those that were predominant at your site.

Comments: Use the back of the Site Visit Form for any additional information you wish to provide

Option 2. Roadside Surveys in Priority Blocks

Participants that adopt a priority block will complete a roadside survey in the block. Each survey route is 4.5 miles long with stops at 0.5-mile intervals or greater (10 survey sites in total) along secondary roads within a priority block. The observer will map out a route that zig-zags throughout the priority block. Do not choose a route that includes roads that are heavily traveled, such as a state route, but rather back-roads that are safer. At each stop one observer will collect bumblebees for 10 minutes. Surveys will be completed between 11 am and 5 pm on sunny, warm days with little wind. Fill out a new Site Survey Form for each stop. At each stop place all collected bumblebees in a single container filled with soapy water. At the end of the route, if you have found bumblebees at each stop you will have 10 containers of specimens. Be sure to label your containers with the Site Name on your Site Survey Form so that the specimens can be matched to the field form later. Ideally, each route will be surveyed once a month. But, if you can only do it once, try for mid-summer when most species are out.

Option 3. Casual Sightings

While we prefer that participants select sites on priority blocks to survey regularly (or even once), we also understand that many people encounter bumblebees more spontaneously. This can happen during a lunch break at work, a weekend at camp, a hike up a mountain, or even your daily bicycle ride. For these casual sightings you can use the VBS **Casual Sightings Form**. A few of these forms are included in this package of materials; feel free to make copies—keep one in the car, one on the refrigerator, one in your daypack, so that you can record bumblebees as you encounter them. But remember that if you are actually doing a site survey, no matter how short a time period, try to use the Site Survey Form whenever possible.

Step 3: Submitting Survey Data

No survey work is complete until results are submitted to the VCE office. Prompt submission of accurate data is critical to the project's success. After each site visit, stop to make sure your forms are complete. **Resist the temptation to finish data forms after you've left the site.**

Organizing Your Data

When you return home from a site visit, keep your Site Visit Form in a safe place.

- ◆ **All materials must be labeled** with the date and Site Name that was written on your Site Visit Form or Casual Sightings form.
- ◆ Any specimens **must be labeled** with their corresponding Site Visit Form name and date or Casual Sightings Form voucher number and date so that each can be matched with the correct data.
- ◆ Any digital photograph file **must be labeled** with its corresponding Site Visit Form name and date or Casual Sightings Form voucher number so that each can be matched with the correct data. Save digital images as **large** JPEG files. They can be submitted on a CD with your field forms. The file name must be the Site Survey Name and date (i.e. bigfarm7612.jpg) or Casual Sightings Form voucher number you assigned to it (i.e. KPM001.jpg). If you include multiple digital shots, add letters to the name (i.e. bigfarm7612a.jpg, bigfarm7612b.jpg, KPM001a, KPM001b).
- ◆ See Appendix III for information on processing and handling the specimens you have collected upon returning from the field.

Protecting and Submitting Your Specimens and Data

To ship specimens safely, pack them in a small, sturdy container (plastic or cardboard) along with their corresponding Site Visit Forms. Place this container inside a larger box and pad it with crumpled newspaper or foam "peanuts." If you are an active participant, send your specimens to our office regularly (at least once a month). **Do not wait until the end of the field season to send everything in.** Mail or deliver material to the VCE office at:

Postal Address:
Vermont Center for Ecostudies
PO Box 420
Norwich, VT 05055

Physical Address:
Vermont Center for Ecostudies
20 Palmer Court, 2nd Floor
White River Junction, VT 05001

Map: <http://www.vtecostudies.org/location.html>

Appendix I

Resources

- ◆ *Bumblebees of the World*. <http://www.nhm.ac.uk/research-curation/research/projects/bombus/>
- ◆ <http://www.bumblebee.org/>
- ◆ Bumblebee Conservation. Xerces Society. <http://www.xerces.org/bumblebees/>
- ◆ *The Very Handy Manual: How to Catch and Identify Bees and Manage a Collection*. Compiled mainly by [Sam Droege](#) at the USGS Native Bee Inventory and Monitoring Lab with input from specialist researchers and taxonomists over several years from 2004-present. This guide provides detailed instructions on bee monitoring techniques including specimen collection, processing and management, bee identification, and more! The manual also provides guidance on the capture, monitoring, identification, and curation of native bees.
- ◆ *A Guide to Identifying Bees Using the Discover Life Bee Keys*. Sam Droege. http://www.discoverlife.org/ed/tg/How_to_use_the_discoverlife_guides.html
- ◆ *Bumble Bees of the Eastern United States*. Sheila Colla, Leif Richardson, and Paul Williams. <http://www.fs.fed.us/wildflowers/pollinators/documents/BumbleBeeGuide2011.pdf>

Entomology Equipment

BioQuip Products
2321 Gladwick Street
Rancho Dominguez, CA 90220

Telephone: (310) 667-8800
Fax: (310) 667-8808
E-mail: bioquip@aol.com
Web Site: www.bioquip.com

Organizations

Vermont Entomological Society
www.vermontinsects.org/

Xerces Society
4828 SE Hawthorne Blvd.
Portland, OR 97215
www.xerces.org

Appendix II

Vermont Bumblebee Survey Priority Block Numbers (#) for Selected USGS 1:24,000 Quadrangles (USGS Quad Name)

| USGS Quad Name | # |
|------------------|---|
| Albany | 4 |
| Andover | 5 |
| Arlington | 1 |
| Averill Lake | 6 |
| Bakersfield | 6 |
| Barnet | 2 |
| Barre East | 5 |
| Barre West | 3 |
| Bellows Falls | 3 |
| Bennington | 1 |
| Benson | 3 |
| Bethel | 6 |
| Bloomfield | 3 |
| Bolton Mountain | 4 |
| Bomoseen | 6 |
| Brandon | 3 |
| Brattleboro | 1 |
| Bread Loaf | 6 |
| Bridport | 5 |
| Bristol | 6 |
| Brookfield | 1 |
| Burke Mountain | 6 |
| Burlington | 4 |
| Cabot | 6 |
| Caspian Lake | 6 |
| Cavendish | 5 |
| Charlotte | 6 |
| Chelsea | 2 |
| Chester | 5 |
| Chittenden | 1 |
| Colchester | 3 |
| Colchester Point | 6 |
| Cold Hollow Mts. | 5 |
| Concord | 3 |
| Cornwall | 5 |
| Craftsbury | 6 |
| Crystal Lake | 3 |
| Danby | 1 |
| Delectable Mtn. | 1 |
| Dorset | 5 |
| East Alburg | 5 |
| East Corinth | 2 |
| East Middlebury | 1 |
| Eden | 2 |
| Enosburg Falls | 4 |
| Essex Center | 6 |
| Essex Junction | 3 |
| Fairfield | 5 |
| Fairlee | 4 |

| USGS Quad Name | # |
|------------------|---|
| Gallup Mills | 5 |
| Georgia Plains | 5 |
| Gilman | 1 |
| Gilson Mountain | 6 |
| Governors Mtn. | 1 |
| Groton | 2 |
| Groveton | 3 |
| Hancock | 3 |
| Hanover | 1 |
| Hartland | 4 |
| Hazens Notch | 1 |
| Highgate Center | 3 |
| Hinesburg | 6 |
| Huntington | 4 |
| Irasburg | 2 |
| Island Pond | 4 |
| Jacksonville | 3 |
| Jamaica | 5 |
| Jay Peak | 5 |
| Jeffersonville | 2 |
| Joes Pond | 2 |
| Johnson | 5 |
| Juniper Island | 6 |
| Killington Peak | 4 |
| Knox Mountain | 3 |
| Lincoln | 1 |
| Londonderry | 5 |
| Lowell | 3 |
| Ludlow | 2 |
| Lyme | 2 |
| Lyndonville | 4 |
| Maidstone Lake | 2 |
| Manchester | 2 |
| Marshfield | 2 |
| Middlebury | 2 |
| Middlesex | 3 |
| Middletown Spngs | 3 |
| Miles Pond | 1 |
| Milton | 2 |
| Monadnock Mtn. | 6 |
| Monkton | 4 |
| Montpelier | 5 |
| Morgan Center | 5 |
| Morrisville | 5 |
| Mount Carmel | 6 |
| Mount Ellen | 2 |
| Mount Holly | 4 |
| Mount Mansfield | 6 |
| Mount Philo | 3 |

| USGS Quad Name | # |
|-----------------|---|
| Mount Snow | 3 |
| Mount Worcester | 1 |
| Newbury | 3 |
| Newfane | 4 |
| Newport | 6 |
| Newport Center | 3 |
| North Hero | 1 |
| North Troy | 2 |
| Northfield | 3 |
| Norton Pond | 6 |
| Orleans | 1 |
| Orwell | 4 |
| Pawlet | 5 |
| Peacham | 4 |
| Peru | 4 |
| Pico Peak | 5 |
| Plainfield | 5 |
| Plymouth | 1 |
| Port Henry | 5 |
| Poultney | 4 |
| Pownal | 6 |
| Proctor | 4 |
| Putney | 3 |
| Quechee | 2 |
| Randolph | 2 |
| Randolph Center | 6 |
| Readsboro | 4 |
| Richford | 4 |
| Richmond | 6 |
| Rochester | 3 |
| Rouses Point | 4 |
| Roxbury | 1 |
| Rutland | 2 |
| Saxtons River | 2 |
| Seneca Mountain | 4 |
| Sharon | 1 |
| Sheldon Springs | 4 |
| Snake Mountain | 6 |
| South Hero | 4 |
| South Mountain | 5 |
| South Royalton | 3 |
| South Strafford | 5 |
| Spectacle Pond | 6 |
| Springfield | 2 |
| St. Albans | 4 |
| St. Albans Bay | 5 |
| St. Johnsbury | 1 |
| Stamford | 3 |
| Stannard | 2 |

| USGS Quad Name | # |
|-------------------|---|
| Sterling Mountain | 3 |
| Stone Mountain | 4 |
| Stowe | 2 |
| Stratford | 2 |
| Stratton Mtn. | 3 |
| Sudbury | 3 |
| Sunderland | 5 |
| Sutton | 1 |
| Tinkerville | 2 |
| Townshend | 4 |
| Underhill | 5 |
| Vergennes West | 3 |
| Vershire | 4 |
| Waitsfield | 2 |
| Wallingford | 1 |
| Walpole | 3 |
| Warren | 4 |
| Washington | 1 |
| Waterbury | 4 |
| Wells | 5 |
| West Burke | 6 |
| West Charleston | 2 |
| West Dover | 3 |
| West Rupert | 5 |
| West Rutland | 1 |
| West Topsham | 2 |
| Westminster West | 3 |
| Westmore | 4 |
| Weston | 6 |
| Windham | 5 |
| Windsor | 1 |
| Wolcott | 4 |
| Woodbury | 3 |
| Woodford | 5 |
| Woodstock North | 2 |
| Woodstock South | 1 |
| Woodsville | 1 |
| | |

USGS Map Key N ↑

| | |
|---|---|
| 1 | 4 |
| 2 | 5 |
| 3 | 6 |

Appendix III

Field Technique and Specimen Curation

Although each volunteer will bring or develop his or her own skills and style in the field, below are some tips for project participants. For more details on field techniques consult the following excellent resource:

- ◆ ***The Very Handy Manual: How to Catch and Identify Bees and Manage a Collection.*** Compiled mainly by [Sam Droege](#) at the USGS Native Bee Inventory and Monitoring Lab with input from specialist researchers and taxonomists over several years from 2004-present, this guide provides detailed instructions on bee monitoring techniques including specimen collection, processing and management; bee identification; and more! The manual also provides guidance on the capture, monitoring, identification, and curation of native bees.

Field Supplies – The following equipment is helpful or essential for collecting bumblebee specimens in the field for this survey project (suppliers are listed in Appendix I):

- ◆ Insect net
- ◆ Collection containers with soapy water
- ◆ Field notebook
- ◆ Field Forms
- ◆ Pencils
- ◆ Map and GPS unit
- ◆ Wristwatch

1. Netting Technique – Bees are visually-oriented insects. The most successful field workers move steadily and slowly. Always keep your shadow from passing over a perched bee (unless you want it to fly away). Trying to net a flying bumblebee is often difficult. So make your attempt on a bumblebee that has settled on a flower, its nectar source. Once a specimen is in the net, immediately flip the purse of the net over the metal ring to keep it from escaping.

Always hold your net in a “swing-ready” position. One hand should be below the head and the other towards the back or middle of the pole. Hold the tip of the net lightly against the pole with the hand near the head so that it does not drag in vegetation. When you start your swing drop the tip of the net.

Always keep a mental check for the presence of thorny plants in the area where you might swing—for obvious consequences to your net. Additionally, in some areas some plants have seeds that can implant themselves directly into the netting; if that is the case then you might try moving from the usual coarse weave net bag to the fine weave type that BioQuip sells.

When swinging a net, speed is important as well as follow-through. Bees are very visual and very fast. If you are timid in your swing or cut your swing short, bees will evade the net. Center your net on the bee if at all possible even if it means having to plow through some vegetation. When a bee is flying low to the ground it is better to slap the net over the bee than it is to try to catch it with the corner of your net.

All else being equal, it is better to swing at a bee that is just flying into or away from a flower than a bee that is actually on a flower. Particularly if you are trying not to damage the plant, a less than vigorous swing of the net will simply push a bee on a flower under the net and it will fly away afterwards. After some practice you can bring your net up to a bee on a flower, wait for the bee to leave the flower, push the flower out of the way with your net and still easily capture the bee.

When looking at a clump of flowers that could contain bees stand 4-8 feet away. Most people stand too close to the flowers, which can scare away some of the bees you are interested in, limit both the number of flowers (and therefore bees) in your field of view, and limit your depth of field. In this way you can view a large area of flowers, spot a bee, and either lean forward or take one step to put that bee into your net. If you have to take 2 steps or more, you are too far away.

There are two ways to catch multiple individuals in a net. One way is to turn your net head sideways after capturing a bee, allowing the net bag to close over the head and hoping that the bee will not find a way out. The other is to physically hold the bag closed above the tip containing the bees (note, in between swinging at bees, you will be holding the closed net against the pole as you carry it from place to place). In both cases you will have to periodically snap the contents of the net to the bottom. Do this vigorously or some wasps (in particular) may not go to the bottom, and you could end up grabbing them through the net with obvious consequences to your hand.

A video that demonstrates how to use a net to collect bees can be seen at:

<http://www.youtube.com/watch?v=n6ZF1z3uA7E>

2. Removing Bumblebees From the Net - In the beginning, there is usually a great fear of being stung by your subjects. However, even bumblebees do not sting in a net, unless they are physically grabbed or trapped against the net. Thus, over time you should concentrate on diminishing your fears, and spend more time sticking your hand and kill jar directly into the net. If you are putting your net on the ground to remove bees, you are taking too much time.

The most efficient means of collecting large numbers of bees is to use vials or containers of soapy water. In that way you can fill your net with bees and only have to remove them periodically rather than after catching an individual bee or small number of bees. However, cleaning and processing bees killed this way requires some care to do properly (see section on washing and drying bees).

Once you have captured a bee or bees in the net, there are several ways to remove them. In all cases, it is best to vigorously snap the net to drive the insects to the bottom. You can then safely grab the bag just above where they are resting. Even the larger and more aggressive bees can't get at the hand that is closing off the net, due to the bunching of the netting.

Most collectors take a more direct approach and bring the open kill jar and its lid into the net, trapping the bee against the netting. Slapping the hand on top of the kill jar through the netting is at times useful to drive the bee to the bottom of the jar. This can help prevent bees from escaping when you put the cap on.

A video that demonstrates how to remove bees from a net can be seen at:

<http://www.youtube.com/watch?v=n6ZF1z3uA7E>

3. Collecting Bumblebee Specimens

Soap Jar or Vial – We recommend an alternative to chemical-based kill jars for ease of use and safety. We use containers filled with soapy water (a mix of water with dishwashing detergent) or alcohol. The best jars/vials have a tight fitting lid and are large enough to hold a fair number of bees. They should fit in your pants pocket and be easy to hold in one hand along with the lid. Fill the vial about half full with soapy water.

The jar will form a constant head of suds while riding around in your pants pocket or field vest. Using it in the net has the great advantage of immediately trapping any insect in the suds, thus permitting you to clean out the net of as many specimens as you wish. With a chemical based (cyanide, ethyl acetate) kill jar, you can accumulate 2-4 specimens with some effort, but at some point, more would be leaving than going in. The soapy jar is particularly nice when dealing with large, nasty specimens. The Patuxent lab favors using the large centrifuge tubes, as they slip into the pocket easily.

You have to be a bit more aware of how you carry the jar when open (water seeking its own level and all that), but such jars can also easily be used to directly collect off of flowers without a net.

Specimens can be readily left in the soapy water for 24-hours and, while a bit soggy, will even last for 48-hours without too much degradation. Afterwards, specimens can be:

1. dried and pinned (preferred method)
2. drained and put into alcohol for long-term storage

3. drained, wrapped with a piece of cloth (to soak up excess moisture and to prevent breakage) and frozen in a plastic bag.

Specimens look best if cleaned and dried within 24 hours of capture.

The advantages of the Soap Jar are:

- Don't have to lug toxic chemicals around
- Soap and water are readily available
- Restrains specimens immediately
- Can collect all specimens in a net at one time
- Inconspicuous to the general public
- Pollen and gunk are washed off while in the vial
- Cheap

Disadvantages:

- No pollen analysis
- Specimens are wet
- Jar needs to be held a bit more upright when open than a normal killing jar
- If cap not on correctly, the water can leak
- Specimens have to be dried prior to pinning

Kill Jars - Several companies make chemical based kill jars, which use either ethyl acetate or potassium cyanide as the killing agent. There are advantages and disadvantages to both types.

Ethyl acetate - Traditional jars are made of glass with a layer of plaster of paris at the bottom. At the start of the collecting day, pour enough ethyl acetate into the jar so that it soaks into the plaster, but leaves no liquid on top. If you use the jar regularly, then the ethyl acetate will need to be recharged every couple of hours as it will evaporate. The advantages of using ethyl acetate are: less toxic than potassium cyanide, not a controlled substance, and relaxes the specimen, which is useful if the genitalia are being pulled. The disadvantages are: needs to be replenished often (requiring either that ethyl acetate be brought into the field or that several charged kill jars remain available), can cause the jar to “sweat” inside which may mat a specimen’s hairs, and significantly degrades DNA.

Potassium cyanide - Most collectors eventually end up using a cyanide-based kill jar. However, it can be quite difficult to obtain this chemical. BioQuip makes kill jars with a hollow plaster top underneath the lid that can be charged with potassium cyanide crystals. Cyanide jars can be made from any glass or plastic container. Most people will wrap the bottom of glass jars and vials with duct tape to reduce the chance of breakage in a fall. Additionally, it is handy to place a bit of paper towel in the bottom of each jar to absorb the extra moisture and regurgitated nectar from the bees collected.

After bees have been placed into a well-charged kill jar, they usually quiet down in just a few seconds. If the specimens are taken out of the jar too soon, some may “wake” back up and begin to move again, albeit usually only very slowly. Usually thirty minutes or so in the kill jar will prevent this.

4. Bee Washer and Dryer for Soap Jar Specimens - You can obtain beautifully coiffed hair on even the longest-haired of bumblebees, if you spend the time shaking them around in a paper towel. Unfortunately, that can take a while. Most people shake them only until their wings unfold and then pin them, leaving the specimen less than presentable. We then have to ID bedraggled specimens which, in the worst cases, can lead to errors in identification and always leads to a lessening of the aesthetic experience. That need not be as you can use a hair dryer and the system, or modification thereof, below to speed things up.

You will need the following:

A small clear glass pint or half pint jar (a quart will do) that has a canning jar lid of the kind with a removable central metal disk.

A section of window screen will be used to replace the center of the canning jar lid. We use the fiberglass type, but metal might be ok, though they could be too stiff or may unravel. Note that you can buy loose fiberglass screen from the hardware store and cut it with scissors.

A hair dryer.

Procedure:

1. Wash the bees in cold water using a strainer. Blot the specimens on paper towels to get the bulk of the moisture off.
2. Dump the specimens from the paper towel into the canning jar.
3. Put the lid back on the jar with the screen in the middle, make sure the screen is snug around the entire lid.
4. Turn on hair dryer. We use high heat, although heat is not always necessary, particularly if the specimens are rinsed in quick evaporating alcohol.
5. Place the jar on its side on the folded hand towel and place hair dryer pointing into the jar as closely as possible, without causing the hair dryer to cut out (usually about 1 inch). This can be hand held or set up in a wide variety of ways so that you don't need to hold the blower. If you put some hair dryers right up to the screen, they will overheat and turn themselves off (stick them in the freezer if you want them to come back on quickly). While drying, shake the specimens back and forth vigorously, hitting the sides on the towel periodically to dislodge them if they stick to the glass. Specimens, when wet, are very flexible and tough, so they can take a moderate amount of bumping around.
6. Once the specimens are all loose, shift the jar slightly downward so that the specimens slide towards the screen and whirl around in the dryer's wind; continue shaking the specimens. Depending upon your hair dryer and your technique, this may take anywhere from 1.5 to 3 minutes.

5. Pinning 101

Types of Insect Pins to Use - Bees are usually pinned using pin sizes 1-3, with size 2 being the most common. Pin size 1 is prone to bending when pressed into traditional hardboard lined trays and boxes, but does nicely in foam units. Pin sizes below 1 should not be used as they are delicate, do not hold labels well, and end up bending if the specimen is moved or viewed often..

Traditional Pinning Techniques - Bees can be pinned directly from the killing jar into boxes, or they can be washed first. If the bees are dry and not matted down, then pinning directly to a collecting box is best, as it preserves the pollen load for future analysis and speeds up the entire process. However, if the bees are matted from too much moisture and regurgitate, wash and dry them using the protocols listed in this manual. They will result in better looking, easier to identify specimens.

Each person develops his or her own process when pinning bees. Some pin under the microscope, which usually results in very accurate placement of the pin, but many pin by eye. One technique is to hold larger specimens between the thumb and forefinger with the pin ready in the other hand. Use another finger from the hand holding the pin to help hold the specimen steady while inserting the pin accurately into the bee's scutum.

Others pin larger bees using a pair of forceps or tweezers, trapping the specimen on a foam pad. Expanded polyethylene foam (often referred to as Ethafoam) or cross-linked polyethylene foam (our preferred foam) is better than polystyrene foam (usually referred to as Styrofoam) for pinning purposes. Styrofoam is not supportive enough; both labels and specimens will bend too much when pinned on Styrofoam.

Specimens are best pinned through the scutum between the tegula and the mid-line. The midline of the scutum often contains characters that are very useful in identification, which can be destroyed by a pin. Most museums prefer that specimens be pinned on the right side.

For someone new to pinning, use of a purchased insect pinning block is helpful to determine the correct height at which a specimen should be placed. With experience, one can use pieces of foam of the correct depth, or even adjust specimen height by eye, which will be the quickest. Remember to leave enough room at the top of the pin

so that the specimen can be safely picked up by the largest of fingers. Equally important, leave enough room at the bottom for two or more labels and room for the pin to go into the foam of a collection box.

A video that demonstrates how to pin bees can be seen at:

<http://www.youtube.com/user/swdroege#p/a/u/1/V2F8LBQV5L0>

Bee Pinning Boxes - After a batch of specimens is washed, dried, and pinned, they are placed in a cardboard specimen box. Each pinned bumblebee should have a small tag on the pin with the date and site name from the Site Survey Form or the Casual Form.

There are a variety of drawers, cabinets, and boxes available to hold specimens. You can purchase cheaper boxes from a place like Bioquip (<http://www.bioquip.com/search/DispProduct.asp?pid=1009>), or boxes can be made from scratch. Instructions for making “pizza” insect pinning boxes can be found in the Very Handy Manual.

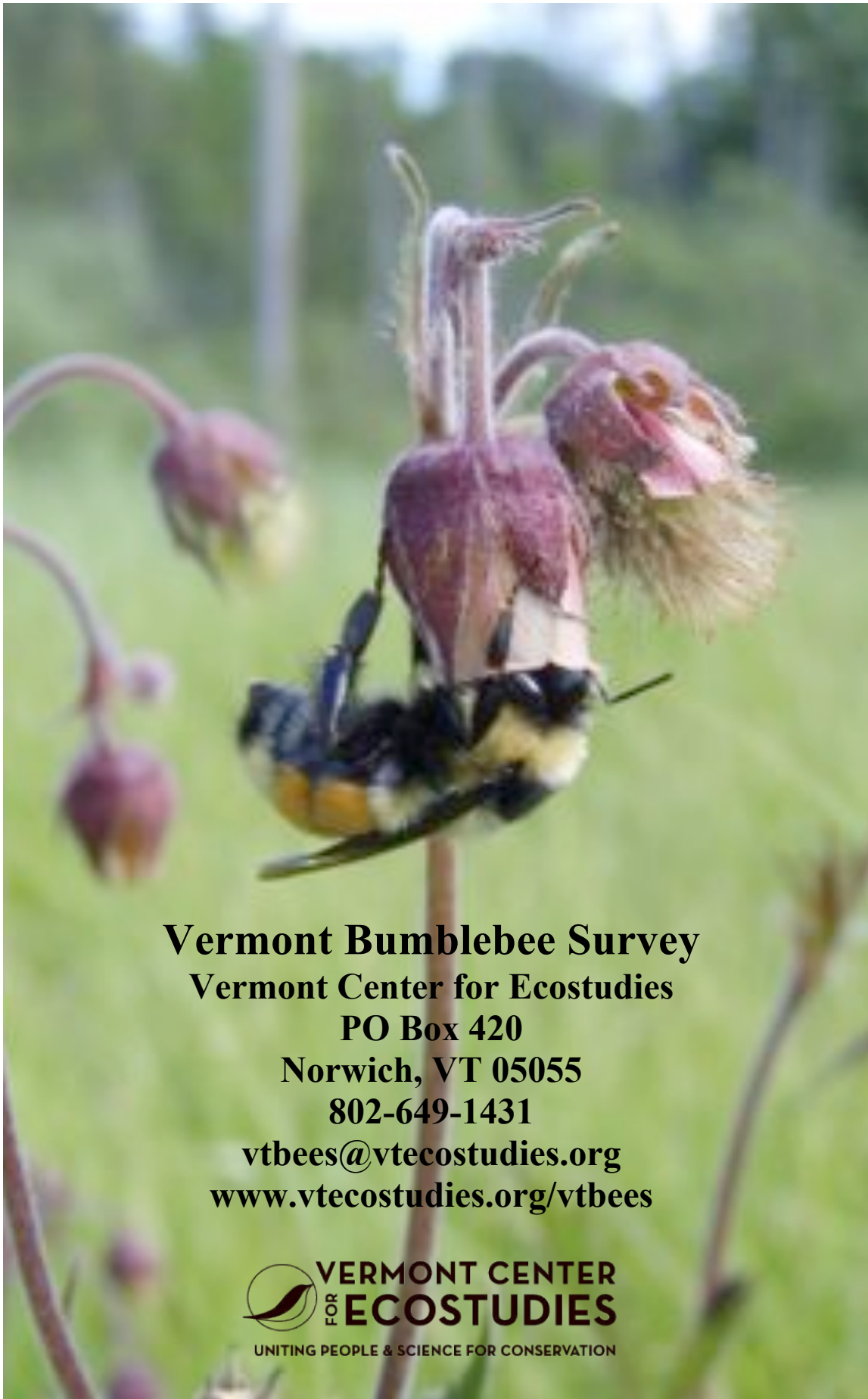
6. Identifying Bumblebees

Bumblebees can be tricky to identify for the beginner. **You don’t need to identify your specimens to species to participate in this project.** We’ll be looking at all the specimens to verify them, and you can even come in and help. With three castes to identify: queen, male, and female workers, and each species with many color morphs, it’s not easy. Luckily, there are not that many species to sort out, and with patience and experience, you will soon be able to identify some species visually in the field. But to be certain, it is best to use a key and magnification (either a hand lens, or better yet, a dissecting scope) to examine them.

We recommend the online Discover Life key for identifying Vermont bumblebees,

<http://www.discoverlife.org/mp/20q?guide=Bombus&cl=US/VT>. There are detailed instructions for how to use this online key in the Very Handy Manual and online at

http://www.discoverlife.org/ed/tg/How_to_use_the_discoverlife_guides.html.



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