

## Forest Service Region 4 Pollinator Survey Protocol for Bees and Butterflies

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**Goals:** The goals of this Region 4 pollinator inventory and monitoring protocol is to assess which bees and butterflies occur in Region 4 lands and to establish baseline information from which we can monitor their abundance and assemblage structure. A secondary goal is to better understand habitat and floral associations. These procedures can be used for both inventory and monitoring of pollinators, and we urge users to use the protocols even when inventory is the goal so that they may be used for monitoring in the future.

### **Ordering information for supplies needed for pollinator protocols**

Blue vane traps: Company = SpringStar, Website = <https://www.springstar.net/products/blue-vane-traps>

Soft wire (wrap around top of vane trap basin in indentation, twist and use remaining length to secure to rebar)

Bee cups: Company = Thornton Plastics, Website = <https://www.thorntonplastics.com/40-dram-vial.html>

(We used the 40 dram (5 oz) plastic vials). Smaller sizes can be used for bee vials.

Paint brand (to paint the outside of bee cups): Rust-oleum spray paint

Blue paint: Color = deep blue

Yellow paint: Color = sun yellow

White paint: Color = white

Insect nets (12 inch diameter ring): Company = BioQuip, Website =

<https://www.bioquip.com/Search/WebCatalog.asp?category=18000&prodtype=1>

(Student Insect Net with 18 inch handle 7112NA or Professional Series Insect Nets with 3 ft handle 7312GR)

Kestrel 2000 or other model (available from many websites; needs to measure average wind speed and air temperature;

<https://kestrelmeters.com/>)

Quadrat: Can be made of PVC or 3 ft long steel rod (3/8 inch diameter) bent with 3-1 foot length sides (U-shaped)

**Identification books.** There are many out there. These are our favorites.

### **Wildflower identification book:**

Denver Botanic Garden. 2018. Wildflowers of the Rocky Mountain Region. Timber Press Field Guide.

Hitchcock, C.L. 2018. Flora of the Pacific Northwest. University of Washington Press. (This is a key for botanists.)

### **Butterfly identification book:**

Brock, J.P. and K Kaufman. 2003. Kaufman's Field Guide to Butterflies of North America. Houghton Mifflin Harcourt Publishing.

### **Bee identification books:**

Wilson, J.S. and O.J. Messinger Carril. 2015. The Bees in Your Backyard. Princeton University Press.

Williams, P.H., R.W. Thorp, L.L. Richardson and S.R. Colla. 2014. Bumble Bees of North America: An Identification Guide. Princeton Field Guides.

Tronstad, L.M. and M.E. Dillon. 2019. Native Bees of Wyoming Field Guide. (4x6 inch pocket guide; available at:

<https://wyobiodiversity.net/collections/frontpage/products/native-bees-of-wyoming-field-guide>

**Supplies needed:**Deploying trap

Bee cups (3 blue, 3 yellow and 3 white per site)

Vane traps (3 per site)

Rebar (3 ~0.5 m tall in "L" shape to hang vane traps and 9 short pieces ~9 inches tall for bee cups)

Zip ties ~12 inches (12 per site but bring extras; to secure bee cups and hang vane traps)

Mallet (to pound rebar into ground)

Datasheet

~1 gallon of soapy water per 12 bee cups (~1 tsp dish soap per gallon of water)

Retrieving traps

Gallon ziplock bags (3 per site) or smaller bags if using a funnel to collect them

Insect kill jars (optional)

Coffee filters (minimum 3 per site)

Quart bags or whirl-paks

Funnel

Cooler with ice

Epipen (for safety in case someone is stung and reacts)

Datasheet

Labels

Butterfly and bee transects

Insect net(s)

Clear vials

Glassine envelopes

Bag for vials (numbered)

Datasheet

Timer or stopwatch

Permanent marker

Labels

Wildflower identification book

Miscellaneous supplies

Camera

Quadrat (to record flower density)

Kestrel (record temperature and wind speed; if you don't have a Kestrel, please take a thermometer)

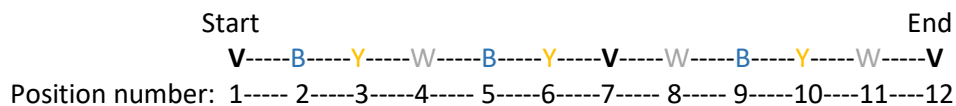
GPS or tablet

Watch or phone

## Deploying Traps

Traps will be set up along a ~100 m transect where each trap is 10 m apart.

1. Choose a representative habitat for the area and stay within that habitat when setting up traps and netting.
2. Select an area where a ~100 m transect will fit.
3. Begin by placing an "L" shaped rebar in the ground and hanging a vane trap from it. Pound the rebar into the ground several inches until it is stable. Attached the vane to the basin of the vane trap by snapping it in place. Hang the vane trap from the zip tie connected to the vane and secure it to the vertical rebar with wire attached around the top of the basin. Do not add anything to the vane trap. Pollinators are attracted to the vane trap by color alone.
4. Record a GPS point of the starting location and record on the datasheet. Record the time.
5. Take 10 long steps (~10 m) to the next spot to a place trap.
6. Pound a short rebar into the ground. Place a blue cup there and secure it with a zip tie (note that zip ties can be reused). Fill cup with soapy water.
7. Take 10 long steps (~10 m) to the next spot to a place trap.
8. Pound a short rebar into the ground. Place a yellow cup there and secure it with a zip tie (note that zip ties can be reused). Fill cup with soapy water.
9. Take 10 long steps (~10 m) to the next spot to a place trap.
10. Pound a short rebar into the ground. Place a white cup there and secure it with a zip tie (note that zip ties can be reused). Fill cup with soapy water.
11. Repeat these steps and place the vane traps (V), and blue (B), yellow (Y) and white (W) bee cups according to the diagram below. Basically, the transect will start and end with a vane trap and a vane trap will be placed in the center as well.



12. Record the location at the end of the transect using a GPS and record the time on the datasheet.
13. Pick up bee cups and vane trap after 24-48 hours (but no longer)!



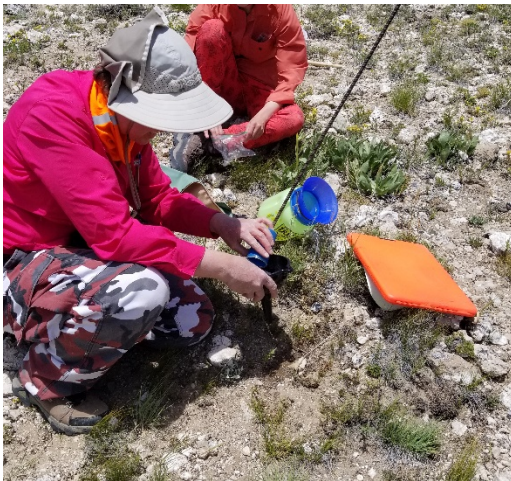
Vane trap hung from "L" shaped rod. Note wire at the top of the yellow basin that is used to secure the vane trap to the stake.



Bee cup deployed next to a short stake. Note the zip tie securing the bee cup to the stake.

## Retrieving Traps

1. Record time and date that you begin collecting traps on datasheet.
2. Prepare labels. Be sure to use either pencil on rite-in-the-rain paper or print with a laser printer. Include site name, GPS coordinates, date and time deployed and retrieved, position number (see diagram) and trap type.
3. There are a couple of ways to collect bees from a vane trap. Here are some options.
  - a. Carefully unscrew the top of the vane trap, but do not remove the top (you will lose bees). Carefully slide a gallon ziplock bag over the top of the vane trap as you remove the top so that no bees escape. Tighten the ziplock bag around the vane trap and invert. Tap the vane trap until all bees are in the bag. (I sometimes put a little bit of ethanol or rubbing alcohol in the bottom of the bag). **Add a label.** Seal the bag with a little air. Place bags in a cooler of ice.
  - b. Carefully unscrew the top of the vane trap, but do not remove the top (you will lose bees). Carefully slide a funnel (~8 inch diameter) over the top of the vane trap as you remove the vane so that no bees escape (cut off the tip of the funnel so that the opening is larger to allow large bees through). Hold a bag around the opening of the funnel. Tap the vane trap until all bees are in the bag. **Add a label.** Seal the bag with a little air. Place bags in a cooler of ice.
  - c. Carefully unscrew the top of the vane trap, but do not remove the top (you will lose bees). Carefully slide a funnel over the top of the vane trap as you remove the vane so that no bees escape (cut off the tip of the funnel so that the opening is larger to allow large bees through). Hold an insect kill jar at the funnel opening. Tap the vane trap until all bees are in the jar. Transfer the bees to a bag after a few minutes when bees expired and **add a label.** Seal the bag with a little air. Place bags in a cooler of ice.
4. To collect insects from the bee cups, place a coffee filter in a funnel, swirl water in bee cup and pour contents of the bee cups slowly through the filter. Place the label in the coffee filter, fold and place in a bag. If the label is secured carefully in the coffee filter, you can place all coffee filters in the same bag for that site. Add air to the bag to protect the bees during transport and storage. Place in a cooler for transport.
5. Once back in civilization, store specimens in the freezer.



The soapy water in a bee cup is poured through a coffee filter supported by a funnel.

## Butterfly and Bee Transects

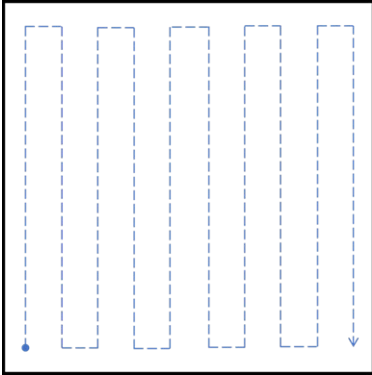
Actively net for butterflies for a minimum of 30 minutes first and then bees for a minimum of 30 minutes, while staying in the same type of habitat; the transect should be 1 km long but likely will need to be condensed by walking parallel lines (two options are shown on the next page). By actively netting, we mean stop your timer when you are processing a butterfly or bee and start it again when you are searching for them. Survey for butterflies first so you can watch for good bee habitat (i.e., flowers) along the way. This can be split between 2 people where each person surveys for butterflies for a minimum of 15 minutes and bees for a minimum of 15 minutes or one person surveys for butterflies for a minimum of 30 minutes while the other person surveys for bees for a minimum of 30 minutes. Transects should wind around the plot in a systematic fashion, but your actual path will depend on the shape of the habitat patch. See figures on next page for examples of transect paths. Capturing bees depends more on blooming flowers than butterflies, so bee transects should focus more on flower blooms within the habitat patch.

### Butterfly transects

1. Record the GPS location and starting time on the datasheet.
2. Start your GPS to record the transect you walk.
3. With your net in hand, walk slowly watching for butterflies within 5 meters of your path.
4. Capture any butterflies you encounter if possible. If captured, pause the track on your GPS, carefully place the butterfly in a glassine envelope (be gentle as the scales easily rub off their wings and can make them difficult to identify). Fold their wings together before placing them in the envelope. Note the time since surveys began on the envelope and place in a bag labeled with the site name, date, GPS coordinates, elevation and butterfly transect.
5. If you could not capture the butterfly, note the group the butterfly belonged to (e.g., white, fritillary) and the number you observed on the datasheet (e.g., 2 swallowtails)
6. After the butterfly was processed, resume your transect and start your GPS again. Repeat until you have walked a minimum of 30 minutes **and** 1 km (see two possible options, next page, for transect patterns). Remember to stay in the same
7. Record the distance walked and the length of time walked on the datasheet. Save track and record name on datasheet.
8. Place the bag of butterflies in the cooler for transport. Place them in a protect spot in the cooler to avoid damage to specimens.
9. Place in a freezer once you return to civilization.

### Bee transects

1. Record the GPS location and starting time on the datasheet.
2. Start your GPS to record the transect you walk.
3. With your net in hand, walk slowly watching for bees of all sizes. Walk through areas with flowers where you can capture bees feeding and collecting pollen. Netting is biased toward larger bees so be sure to keep your eyes open for smaller bees too. One way to capture smaller bees is to swing net back and forth in flowers and see what you captured in your net. Be sure to walk throughout the plot, netting on different flower taxa to collect a diverse assemblage of bees.
4. Capture any bees you encounter. If captured, pause the track on your GPS, carefully transfer the bee to a clear numbered vial (slide the vial into the net to transfer, use the net as a lid until the vial is capped). Place vial in a bag labeled with the site name, date, GPS coordinates, elevation, bee transect and the plant you captured the bee on.
5. Resume your transect and start your GPS again. Repeat until you have surveyed at least 30 minutes.
6. Record the length of time and distance traveled on the datasheet. Save track and record name on datasheet.
7. Place the bag of bees in the cooler for transport including air in the bag to protect specimens.
8. Place the bag of bees in a freezer once you return to civilization.
9. Transfer bees from vials into labeled bags with a little air once they perished. Keep bees captured on different plants in separate bags.



## Other information to record

Record additional information about the site either when you deploy or retrieve the traps (or both).

1. **Record wind speed and air temperature:** use a kestrel to record average air temperature and average wind speed both when you deploy and retrieve the traps. Also collect this information at the end of each transect.
2. **Blooming flowers:** Count the number of blooms of each plant species.
  - a. Haphazardly place a quadrat in ~3-10 locations in the area (e.g., close your eyes and throw a quadrat in a representative spot in the habitat sampled). The quadrat can be any size but the area must be recorded. More replicate counts should be collected for small quadrates, for example repeat 3 times for a 1 m<sup>2</sup> quadrat and 10 times for a 1 ft<sup>2</sup> quadrat.
  - b. Take a photo of the datasheet then a photo of each quadrat.
  - c. Count the number of blooms in the quadrat by flower species. An estimate can be made for plants that have many small flowers that are subdivided by the plant (e.g., a plant with umbels). For example, count how many blooms there are per stem on a plant with umbels and then multiple the number of blooms per stem by the number of stems.
  - d. Estimate the percent canopy cover of herbaceous vegetation in each quadrat and record (0-100%). Herbaceous cover is the percent of area within the quadrat covered by plants (opposite of percent bare ground).
3. **Landscape photos:** Take a photo in each cardinal direction by the central vane trap.
4. **Dominant plants:** Record and take photos of the 5 most abundant blooming plants. Count the total number of species of forb present at the site.
5. **Vegetation type or type of habitat:** record the vegetation type or type of habitat choosing from the categories below.

Alpine  
Conifer Forest  
Deciduous Forest  
Desert  
Forbland  
Grassland  
Meadow

Mountain Shrubland  
Riparian  
Rocky Slope - talus, scree, other rocky  
Sagebrush Steppe  
Salt Desert Shrub  
Other (define)

6. **Short description of specific type of habitat:** Identify or describe the specific type of habitat (e.g., mountain big sagebrush, aspen-forb, lodgepole pine forest).

**Pollinator Datasheet**

Data collectors: \_\_\_\_\_

Forest: \_\_\_\_\_ Ranger District: \_\_\_\_\_ Date: \_\_\_\_\_

Habitat type: \_\_\_\_\_ Number of forb species present: \_\_\_\_\_

Description of habitat type: \_\_\_\_\_

List plants blooming: \_\_\_\_\_

GPS Datum: \_\_\_\_\_


**Vane Trap and Bee Cup Transect**

Deployment: First trap: N \_\_\_\_\_ ° W \_\_\_\_\_ ° Elevation: \_\_\_\_\_ ft / m

Site name on GPS \_\_\_\_\_ Time: \_\_\_\_\_ am / pm

Last trap: N \_\_\_\_\_ ° W \_\_\_\_\_ ° Elevation: \_\_\_\_\_ ft / m

Site name on GPS \_\_\_\_\_ Time: \_\_\_\_\_ am / pm

Wind speed: \_\_\_\_\_ units: \_\_\_\_\_ Temperature: \_\_\_\_\_ °C

Retrieving Traps: Date: \_\_\_\_\_ Time 1<sup>st</sup> vane retrieved: \_\_\_\_\_ Time last vane retrieved: \_\_\_\_\_

Wind speed: \_\_\_\_\_ units: \_\_\_\_\_ Temperature: \_\_\_\_\_ °C

Landscape Photo numbers: North: \_\_\_\_\_ East: \_\_\_\_\_ South: \_\_\_\_\_ West: \_\_\_\_\_

Other photo numbers: \_\_\_\_\_

Weather over the collection period: \_\_\_\_\_

Notes: \_\_\_\_\_

**Transects**

Butterflies: Track length: \_\_\_\_\_ km / mi Track time: \_\_\_\_\_ min

Track name on GPS: \_\_\_\_\_

Bees: Track length: \_\_\_\_\_ km / mi Track time: \_\_\_\_\_ min

Track name on GPS: \_\_\_\_\_

Notes: \_\_\_\_\_



### Habitat information

Record the number of blooms for each plant in 3-10 quadrats (if using 1 ft<sup>2</sup> quad, measure 10). If you don't know the plant species, write a description (e.g., yellow petals and disc flower), take a photo and record the photo number. Write down the number of blooms for each plant in the cells by the quad number. Photograph each quad and record the photo number (photo #). Record percent herbaceous cover for each quadrat (% herb cover).

Size of quadrat: \_\_\_\_\_ x \_\_\_\_\_ units: \_\_\_\_\_

	Plant #1	Plant #2	Plant #3	Plant #4	Plant #5	Plant #6	Plant #7	Plant #8	Photo #	% Herb cover
Plant name										
Quad number										
Quad 1										
Quad 2										
Quad 3										
Quad 4										
Quad 5										
Quad 6										
Quad 7										
Quad 8										
Quad 9										
Quad 10										

### **Bees on flowers during netting**

Record the bees captured on different plant species. Photograph each plant species and record the photo number. Bees in vials will be placed in different bags depending on the plant they were captured on.

Plant species	Photo #

### **Information on labels for traps**

Forest:

Site:

N:

W:

Date & Time Deployed:

Date & Time Retrieved:

Trap type & position number:

### **Label information for butterfly and bee transects**

Forest:

Site:

N:

W:

Date & Time:

Distance & Time netted:

Plant captured on (bees only):

Butterfly or Bee transect: