



Environmental Analysis Program

Pomona College
Biogeochemistry Laboratory

SOP-F611

Pollinator Observation Surveys

Standard Operating Procedure

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1. Purpose

This SOP describes standardized methods for surveying pollinator communities at EA Program field sites using timed visual observations and passive pan traps. Pollinator surveys document the diversity and relative abundance of bees, butterflies, flies, beetles, and other flower-visiting insects, providing data for assessing habitat quality, restoration success, and the effects of land use on pollination services (Lebuhn & Fenter, 2013; Potts et al., 2010).

2. Scope

- **Applies to:** Standardized pollinator observation surveys and pan trap sampling at all EA Program terrestrial field sites with flowering vegetation, including the Bernard Field Station, campus landscapes, restoration sites, and agricultural study areas
- **Does not apply to:** Targeted bee nesting surveys; hive management; pollen analysis (paleontology); pollinator genetics or molecular identification (though specimens collected here may be used for those purposes); aquatic insect sampling (see [SOP-F610](#))
- **Location:** All EA Program field sites with floral resources

3. Responsibilities

Role	Responsibility
PI / Field Lead	Approve survey design and collection permits
Trained Personnel	Conduct surveys and process pan trap samples per this SOP
New Students	Complete training (insect identification and sting safety) before independent work

4. Definitions

- **Diel activity pattern:** The temporal distribution of an organism's activity across a 24-hour period; most bee species are diurnal with peak activity between 09:00 and 15:00 under sunny, warm conditions; surveys outside peak activity hours systematically underestimate community richness (Lebuhn & Fenter, 2013).
- **Floral density:** The number of open flowers per unit area at a survey location; a key covariate for pollinator abundance because visitation scales with resource availability; estimated visually as flowers per m² or as qualitative categories (low, medium, high) at each survey event.
- **Focal flower observation:** A survey method in which a single flowering plant or patch is observed for a fixed duration (typically 10 minutes) and all pollinators visiting any flower during that period are recorded; useful for comparing visitation rates between plant species or treatments (Westphal et al., 2008).
- **Functional group:** A coarse taxon category used when species-level identification is not possible in the field; the EA Program uses 10 groups: honey bee (HB), bumble bee (BB),

small native bee (SB), large native bee (LB), butterfly (BF), syrphid fly (SF), other fly (OF), beetle (BT), wasp (WA), and other (OT).

- **Independent detection event:** A single detection of a pollinator at a flower, counted only once per survey period regardless of how long the individual remains; used to standardize counts across surveys of different duration.
- **Pan trap:** A colored bowl (white, fluorescent yellow, fluorescent blue) filled with soapy water; passively captures flying insects attracted by color resemblance to flowers; effective for small- to medium-sized bees but under-represents large-bodied bees and butterflies (Lebuhn & Fenter, 2013; Westphal et al., 2008).
- **Pollinator:** Any animal that moves pollen from the anther to the stigma of a flower, facilitating plant reproduction; includes bees, flies, butterflies and moths, beetles, and hummingbirds; bees are the dominant pollinators at most EA Program field sites (Potts et al., 2010).
- **Pollination service:** An ecosystem service provided by flower-visiting animals; essential for reproduction of approximately 75% of flowering plant species and 35% of global food crop production (Potts et al., 2010).
- **Timed observation transect:** A standardized survey in which the observer walks a fixed route (typically 50 m x 2 m) at a standardized pace (approximately 10 m per minute) and records all pollinators observed on flowers within the survey corridor; produces a count-based estimate of relative pollinator activity (Dicks et al., 2016; Lebuhn & Fenter, 2013).
- **Voucher specimen:** A preserved insect specimen deposited in a reference collection to document the occurrence of a species at a site; required for any first records and difficult identifications; pinned through the right mesopleuron following standard entomological practice.

5. Safety and Hazards

Hazards

- **Biological:** Bee and wasp stings are the primary hazard. Personnel with known Hymenoptera allergies must carry a prescribed epinephrine auto-injector (EpiPen) and inform the field lead before every outing. Africanized honey bees may be present at some Southern California sites.
- **Chemical:** Soapy water in pan traps (low risk). Ethanol (70%) used for specimen preservation is flammable.
- **Physical:** Heat exposure during mid-day surveys. Uneven terrain. Pan traps may be trampled by people or wildlife.

5.1. Required PPE

- ☐ Closed-toed shoes or field boots
- ☐ Light-colored clothing (dark colors attract bees)
- ☐ Sun protection (hat, sunscreen)
- ☐ EpiPen (if allergic; inform field lead)
- ☐ Nitrile gloves (when handling preserved specimens)

5.2. Permits

Insect collection may require a Scientific Collecting Permit from CDFW depending on the site and target taxa. No permit is needed for observation-only surveys.

5.3. Emergency Procedures

For anaphylactic reactions: administer EpiPen, call 911. Refer to [SOP-F001 Field Safety](#). If encountering an aggressive swarm, walk calmly away; do not swat or run erratically.

6. Equipment and Materials

6.1. Timed Observations

Item	Notes
Stopwatch or phone timer	For standardizing observation periods
Hand lens or magnifying glass	For in situ identification
Camera (macro-capable or phone)	For photo-documenting pollinators
Field data sheet	Pre-printed from Appendix A
Insect field guide	e.g., <i>California Bees and Blooms</i>
iNaturalist app (smartphone)	For photo-based identification; see SOP-F602
Compass and GPS	For recording transect or plot locations

6.2. Pan Traps

Item	Notes
Plastic bowls (12 oz, 3.25 in rim)	White, fluorescent blue, and fluorescent yellow; one of each color per station
Fluorescent spray paint (blue, yellow)	For painting white bowls; use UV-bright paints
Unscented liquid dish soap	2–3 drops per bowl (breaks surface tension)
Water	To fill bowls approximately 2/3 full
Wooden stakes or wire stands	For elevating bowls to canopy height in tall vegetation
Fine mesh strainer	For removing insects from bowls
Whirl-Pak bags or vials	For storing collected specimens
70% ethanol	For preserving specimens
Forceps (soft-tipped)	For handling specimens
Labels (waterproof, internal)	For vial and bag identification

7. Procedure

7.1. Survey Timing and Conditions

Conduct pollinator surveys during peak pollinator activity:

- **Time of day:** 09:00–15:00 local time (peak flight activity)
- **Weather:** Sunny to partly cloudy; wind speed below Beaufort 4 (< 5.5 m/s); temperature above 15 C. Do not survey during rain, heavy overcast, or high winds, as pollinator activity drops sharply.
- **Season:** During peak bloom at the study site. In Southern California, this is typically March through June for most habitats, with a secondary bloom in fall for some species.
- **Flowering requirement:** Surveys are only meaningful when flowers are present. Record the dominant flowering species and estimate floral density (flowers per m²) at each survey location.

7.2. Method A: Timed Observation Surveys

Timed observations record pollinator visits to flowers along a fixed route or within a fixed plot during a standardized time period (Dicks et al., 2016; Lebuhn & Fenter, 2013).

Transect walk method:

1. Establish a transect (typically 50 m x 2 m, or a 100 m x 1 m corridor) through the area of interest. Record the transect coordinates per [SOP-F006](#).
2. Walk the transect slowly at a pace of approximately 10 m per minute.
3. Record every pollinator observed visiting a flower within the 2 m band on either side of the transect center line (or 1 m on each side for a 2 m wide transect).
4. For each observation, record:
 - Pollinator group or species (see Section 6.4)
 - Flower species being visited
 - Behavior (nectaring, pollen collecting, resting)
 - Time of observation
5. Complete the transect in 10–15 minutes. Do not stop and wait for pollinators; maintain a steady pace.
6. Repeat the transect 2–3 times per sampling event, spaced at least 30 minutes apart.

Focal flower observation method:

1. Select a flowering plant or patch and observe for a fixed period (typically 10 minutes).
2. Record every pollinator that visits any flower on the focal plant during the observation period.
3. This method is useful for comparing visitation rates among plant species or treatments.

7.3. Method B: Pan Trap Sampling

Pan traps passively capture flying insects attracted to colored bowls (Lebuhn & Fenter, 2013; Westphal et al., 2008).

1. At each sampling station, set out three bowls: one white, one fluorescent blue, one fluorescent yellow. Space bowls approximately 3 m apart.
2. Fill each bowl approximately 2/3 full with water. Add 2–3 drops of unscented dish soap (this breaks the surface tension so insects sink).
3. Place bowls at the height of the surrounding vegetation canopy:
 - In short grass or bare ground: set directly on the ground
 - In tall vegetation (> 30 cm): elevate on stakes or wire stands so the bowl rim is at canopy height
4. Deploy traps in the morning (by 09:00) and retrieve after 24 hours. For shorter deployments (4–6 hours), retrieve in the afternoon.
5. Pour the contents of each bowl through a fine mesh strainer. Transfer captured insects to a labeled Whirl-Pak bag or vial with 70% ethanol.
6. Label each vial with: site, station number, bowl color, date deployed, date retrieved, and collector initials.
7. Return specimens to the lab for sorting, pinning, and identification.

Note

Pan traps are biased toward small- to medium-sized bees and may under-represent large-bodied bees (bumble bees) and butterflies (Westphal et al., 2008). Combine pan traps with timed observations for a more complete picture of the pollinator community.

7.4. Pollinator Identification

Identify pollinators to the finest taxonomic level possible in the field. At a minimum, assign each observation to one of the following functional groups:

Code	Group	Examples
HB	Honey bee	<i>Apis mellifera</i>
BB	Bumble bee	<i>Bombus</i> spp.
SB	Small native bee	<i>Halictus</i> , <i>Lasioglossum</i> , <i>Ceratina</i>
LB	Large native bee	<i>Xylocopa</i> , <i>Megachile</i>
BF	Butterfly	All Lepidoptera
SF	Syrphid fly (hover fly)	Syrphidae
OF	Other fly	Bombyliidae, Tachinidae, etc.
BT	Beetle	Flower-visiting Coleoptera
WA	Wasp	Vespidae, Sphecidae, etc.
OT	Other	Hummingbirds, moths, ants

Photograph all specimens that cannot be identified in the field. Upload photos to iNaturalist per [SOP-F602](#) for community-assisted identification.

7.5. Specimen Processing (Lab)

1. Sort pan trap specimens by order under a dissecting scope.
2. Pin bee specimens following standard entomological practice (pin through the right mesopleuron) and label with locality, date, collector, and determination.
3. Store pinned specimens in a labeled unit tray in the insect collection.
4. Specimens can be submitted to a taxonomic specialist or DNA barcoded (COI) for species confirmation.

8. Quality Control

- Record weather conditions (temperature, wind, cloud cover) at the start and end of every survey. Do not compare data collected under different weather conditions without accounting for detectability.
- On 10% of surveys, have two observers independently record pollinators on the same transect to assess inter-observer agreement.
- Record floral density and dominant flowering species at every survey; pollinator abundance is strongly influenced by floral resource availability.
- For pan traps, inspect bowls mid-deployment if wind or wildlife disturbance is likely. Refill or replace tipped bowls and note the interruption.
- Voucher-pin at least 5 representative specimens per functional group per site per season for the reference collection.

9. References

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- Potts, S. G., Biesmeijer, J. C., Kremen, C., Neumann, P., Schweiger, O., & Kunin, W. E. (2010). Global pollinator declines: Trends, impacts and drivers. *Trends in Ecology and Evolution*, 25(6), 345–353. <https://doi.org/10.1016/j.tree.2010.01.007>
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10. Related SOPs

SOP	Title	Relationship
F001	Field Safety	Required prerequisite; sting response

SOP	Title	Relationship
F006	GPS and Site Navigation	Survey location coordinates
F602	iNaturalist	Photo-based identification
F603	Vegetation Transects	Floral resource documentation
F615	Bird Point Counts	Companion fauna survey method

11. Training Record

Before conducting pollinator surveys independently, personnel must:

1. Read this SOP and [SOP-F001 Field Safety](#) in full
2. Disclose any Hymenoptera allergy to the field lead and carry an EpiPen if prescribed
3. Demonstrate identification of the 10 pollinator functional groups (Section 6.4) using pinned specimens or photographs
4. Participate in a supervised transect observation survey and pan trap deployment
5. Be signed off by the PI or field lead

12. Appendix A: Pollinator Observation Data Sheet

Site: _____ Transect ID: _____ Date: _____

Observer: _____ Start time: _____ End time: _____

Weather: Temp: ____ C Wind (Beaufort): ____ Cloud: ____ % Sun: Y / N

Dominant flowering species: _____

Time	Pollinator Group/Species	Flower Species	Behavior	Photo #
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