

Protocols for Monitoring Pollinators: Butterflies & Day-Flying Moths

Objective and Purpose

» Pollinators provide immeasurable benefits to both natural and anthropogenic ecosystems and global food security is dependent on their ecosystem services (van der Sluijs and Vaage, 2016). Plant-pollinating invertebrate species include those that belong to the orders Hymenoptera, Diptera, Lepidoptera, and Coleoptera. Although there has been concern over declining worldwide pollinator diversity within the scientific community since the mid-1990s, mainstream concern over this issue is relatively new. Since pollinator diversity contributes to higher overall biodiversity within an ecosystem, monitoring the state of native pollinators is an important aspect of the Urban Biodiversity Inventory Framework (Eardley et al., 2006).

Protocol Consistency

Standardizing sampling protocols for the Urban Biodiversity Inventory Framework is a critical requirement of designing surveys that are replicable and producing results that are spatially and chronologically comparable (Larsen, 2016). This is especially important for long-term monitoring efforts that aim to measure changes over time. While a standardized approach among all cities using the Urban Biodiversity Inventory Framework is preferable, each city may identify a methodology best suited for their species of interest and resources at hand. It is important to record and report the methodology used and remain consistent in protocols unless modifications are essential to its improvement. It is equally important that site conditions and day-of conditions for sampling are kept as similar across sites as possible to reduce the impacts of confounding factors. All methodology will be improved with the use of non-biased approaches to data collection, appropriate sampling efforts and accurate reporting of data. The methodology below follows the assumption that the

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observers are properly trained, using methods to limit bias, and following designated protocol to ensure consistency among sites and years of sampling efforts.

Track 2 Presence/Absence

Data to be Entered into UBIF Database

- » City
- » Data Collector(s)
- » Date
- » Location name
- » Ecosystem/habitat of interest
- » Taxonomic group
- » Species
- » GPS coordinates of transects (Lat/Long in decimal degree format)
- » Reference or city site
- » Presence or absence of target species

Additional Required Information to Record (see Data Collection Sheet)

- » Number and length of transects

Optional Information to Record (see Data Collection Sheet)

- » Start and end time of transect walks

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- » Temperature, wind and weather (sunny, partly cloudy, etc.)
- » Dominant vegetation in the area and flowers that are in bloom

Sampling Protocols:

Protocols adapted from those described in Arnold and Parrent (2014), Royer et al. (1998) and Van Swaay et al. (2012).

Condition Requirements:

- » Data collection should occur only when temperature is greater than 55° and wind is less than 15 mph. Some cloud cover is acceptable, but rain should be avoided. Collection time should occur between 3.5 hours before and 3.5 hours after the sun is at its highest point.
- » Data collection must occur over the course of the known flight period of the target species and within the post-rain flowering season, which varies by region.

Establishing Transects:

- » Transect locations will be selected systematically within a site and should be restricted to one habitat and land-use type. It is important to consider available resources for the target pollinator when selecting transect locations.
- » The entire length of the transect should be exposed to sunlight.
- » Transects do not need to be straight and can bend around structures (trees, bushes, etc.).
- » A total of twenty 50 m transects per site is recommended. Other combinations that add up to a total of 1000 m per site may also be used, but be sure to keep transect lengths consistent across sites and over time.
- » Permanent transects are recommended as long as the required resources for the target pollinator remains available.
 - Permanently mark the beginning and end of each transect using weather and fireproof markers.
 - If using permanent transects is not possible, keep transects in the same general area during each data collection period.

Collecting Presence/Absence Data:

- » Starting from one end, walk the entire length of the transect at a slow and constant pace.
 - Time spent walking along each transect will depend on transect length. Overall effort should be kept consistent across all transects and sites.
- » Inspect the designated area around the transect for the target species. This area should include approximately 2.5 m to the right and left of the transect, 5 m in front of the surveyor, and 5 m above the ground (Figure 1). Surveyors will not inspect the area behind them.
- » If the target pollinator is seen at any point along the transect, the species is considered present. If target pollinator is not seen along the transect, then it is considered absent.
 - Some pollinators can be difficult to identify from a distance (e.g. female butterflies of a certain species). In this case, the surveyor can use an insect net to capture and verify whether or not the individual belongs to the target species. If positive identification cannot be made in the field, a specimen should be collected for more detailed identification.
- » Presence/absence data should be collected from city and reference sites once per week over the course of the flight period.

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Track 3 Relative Abundance

Note: Track 3 data can be collected from the same sites and transects surveyed in Track 2. If Track 2 is not used, refer to Track 2: “Establishing Transects” for information on transect establishment within city and reference sites. Special permits may be required for collecting and marking pollinators. Verify any permits or wildlife regulations that may apply prior to conducting surveys.

Data to be Entered into UBIF Database

- » City
- » Data Collector(s)
- » Date
- » Location name
- » Ecosystem/habitat of interest
- » Taxonomic group
- » Species
- » GPS coordinates of transects (Lat/Long in decimal degree format)
- » Reference or city site
- » Relative abundance (%) of target species

Additional Required Information to Record (see Data Collection Sheet)

- » Number and length of transects
- » Counts of target and non-target individuals

Optional Information to Record (see Data Collection Sheet)

- » Start and end time of transect walks
- » Temperature, wind and weather (sunny, partly cloudy, etc.)
- » Dominant vegetation in the area and flowers that are in bloom

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- » Non-target species information

Sampling Protocol:

Sampling protocols were adapted from those described in Arnold and Parrent (2014), Nowiki et al. (2008), Royer et al. (1998), Sutherland (2006), and Van Swaay et al. (2012).

Collecting Relative Abundance Data

- » Starting from one end, walk the entire length of the transect at a slow and constant pace.
 - Time spent walking along each transect depends on transect length and number of pollinators along the transect. Overall effort should be kept consistent across all transects and sites.
- » Inspect the designated area around the transect for all butterfly or moth pollinators. This area should include approximately 2.5 m to the right and left of the transect, 5 m in front of the surveyor, and 5 m above the ground (Figure 1). Surveyor will not inspect the area behind them.
- » Butterflies and day-flying moths observed within the designated area around the transect will be counted as being either a target species or a non-target species.
 - Some individuals can be difficult to identify from a distance (e.g. female butterflies of a certain species). In this case, the surveyor can use an insect net to capture and verify whether or not the individual belongs to the target species.
 - Take care to avoid counting the same individual twice.
 - Two surveyors should work together when collecting data. One surveyor can walk the transect and verbally identify the individuals as target or non-target species, while the other surveyor records the information.
- » It is recommended that transect counts occur once per week over the course of the flight

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period.

Calculating Relative Abundance

- » After each trap deployment period, counts will be summed for target species and non-target species for each transect.
- » Relative abundance (%) for each transect will be calculated as the proportion of the individuals

Relative Abundance (%) =

$$\frac{\text{Number of target species}}{\text{Number of target species} + \text{Number of non-target}} \times 100$$

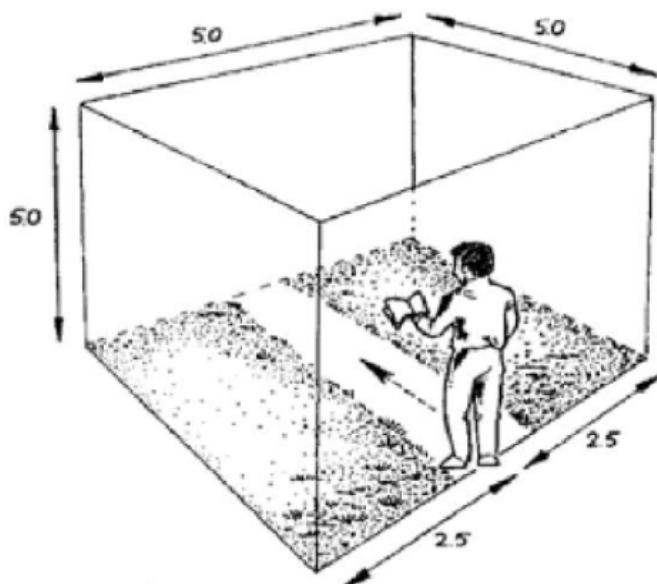


Figure 1. Starting from one end, walk the entire length of the transect at a slow and constant pace. Inspect the designated area around the transect, which includes approximately 2.5 m to the right and left of the transect, 5 m in front of the surveyor, and 5 m above the ground. Surveyor will not inspect the area behind them. Image from Van Swaay et al. (2012).

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counted that belong to the target species.

Citations and Additional Resources

- Arnold, T. and J. Parrent 2014. Native Pollinator Observation and Monitoring- A Pilot Project. Grey Bruce Centre for Agroecology, Ontario, Canada.
- Eardley, C., D. Roth, J. Clarke, S. Buchmann and B. Gemmill. 2006. Pollinators and Pollination: a resource book for policy and practice. First ed. African Pollinator Initiative, Pretoria, South Africa. 92 p.
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- Nowicki, P., J. Settele, P.Y. Henry, M. Woyciechowski. 2008. Butterfly monitoring methods: the ideal and the real world. Israel Journal of Ecology & Evolution. 54(2008): 69-88.
- Royer, R., J. Austin, W. Newton. 1998. Checklist and "Pollard Walk" butterfly survey methods on public lands. USGS Northern Prairie Wildlife Research Center. Paper 10.
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- van der Sluijs, J.P. and N.S. Vaage. 2016. Pollinators and global food security: the need for holistic global stewardship. Food Ethics. 1(1):75-91.
- Van Swaay, C.A.M., T. Brereton, P. Kirkland, M.S. Warren. 2012. Manual for Butterfly Monitoring. Report VS2012.010, De Vlinderstichting/Dutch Butterfly Conservation, Butterfly Conservation UK & Butterfly Conservation Europe, Wageningen.