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USDA LTAR Common Experiment measurement: Butterfly diversity and abundance

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We use this protocol and it's working

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Abstract

We will use a measure of butterfly abundance and diversity collected using a method standard across the US and the globe (Wepprich, et al. 2019). This method is used in regional studies, for example, the states of Ohio, Illinois, and Michigan in the US and the countries of the UK, the Netherlands, and Spain. Within these regions across hundreds of sites, data collection is performed by scientists and citizen scientists. Butterflies are the easiest-to-measure indicator of pollinator and insect abundance; metrics from large-scale butterfly surveys have proven consistent with long-term responses of pollinators and other insects across the globe (Van Klink, et al. 2020). The recommended method is easily employed by people not trained with insects and is not burdensome in terms of time. For every replicate, it involves walking a 1 km line transect at least once a month and recording the number and species of butterflies within a set distance of the transect.

Materials

- Stopwatch
- Watch
- Clipboard
- Site map
- Pencil
- Butterfly net
- Binoculars
- Datasheets
- Butterfly ID guide

Before start

This protocol has been altered from https://faculty.jmcl.wwu.edu/Wildlife/bfly_walk.pdf and https://ukbms.org/methods. The presence and abundance of butterflies are sampled using transect counts, modified from Pollard (1977).

Pollard walks

1h 30m

1 Transect routes are established as appropriate for each site.

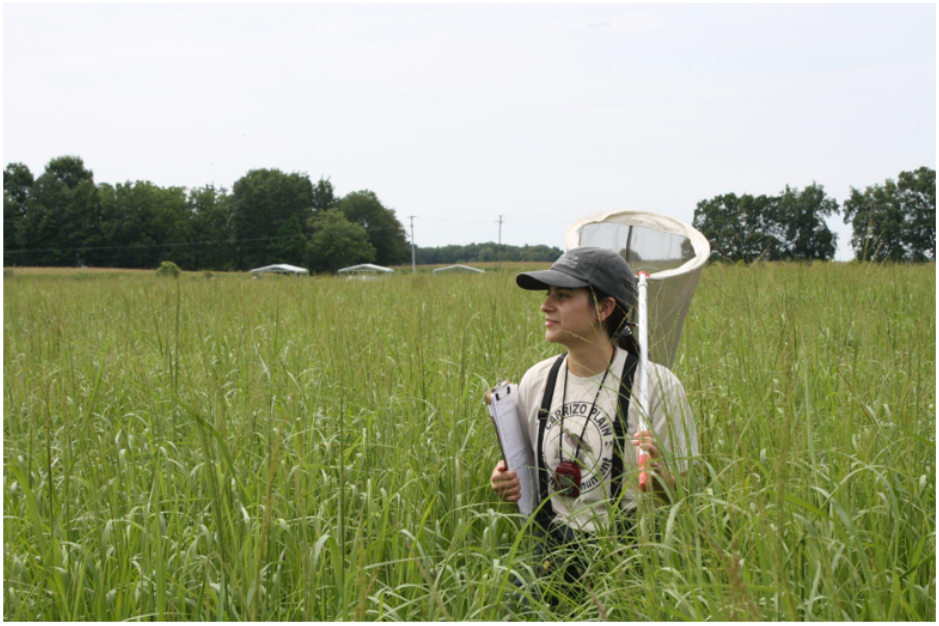
2 The recommended transect length is 1 km and the walking duration is 1 hour and 30 minutes.

> **Note**
>
> If areas, such as prevailing and alternative treatments in LTAR, do not allow 1 km transects, these values are scaled proportionally. For example, at the LTAR Kellogg Biological Station, some treatments permit 100 m transects that are walked for 8 min.

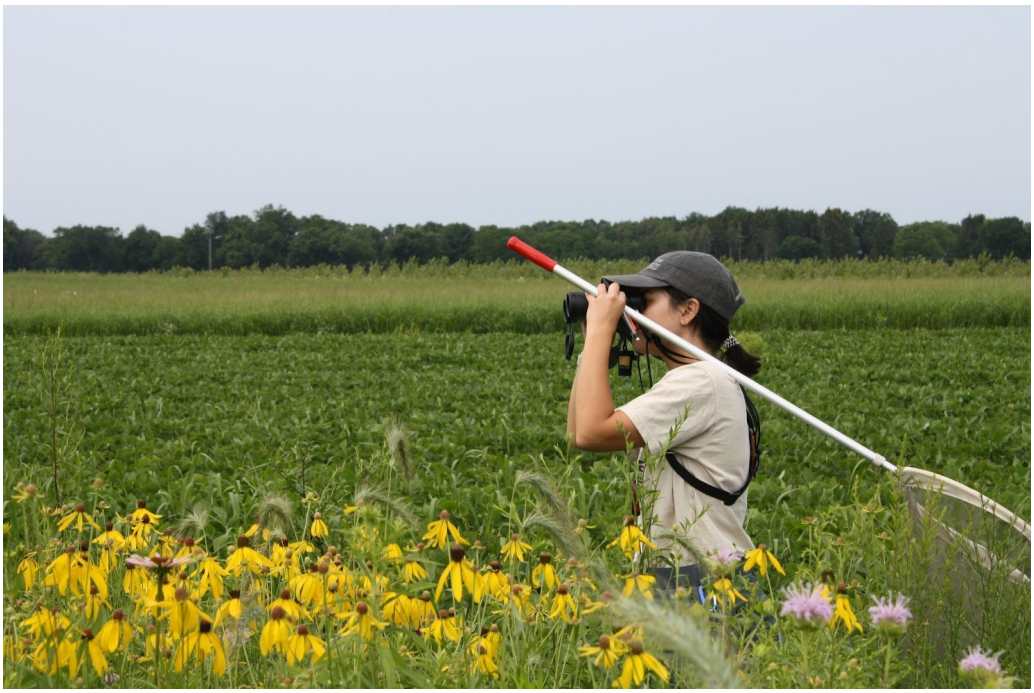
3 Transects are marked before surveys commence, and the same transect is sampled throughout the research effort.

4 Sampling transects are surveyed by walking from one end to the other without doubling back. Walk at a steady pace.

5 Observers record butterflies seen within a 5 m radius on both sides and above them while walking a transect at a slow and steady pace (see the figure embedded below).



Credit: Elizabeth Schultheis



Credit: Elizabeth Schultheis

6 To avoid double-counting, butterflies behind the observer are not counted.

7 Species identifications are made visually, using binoculars when needed.

Note

Occasionally, identification may require a photograph or capture with nets, after which the insects are released unharmed.

8 Record species or higher taxa using common names and keep a tally per butterfly taxon.

9 Record each individual once only. If the survey pauses to capture, identify, photograph, or take notes on a butterfly, stop the timer.

10 Transects are walked during midday hours (10:00 am – 4:00 pm) when it is warm and insects are flying.

11 Sampling is restricted to relatively calm conditions and times when air temperature exceeds 11 °C in sunny weather or 17 °C in cloudy weather.

12 Ideally, treatments are sampled weekly, and LTAR Sites should aspire to this frequency of sampling.

> **Note**
>
> However, they can be sampled at least monthly (at most daily, with any rate more than weekly aggregating to a weekly average).

13 Samples will occur during the growing season, with samples beginning 14 days after the first butterflies are observed.

14 The rate at which plots or fields are sampled within an LTAR Site will be consistent across all treatments and replicates.

15 The rate may vary across LTAR Sites for multiple reasons (e.g., staffing or the nature of additional questions being addressed).

16 Measures will still be comparable across sites using standard meta-analytic approaches.

Pollard walks - Covariate metrics

17 Immediately before surveying each transect, record the date, plot (treatment, replicate), surveyor initials, and estimated cloud cover (%).

18 Obtain temperature from weather station records recorded on-site or nearby.

19 Record the time of day and start the stopwatch at the beginning of each survey.

20 Collect data needed on plant diversity using the *USDA LTAR Common Experiment measurement: Cropland plant diversity* protocol.

Pollard walks - Location

21 All replicates of prevailing and alternative treatments.

Pollard walks - Species identification

22 Butterflies are a strong indicator for other insects because they are readily identified on the wing.

23 Data collectors are trained in one survey day by a lead investigator knowledgeable about butterfly species of the region.

24 Most species can be identified and learned quickly using a field guide. Some species, especially skippers, can be identified on the wing but with some difficulty. For these species, individuals can be captured and released or can be photographed.

Calculations

25 An index of abundance is calculated by:

1. Calculating the mean count per transect each week, and then
2. Summing the mean weekly counts (Pollard 1977).

Quality assessment and quality control

26 People conducting surveys will be trained in butterfly identification.

27 This training will occur through field guides and focus on the most common butterflies in a site's experiment. Then, a new investigator will accompany a trained investigator on at least one day of butterfly surveys until the trained investigator knows the new person can identify butterflies.

28 Datasheets will be checked for completeness when submitted at the end of a survey day and then entered into a database.

29 A different person will conduct a second review, checking the entered data against the datasheet.

30 Finally, data will be reviewed for accuracy. This review includes any necessary adjustments to species/taxa identifications based on spelling errors, the likelihood of species occurrence in a given habitat or geographic location, and difficult identification scenarios, such as species challenging to distinguish morphologically or known to hybridize. This review also includes a

check for possible miscounts or typos. For example, if a species typically occurring at low abundance has a very high count in a survey, the reviewer should check the count against the original datasheet.

Recommendations for data collection

31 Table 1. Summary of recommendations for measuring butterfly abundance and diversity.

	A	B	C
	Attribute	Preferred	Minimum
	Spatial scale	All prevailing and alternative treatments	
	Frequency	Once per week	Once per month
	Covariate metrics	Temperature, cloud cover, plant diversity, plant abundance by species	

Protocol references

The key papers describing the method

1. Pollard, E. (1977). A method for assessing changes in the abundance of butterflies. Biological conservation, 12(2), 115-134.
2. Pollard, E, and TJ Yates. 1993. Monitoring Butterflies for Ecology and Conservation. Chapman & Hall, London, UK.

On the appropriateness of the Pollard index for determining population size

Haddad, N. M., Hudgens, B., Damiani, C., Gross, K., Kuefler, D., & Pollock, K. (2008). Determining optimal population monitoring for rare butterflies. Conservation Biology, 22(4), 929-940.

Examples of the use of the method for assessing decades-long trends in butterfly abundance

Wepprich, T., Adrion, J. R., Ries, L., Wiedmann, J., & Haddad, N. M. (2019). Butterfly abundance declines over 20 years of systematic monitoring in Ohio, USA. PLoS One, 14(7), e0216270.

On why butterflies are strong indicators for other insects globally

Van Klink, R., Bowler, D. E., Gongalsky, K. B., Swengel, A. B., Gentile, A., & Chase, J. M. (2020). Meta-analysis reveals declines in terrestrial but increases in freshwater insect abundances. Science 368:417-420.