Monarch Count Survey Instructions

Protocol for the Xerces Society's Western Monarch Count

Equipment List

- Datasheets (bring hardcopies and/or set up the Survey123 app)
- Binoculars (8x42 or 10x50 recommended)
- Pen or pencil & clipboard (if using paper datasheets)
- Smartphone or tablet (helpful but not required)
    - Recommended apps: Survey123, Compass, iNaturalist or Seek, Project Monarch
- Portable phone charger & cord (helpful but not required)
- Camera (helpful but not required)
- GPS unit & handheld compass (helpful if a smartphone is unavailable)
- Copy of Common Overwintering Tree and Shrub Guide & Tagged Monarch Guide (helpful but not required)
- Backpack, water, snacks, layers, waterproof shoes, rain jacket (helpful but not required)
- Kestrel pocket weather meter or outdoor weather thermometer (helpful for professionals and land managers but not required)
- Laser pointer (helpful but not required; do not point the laser at the butterflies!! Rather, use the pointer to help identify tree trunks or branches when communicating with your survey partner)

When and How Often to Count

Monarch Count surveys should be conducted at least once per monitoring period (e.g., once during the early, mid and late season counts; 3 surveys minimum per season), although several visits per monitoring period is preferred. Casual scouting at an overwintering site the afternoon prior to conducting an official survey can help identify monarch activity hot spots and streamline participants' experience in the field the next morning.

Participants should communicate their survey availability to their regional coordinator(s) before the season begins, outlining when and where they plan to count. This allows regional coordinators to plan survey coverage for their county. The goal is to cover as many sites as possible each season. Regional coordinator contact information and a map of known monarch overwintering sites can be found at WesternMonarchCount.org.

Participants are welcome to establish weekly, bi-weekly, or monthly surveys throughout the entire monarch overwintering season (October through March) if capacity allows – all monarch overwintering data will be included in the Xerces Society's Western Monarch Overwintering Sites (WMOS) Database, even if the data are collected outside of the official monitoring periods. However, it is important to conduct Monarch Counts during the early, mid and late season monitoring periods to compare cluster sizes in a standardized way across sites and years.

Temperature and Observer Expectations

Surveys should be conducted by **at least two observers** in the **early morning** while temperatures are low enough that monarch butterflies remain clustered from the evening before. Participants should ideally begin their surveys before 10:00 am. Once the sun rises high enough and temps exceed 13 °C or 55 °F, monarchs typically begin to leave their clustering

locations. Conducting surveys in the morning when the majority of monarchs remain clustered allows participants to more accurately identify the monarch cluster trees and estimate the number of butterflies present in a grove.

Weather measurements should be taken and recorded in the datasheet at the start of the survey; handheld weather meter/kestrel measurements should be taken from inside the grove near the cluster location(s), if present. Although less accurate, participants may note the temperature using their phone weather app if a handheld device is unavailable. The cost of purchasing handheld weather meters can be expensive, so it's common for participants to use their phone or lookup their local weather station website to document temperature and wind speed, etc. Note that "wind direction" is the direction that the wind is coming FROM.

Do not survey during heavy precipitation or strong wind storms because of poor visibility, safety concerns and increased chances of the butterflies being scattered. If a considerable number of fliers are observed (e.g., over 50), please complete your survey but plan to return again when conditions are more favorable for an accurate count (perhaps earlier in the morning or during a slightly cooler day). Monarchs are known to move around within overwintering sites, between overwintering sites and venture out into nearby neighborhood gardens to nectar. If monarchs have left the site for nearby gardens, surveys will not include these butterflies. Additionally, flying monarchs are exceptionally difficult to count and keep track of; participants surveying in the late afternoon run the risk of double counting a significant number of flying butterflies.

Cluster Estimation Protocol

Record each cluster on a separate row/field of the datasheet:

1. Identify a cluster to estimate with your monitoring partner. It's important that you are both counting the same butterflies since you'll compare counts for accuracy at the end.
2. Note the GPS location of the cluster tree. If using the Survey123 app, click on the plus sign under Clusters and place a point at the cluster tree or shrub location. If you're using a paper datasheet, stand at the base of the tree or shrub and gather the GPS coordinates using your smartphone. Maps applications generally work well.
3. Identify the species of tree on which the monarchs are clustered. You may refer to the Overwintering Tree and Shrub Guide for reference to species name and code. Plant identification apps such as Seek can also help you identify the tree or shrub.
4. Individually count the number of monarchs in a small section or area of the cluster, then extrapolate that number out to arrive at a count estimate for the entire cluster. Repeat this process one or two more times from different angles, then take the average.
5. Compare your estimate with that of your monitoring partner's; if both counts are within a 20% margin, record the average of the two counts (yours and your partner's) on the datasheet. If counts are *not* within 20%, discuss why and then start the count again.
6. Repeat this process until you and your monitoring partner have agreed upon estimates for each cluster present at the site. Sum your estimates and note the total number of clustered monarchs on your datasheet.
7. If you are using the Survey123 app, repeat this process for each tree you identify monarch clusters on.
8. Sunners, loners, fliers, and grounders are tracked separately on the datasheet; tally these observations as you move around the site.

9. Sum all clustered monarchs + sunners + fliers + loners + grounders to produce the grand total monarch count.
    - *Note: dead monarchs or monarchs missing an abdomen (e.g., due to predation) should NOT contribute to the grand total.*

Submitting Data

Monarch Count and Habitat Assessment data should be submitted as soon as possible through the Survey123 mobile app or online forms available at WesternMonarchCount.org. Monitoring partners will need to decide who is responsible for submitting their joint datasheet and plan accordingly to avoid submitting multiple reports of the same data. If inconsistencies, missing data or protocol concerns are noted, a Xerces staff person or regional coordinator will attempt to contact the individual(s) for clarification, using the email provided in their datasheet.

Definitions

- **Open Access:** Unrestricted direct access to the overwintering site and cluster trees (e.g., public parks or open spaces that remain open all/most hours, public walkways, roadways, or parking lots, etc.)
- **Limited Access:** Complete or partial access to the site or cluster trees *with* limitations or restrictions (e.g., entry fees, limited operating hours, requires site access coordination or special permissions with landowner, environmental obstacles like poison oak or steep terrain, etc.)
- **No Access:** No direct access to the site or cluster trees; however, the site may or may not be visible from a nearby location such as a public road (e.g., private property with no landowner contact, restricted access area with no staff contact, environmental barriers, etc.)
- **Cluster**: three or more adjacent butterflies with closed wings (likely that the cluster formed the previous day), butterflies are closely packed together, usually touching
- **Sunners**: single butterflies with open wings, temperatures usually exceed 55° F, likely that the sunning butterflies flew from their cluster to the sunning location
- **Loners**: two or fewer butterflies with closed wings not associated with a cluster
- **Fliers**: any number of butterflies in flight
- **Grounders**: any number of living, intact butterflies on the ground (monarchs missing an abdomen or thorax due to predation should be categorized as “dead”)
- **Dead**: butterflies presumed dead or death is imminent (e.g., missing thorax or abdomen)
- **Mating**: individual butterflies engaged in mating activities (a mating pair would be two butterflies)
- **Tagged**: butterflies with a unique applied marking (usually a sticker) on outer hindwing, visible when monarch wings are closed–check the butterfly clusters and loner butterflies!