

Cumberland Piedmont Network

National Park Service
Inventory and Monitoring Division



Standard Operating Procedure 5

Post-Sampling—Version 2.0

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Summary

This standard operating procedure (SOP) describes tasks to be performed after site visits. The tasks detailed in this SOP roughly cover the period **from** when field personnel have returned from the field **to** the point of starting data management activities (covered in SOP 6 *Data Management and Quality Assurance/Quality Control—Version 2.0* [CUPN 2024]). This SOP also covers procedures to follow at the end of a sampling season. The crew leader must check, shortly after sampling at each park (as appropriate and outlined in this SOP) and the field season, that all post-sampling activities have been completed (e.g., tools have been properly stored, data have been pulled from GPS units, voucher specimens have been processed).

Revision Log

Revision Date	Author	Changes Made	Reason for Change	New Version #
June 2020	Johnathan Jernigan	Updated tasks due upon completion of field work and added voucher processing details.	Tasks have been added since version 1.0. We also felt that this was the better place to discuss voucher processing.	2.0

Procedures

1. **Close out travel authorizations.** Any crew member working under a travel authorization must close out the authorization per the procedures of that member's governing agency.
2. **Review field forms.** Field data forms from the sampling event are reviewed to ensure that any noteworthy occurrences or hazards that were encountered have been noted. Field forms are also reviewed for completeness and correctness, with corrections made as appropriate. Corrections are made in such a way that the original data are not lost, so that if the correction is later found to be incorrect, the original data are still preserved.
3. **Transfer digital photographs to CUPN's network drive.** Files are stored in the image folder associated with the park and site from which the image was taken. An example pathway from within the ozone and foliar injury protocol's directory is Images\ABLI\Foliar_Injury\ABLI0001\site_photo. At the "site_photo" directory level, there is also a "site_sketch" directory for scans of the site sketches.

Image files are renamed according to the established naming convention. That convention is currently PPPSSSS_YYYYMMDD_NN, where PPPP is the four-letter park code, SSSS is the site number, YYYY is the year, MM is the numeric month, DD is the day and NN is the sequentially assigned photo number (01, 02, 03, etc.). An example is ABLI0001_20080814_01.

Finalize and scan site sketch field forms. This includes verifying information such as site name and sampling date are correct. Once the site sketch sheets are finalized, they are scanned as jpeg files and stored in the appropriate directory on the network server (Images\ABLI\Foliar_Injury\ABLI0001\site_sketch). Site sketches have a naming convention similar to that of images. That convention is PPPSSSS_YYYYMMDD_SK.jpg, where PPPP is the four-letter park code, SSSS is the site number, YYYY is the year, MM is the numeric month and DD is the day of the month. "SK" is static text that denotes that the file is a sketch. An example is COWP0002_20190731_SK.jpg.

4. **Download data from GPS unit.** If site coordinates have changed or a new site is added, then coordinate data will be downloaded from the GPS and used to update the CUPN GIS files. This task is carried out by the GIS specialist.
5. **Properly store equipment and supplies.** All equipment should be examined to be sure that it is functioning properly. Any malfunctioning equipment should be repaired or replaced. Supplies should be inventoried and, as necessary, purchased.
6. **Prepare trip reports for each park.** A brief summary of the field trip includes the sites visited, dates, crew members, and species evaluated. If injury is suspected, the report also documents what specimens have been sent to the regional expert for evaluation. The trip reports are sent by email within two weeks of the fieldwork.

7. **Schedule the annual Operational Review with other crew members.** Operational reviews are expected to occur within three months of the end of the protocol's field season. If an operational review identifies routine document updates that are needed, these document updates must be completed and submitted to the regional program manager within three months of the completion of the operational review, or prior to the next field season, whichever comes first.
8. **Process voucher leaf samples and send to foliar injury expert.** Once voucher specimens have been in the plant press long enough to properly dry (at least 36 hours), the curatorial specialist will inspect the specimens and take initial digital photographs of them on the white blotter paper where they have been dried. Once photographed, the loose specimens will be sent to a regional expert in the identification of foliar injury along with the data sheets for voucher leaf samples (part of field form). After the expert finishes the evaluation, specimens and evaluation comments are returned to the Cumberland Piedmont Network where the field data and comments will be entered into the NPS Museum Collection Management System (MCMS) to produce an NPS label. The NPS label will be attached to the specimen which will then go through the final preservation process for permanent storage. Right before the final preservation process of lamination takes place, a final photograph is taken and both the initial and final photograph are attached to the specimen's MCMS record. Photographic vouchers will be stored on the CUPN server using guidelines as established in the NPS museum [Conserve O Grams](https://www.nps.gov/museum/publications/conservoogram/22-05.pdf) (<https://www.nps.gov/museum/publications/conservoogram/22-05.pdf>). Details of this entire process are laid out in the subsequent section of this SOP.
9. **Finalize field forms.** Results from the expert evaluation are documented using the data sheets for voucher leaf samples. After the results are received, the final field forms are ready to be scanned, files renamed, and posted to the appropriate folder on the Network drive. The naming convention for field forms uses the site ID, underscore, FOIN, underscore, Date (YYYYMMDD). For example, MACA0001_FOIN_20160725.pdf.

Voucher Specimen Collection, Usage and Storage

One voucher specimen (a specimen is three leaves, though fewer leaves is permissible if that is all that is available) is collected for each species that is ozone-injury suspect at a site. The USFS protocol (USFS 2008) explicitly stipulates that voucher specimens show obvious signs of ozone injury whenever possible. That is, voucher specimens are collected only when injury is suspected. Leaves are not collected that do not show signs of ozone injury. Three leaves per species are placed in a plant press and, after the leaves have properly dried (according to the USFS protocol, at least 36 hours after being placed in the press), the vouchers are sent to and examined by a regional expert. That regional expert then determines if the injury observed is ozone injury. The purpose of the vouchers is to determine if samplers in the field are correctly identifying ozone injury on plants. This verification is necessary since ozone injury is similar in appearance to other types of leaf injury.

Some of the data collected in the field for each voucher aid in characterizing the nature of ozone injury at the site. The injury location datum, for example, is an estimate of the age of injured leaves on plants at the site (mostly younger leaves, mostly mid-aged and older leaves, or no distinct age

class). The second datum, injury type, estimates how much of the injury on injured leaves is ozone injury (most of the injury is stipple, most of the injury is not stipple, or it is difficult to tell how much of the injury is stipple).

The life cycle of voucher specimens is as follows. After the specimens have properly dried, voucher specimens are brought or sent to the CUPN office at Mammoth Cave National Park (MACA). Upon receipt at the CUPN office: the specimens are sorted by park; initially photographed; packaged using blotter paper and cardboard; then sent to the regional expert for inspection. Upon completion of the inspection, the regional expert will return the specimens to the CUPN office at the park.

Catalog/accession numbers are obtained from the originating park. All voucher information (including catalog/accession numbers) is entered into the Museum Collection Management System (MCMS). Next, NPS labels are printed using MCMS. The official label is then attached to the whole specimen (which may include one to three leaves). A second, final official photo is taken including a ruler and color reference card. This final photo is attached to the MCMS record. Specimens are then curated by laminating the voucher together with its NPS label. Note that lamination is not the typical NPS standard for curating plants. Lamination is imperative to be able to see both sides of the leaves clearly to diagnose foliar injury. Most of the plants being laminated are common plants that are already present in park's plant inventories (pers. comm., University of Maryland, G. Smith, 2008). Lastly, the MCMS records are sent to the originating park and vouchers are sent to the park's chosen repository.

The park's chosen repository could be located at that park or some other park (frequently the curatorial facilities at MACA). Also, the network allows parks to have their voucher specimens discarded after analysis. However, discarding specimens is strongly discouraged. Retaining specimens allows future studies (both related and unrelated to the study of ozone and its effects) to use the specimens. However, the network recognizes that the originating park has the authority to determine the fate of its specimens and will abide by their decision. The network will not discard specimens unless instructed to do so by the originating park. Procedures from the NPS museum handbook will be followed for discarding, processing, pressing, preserving, and shipping voucher specimens.

Photography of Voucher Specimens

The vouchers will be photographed twice. The initial photo (Figure 1) takes place before they are shipped to the regional expert. Justification is twofold: (1) if vouchers are damaged or lost in transit to the regional expert, we still have the information from the initial photograph; (2) photographing closeups of individual leaves, before they are curated in the laminate, provides a clearer and more detailed photograph. All voucher specimens (upper/front and lower/back sides) are photographed. The final voucher photograph is taken once the voucher has returned, all its data is entered into Museum Collection Management System, and the official NPS label is printed from MCMS. The final photograph (Figure 2) includes the official NPS label, specimen, color reference card and ruler. Both the initial and final photographs will be attached to the specimen's MCMS record and digitally archived on the CUPN server. Photographs of voucher specimens, henceforth referred to as photographic vouchers, are not required by the USFS protocol (USFS 2008).

There are a number of reasons why these photographic vouchers will be useful to the Cumberland Piedmont Network. First, “handling” of these photographs will not damage them. Second, with the ability to copy digital photographs, it will be possible for multiple parties (for example, the CUPN office and the originating park) to retain vouchers. Third, photographic leaf vouchers are a valuable training and presentation tool. Photographic leaf vouchers will show varying levels of ozone injury mixed with other forms of injury. Photographic vouchers can easily be compiled to illustrate a wide variety of injury levels or mixes. Fourth, archival procedures for digital photographs are simpler than those for specimens, making it relatively easy for the network to build and maintain an archive of digital photographs. And fifth, photographic vouchers can be quickly and easily distributed to interested non-NPS parties.

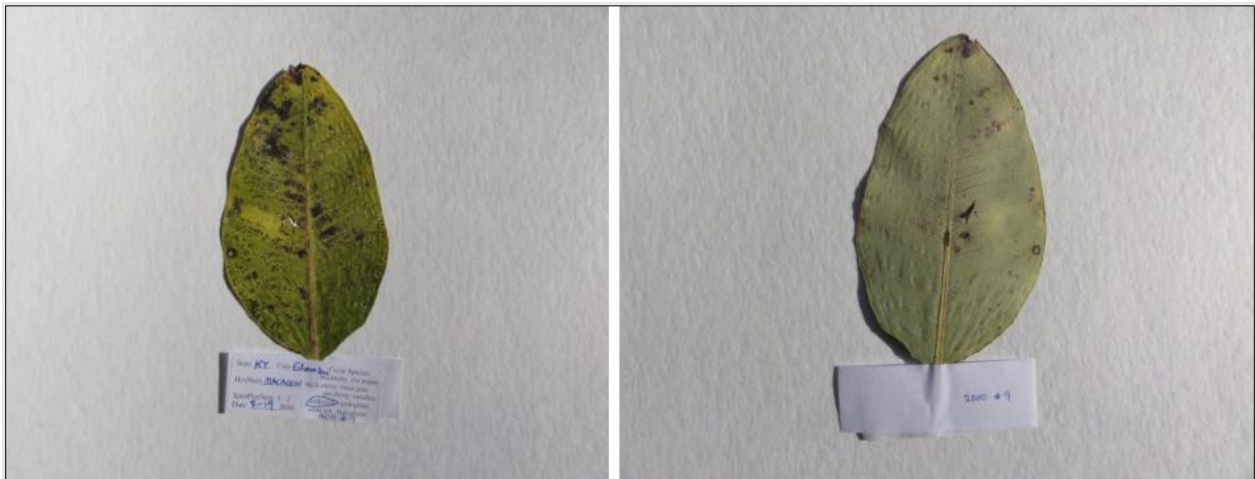


Figure 1. Photographs showing the upper/front (abaxial) and lower/back (adaxial) side of a common milkweed specimen. NPS photos / Brenda Wells (CUPN staff).

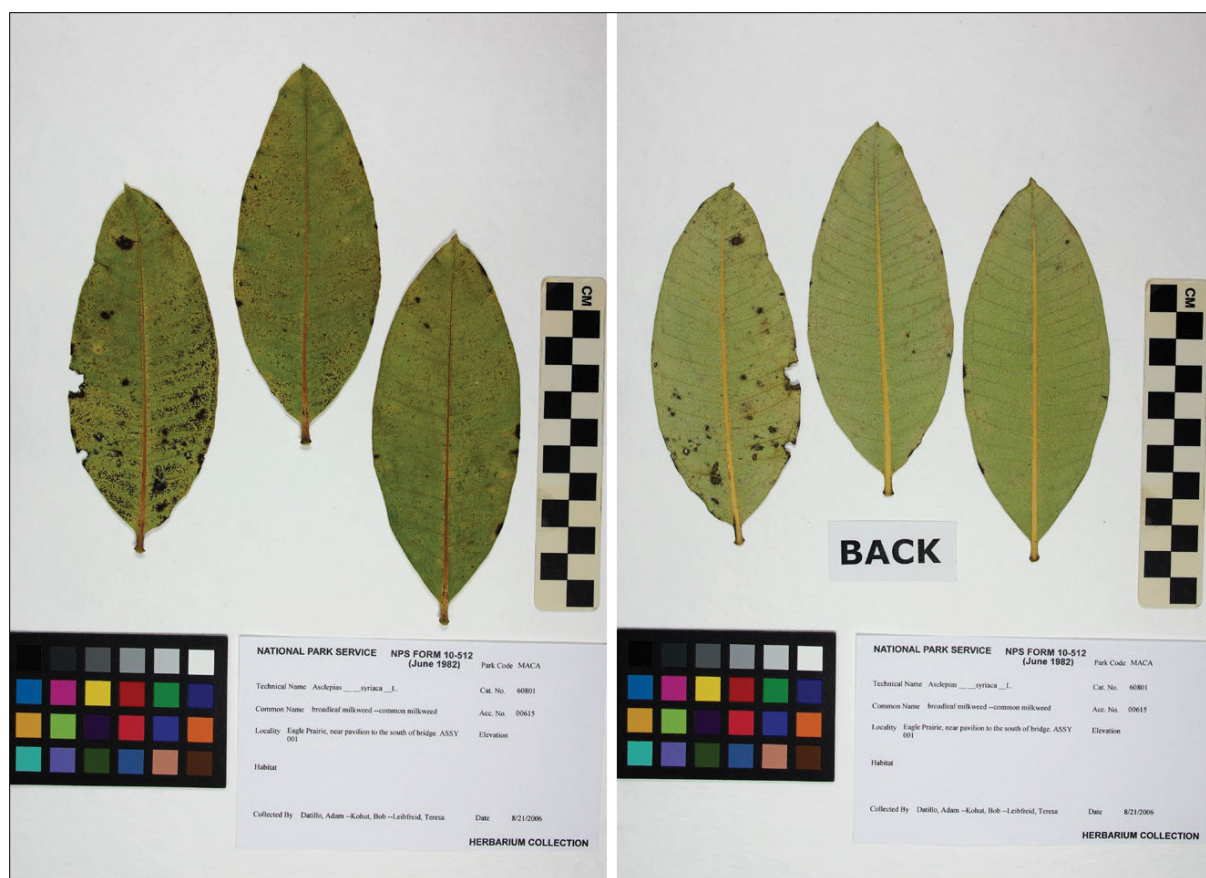


Figure 2. Final photographic voucher showing all three leaves of the voucher. The leftmost photograph shows the abaxial side of the leaves while the rightmost photograph shows the adaxial side of the leaves. These common milkweed leaves were collected from Mammoth Cave National Park in 2006. NPS photos / Brenda Wells (CUPN staff).

Standardized procedures are followed when photographing voucher specimens:

- Photographs are taken from a fixed distance
- Photographs are taken using a standardized set of camera settings
- Photographs are taken using a standardized background
- Petiole labels are shown in the photographs, so that information shown on the label is in the photograph with the leaf
- Petiole labels are numbered on both their front and back sides, allowing the adaxial side of a leaf to be matched to its abaxial side
- Photographs are taken inside under artificial lighting and not outside where light intensity and quality can fluctuate greatly over time

More specific rules for voucher photography may be provided in later versions of this protocol.

Literature Cited

- Cumberland Piedmont Network. 2024. Ozone and Foliar Injury Monitoring. Data management and Quality Assurance/Quality Control—Version 2.0. Standard Operating Procedure. NPS/CUPN/SOP—6. Cumberland Piedmont Network, Mammoth Cave, Kentucky. Available at: <https://irma.nps.gov/DataStore/Reference/Profile/2302030> (last accessed January 2024).
- United States Forest Service (USFS). 2008. Phase 3 Field Guide—Section 9. Ozone Bioindicator Plants (east). Southern Research Station. Knoxville, Tennessee. 49pp.