

Fall 2024

SCL HERBARIUM GUIDE

Best practices, procedures, and
guidelines



SCL Herbarium Guide

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- Section 10 contains information most relevant to duties of student staff

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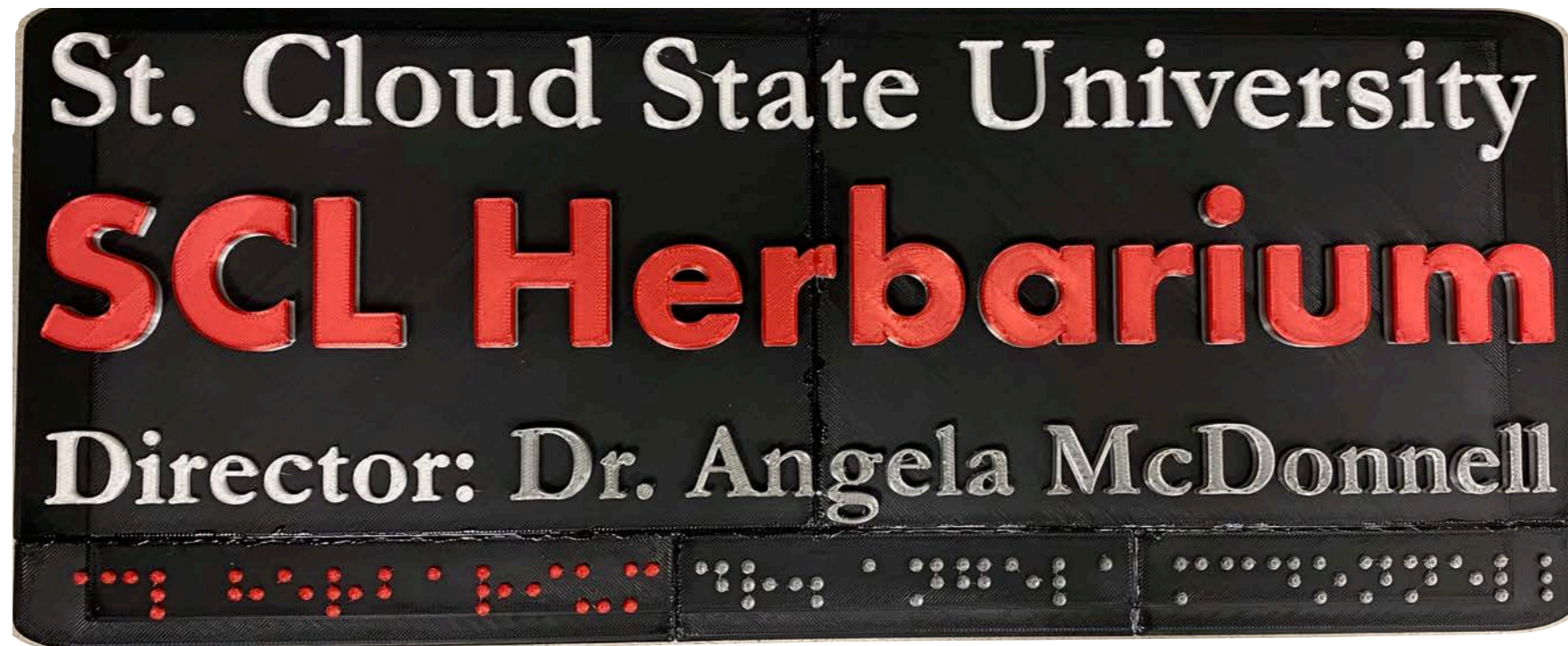
1. Overview of the Herbarium

The St. Cloud State University Herbarium (abbreviated SCL) houses a collection of ca. 30,000 vascular and non-vascular plants. Minnesota plants make up the majority of the specimens, particularly in and around central Minnesota. The Herbarium is used in several Biology courses, including Plant Biology, Plant Systematics, Cultural Botany, and other courses related to the Applied Plant Biology Certificate.

The goals of the Herbarium are to responsibly maintain and expand the collection, and to make specimens accessible for teaching, research, and outreach. It provides a record of the biodiversity of plants of the region, facilitates plant identification, and makes specimens available for research on plant distributions, evolution, and ecology. Specimen information is available to students, researchers, and the general public. The herbarium is developing and will maintain an electronic database that will be available in the future through Specify.

The American Society of Plant Taxonomists issued a position statement that emphasized the importance and value of plant collections in teaching, basic and applied research, and outreach, and stressed the need to support and maintain collections so that they will be available indefinitely. The text of this position statement is available [here](#). Additionally, the Smithsonian National Museum of Natural History has a similar statement, accessible [here](#).

Finally, recent papers highlight the importance of all herbaria, including regional ones like SCL, and highlight the increasingly diverse uses of the data held in herbaria; see [Heberling 2021](#), [Davis 2022](#), and [Marín-Rodulfo, et al. 2024](#)




3D printed SCL signage designed by Dr. Mason McNair

2. Purpose of this Manual

This document outlines the policies and guidelines for the acquisition, accessioning, maintenance and protection, loaning, deaccessioning, and general use of herbarium specimens. It also describes the duties and responsibilities of herbarium personnel, and serves as a resource for student assistants and other users of the herbarium.


3. Description of Collection

Approximately 30,000 total plant specimens have been accessioned and are filed in metal storage cabinets. Most of these are vascular plants, while mosses lichens, and fungi are contained in 1 metal storage cabinet. The vast majority (almost 90%) of specimens in the collection are of vascular plants collected in Minnesota. Most specimens were collected by previous curators while an increasing number are from students enrolled in BIOL 306 and 420/520. Other specimens include personal collections of faculty, voucher specimens of research done by faculty and students, and specimens received from other herbaria as gifts.



Revitalization of the St. Cloud State University Herbarium (SCL)

Kendall Cross, Angela McDonnell
St. Cloud State University, Department of Biological Sciences



Overview

The SCL herbarium was established in 1869 and houses approximately 30,000 specimens. The collection was established just after the time when the city of St. Cloud was founded (Figs. 2-4). Central Minnesota includes the intersection of 3 ecoregions that stretch across North America, the boreal forest, the Eastern temperate forest, and the great plains (Fig. 1). This position is reflected in the collection, which includes mostly specimens from the region (Figs. 5, 6).

Information about MN plant communities and how they have changed over the last ~130 years is currently only available in person or by loan. To increase access and use of our data, we have begun digitization the collection and make specimen efforts and hope to make data available via repositories such as the MN Biodiversity Atlas and the Global Biodiversity Information Facility (GBIF).




Fig. 1. Ecoregions of Minnesota and position of the city of St. Cloud, marked with red star. Map adapted from extension.umn.edu




Fig. 2. Cabinet containing the first collections at SCL collected by Rev. Campbell prior to 1930.




Fig. 3. Photo of specimen of MN state flower, *Cyripedium reginae*.




Fig. 4. Student curators determine best placement of a barcode to a *Magnolia* specimen.

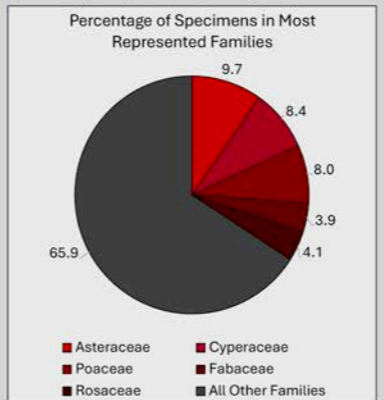


Fig. 5. Approximate percentage of the five most represented families in accessioned collection.

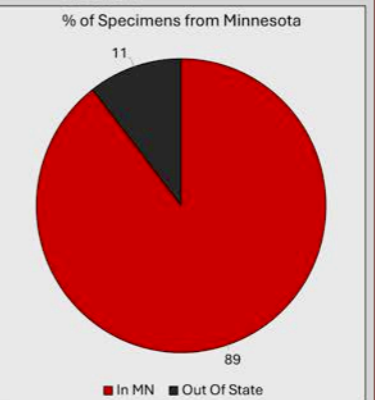


Fig. 6. Approximate percentage of SCL specimens from Minnesota and from outside of Minnesota.

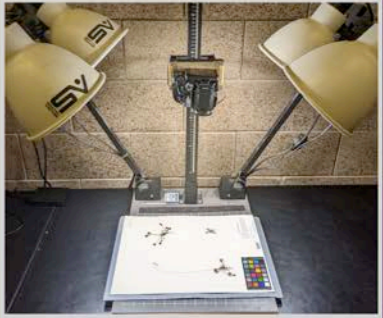


Fig. 7. Digitization station with a *Drosera rotundifolia* specimen.

Current efforts

- Specimens frozen, repaired as needed, cabinets cleaned
- Barcodes applied
- SCSU student-mentor collaboration grant obtained
- Camera and equipment for our imaging station (Fig. 7)
- Digitization beginning this summer


SCL is open for gifts, exchanges, & visitors

- SCL is growing to support research
- New teaching collection in development
- Contact director if you would like to send gifts, initiate exchanges, or request loans

Acknowledgements

Student-Mentor Collaboration Grant
SCSU Department of Biological Sciences

Take a Video Tour of SCL



Poster presented by Kendall Cross at the annual Botany meeting in Grand Rapids, Michigan in 2024.



4. Location of Herbarium

SCSU's Herbarium, designated as SCL in Index Herbariorum, is located in Room 216 of Wick Sciences Building on the campus of St. Cloud State University.

5. Arrangement of Specimens

Specimens are currently filed alphabetically by family. Within each family the genera and species are arranged in alphabetical order. Specimens from Oklahoma are filed in manila folders, those from other states are in green folders, those from other countries are in orange folders, and cultivated plants are in yellow folders.

6. Funding Support

Facilities and some funds are provided by the SCSU Biology Department, including funds for student workers. Supplies and equipment is purchased through grants and research funds. The College of Science and Engineering provides release time for the Curator and may provide additional funds for student workers.

Students interested in pursuing projects in the herbarium are encouraged to apply for a [Student Mentor Collaboration Grant](#), which is available each year in the fall.

7. Access to the Herbarium

We welcome the SCSU community and other researchers and visitors to the Herbarium, but please contact the Curator to obtain permission to access the herbarium collections for teaching or research. All users should follow the usage guidelines in this manual. First-time visitors who use the collections will be provided with information on the location and arrangement of specimens, availability of references and workspaces, and safety procedures. Requests from off-campus individuals to visit or tour the herbarium should be by mail or e-mail to Dr. Angela McDonnell, Department of Biological Sciences or angela.mcdonnell@stcloudstate.edu





8. Use of the Herbarium

Users should follow these guidelines:

A. General Guidelines

- Generally, read and abide by conservation and safety regulations posted in the herbarium.
- Ask for assistance with locating specimens.
- Smoking and tobacco products are prohibited in the herbarium.
- No food or drinks are allowed in the herbarium.
- Herbarium specimens should be treated for pests before being brought from the prep room into the herbarium.
- Biological materials (books, paper) should be treated for pests before being brought into the herbarium.
- Lights should be turned off when the herbarium is unoccupied.
- Visitors should sign the guestbook located near the front entrance.

B. Treatment of Specimens and Biological Materials before entry into the herbarium

- All specimens and biological materials should be deep frozen for at least 48 hours to kill pests before they are brought into the herbarium.

C. Handling of Specimens

- Hands should be clean before handling specimens.
- Gently open and close the cabinets. Doors with broken fixtures should be handled especially gently.
- Use two hands to remove and carry folders; carry folders in a horizontal position.
- Support specimens with both hands, keeping them in a horizontal position (face up). Do *not* turn them over like pages of a book.
- If you need to retrieve a specimen or specimens from the middle of a stack of specimens within a folder, pick up stacks of several specimens at a time and place them to the side until you reach the desired specimen(s).
- Do not remove specimens from the herbarium without permission of the Curator.
- Do not photograph or photocopy specimens without permission from the Curator.
- Do not remove any plant parts from herbarium specimens without permission from the Curator.

C. Handling of Specimens (continued)

- If material comes loose as you handle a specimen, place it in a packet on the sheet; notify herbarium staff if the sheet lacks a fragment packet.
- Notify herbarium staff of any evidence of insects or of recent insect damage to specimens.
- Notify the Curator of any misidentified or misfiled specimens, or specimens in need of repair.
- Keep herbarium cabinet doors closed unless you are removing specimens from them.
- Do not leave specimens out of cabinets overnight.
- Exercise extreme care if you re-file specimens to ensure they are filed in their proper place. The Herbarium staff can re-file specimens if needed.
- Wash hands after handling specimens.

D. Annotating Specimens

Annotations by experts and by the Curator should be handwritten in permanent ink or typed on archival annotation labels. The scientific name, its author, the annotator's name and the date should be on the annotation label. Labels should be glued on the right side only and placed above the specimen label. If needed, the herbarium staff can assist with this.

E. Destructive Sampling Policy

Researchers wishing to remove samples from herbarium specimens for DNA analysis, etc. need to obtain prior permission from the Curator.

F. Citing the Herbarium

When specimens from the collection are cited in a research publication, the Index Herbariorum designation "SCL" should be cited. Clarification of location may be necessary, because it differs from the University's acronym "SCSU".

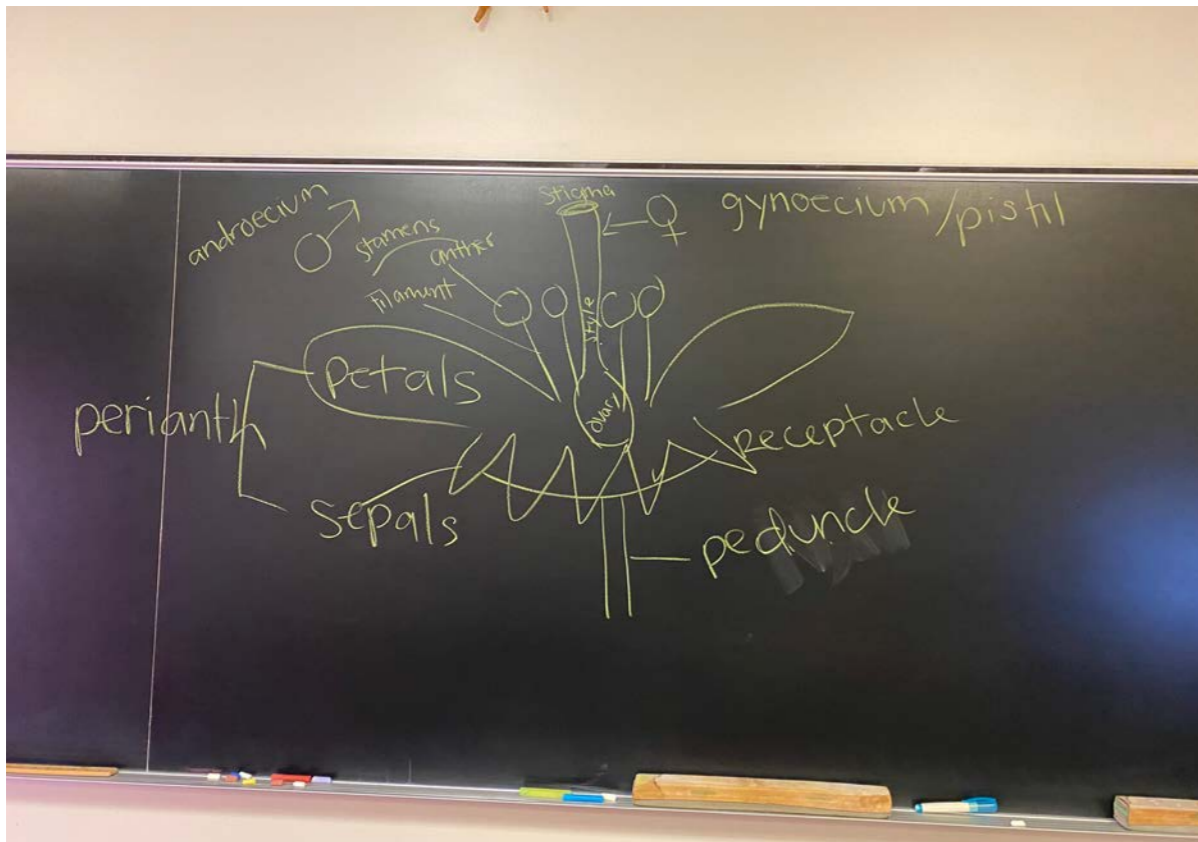
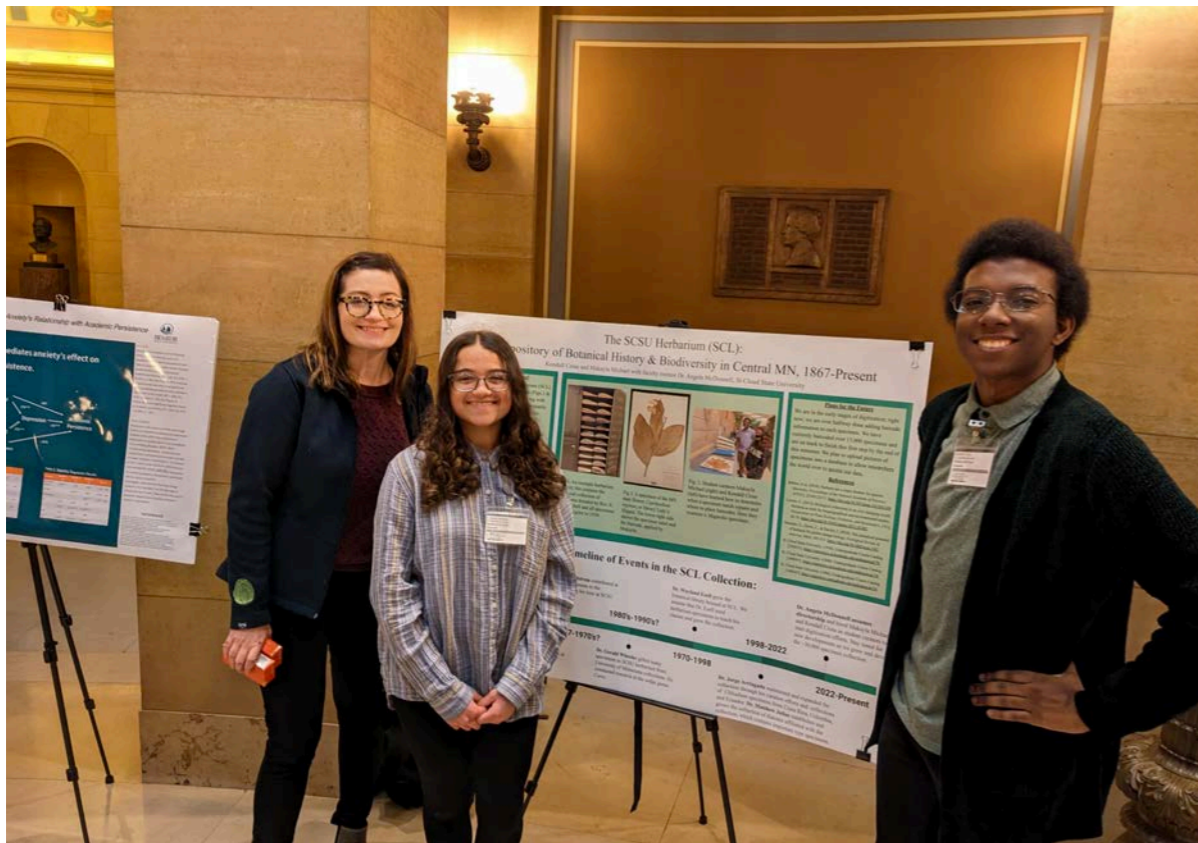
G. Equipment Available

Plant presses, plant dryers, dissecting microscopes and tools, folders, and labels are available. The Curator and Student Assistants can provide help to persons needing to use these items.

H. Assistance with Plant Identification

If available, the Curator or student assistants will be pleased to assist with plant identifications.





9. Specimen Loans

Researchers associated with any herbarium may request a loan of specimens. Contact the Curator, stating the name of the project and the taxa of interest. Upon an agreement, the specimens will be shipped. We expect specimens to be protected from pests during the loan period. Loans may be granted for up to one year with permission from the Curator.

A log of incoming and outgoing loans is maintained digitally. This should be updated each time a loan is processed. Hard copies of loan records should also be filed in a binder by the Curator. The loan database should be queried annually and notice sent to borrowers regarding outstanding loans.

When outgoing loans are taken from the cabinet, a tag should be placed in the cabinet indicating the location to which the specimens were loaned. Damaged specimens should be repaired before shipment. Sheets should be placed between rigid cardboards, and tied with twine. Pack boxes securely with packing material so that they do not shift or rub against each other. Include a packing list and number boxes (i.e. "1 of 3"). Within SCSU only verbal permission is necessary for faculty to temporarily remove specimens from the herbarium for use in class, for an off-campus presentation, etc. However the loan and a record of verbal permission must be recorded in the database.

10. Collections Management

A. Standards of professional practice and Code of Ethics

Herbarium practices will follow standards and guidelines in the Code of Ethics of the International Committee of University Museums and Collections, a committee of the International Council of Museums. The Code of Ethics is available here: <https://icom.museum/en/resources/standards-guidelines/code-of-ethics/>

10. Collections Management (continued)

All individuals associated with the herbarium will:

- protect and conserve the herbarium specimens because they are irreplaceable
- facilitate the use of the herbarium specimens for teaching and research
- use the most acceptable methods of conservation and management
- strive to improve the scientific and educational value of the collection
- use good judgment about dissemination of information that could jeopardize rare or endangered plants
- deny access to users who fail to follow the policies in this manual
- clearly identify any specimens that are hazardous or have been treated with chemicals that make them unsafe to handle.

B. Curator's responsibilities

The Curator of the herbarium is a faculty member of the Department of Biological Sciences with experience collecting, identifying, and mounting plant specimens. Currently Dr. Angela McDonnell is the Curator of the collection. The Curator is responsible for the collection and accessioning of specimens, development and dissemination of herbarium policies and procedures, and development and maintenance of digitizing the information held in SCL. The Curator also supervises the work of student assistants.

C. Graduate or Undergraduate Student Assistants' responsibilities

Undergraduate or graduate students, trained by and under the direct supervision of the Curator, mount, accession, and file specimens, and carry out other duties assigned by the Curator.

Some tasks of the student assistants are to:

- Sweep and remove debris and dust from surfaces in the herbarium and prep room.
- Check insect traps & report results.
- Mount plants.
- Serial stamp and accession specimens.
- Enter specimen data into Specify or other databases.
- Deep-freeze specimens if needed.
- File specimens in herbarium collection.
- Discard trash and unusable paper products.
- Record hours worked, and indicate tasks completed.



11. Procedures for Preparation of Herbarium Specimens

A. Collection, Pressing, and Drying of Specimens

Specimens deposited in the herbarium are collected, pressed in a plant press, and dried in the plant dryer located in the herbarium prep room. Before collecting plant specimens, the following should be considered:

- *Permission from the appropriate agency or individual is needed for collecting specimens on private property, in national parks, national wildlife refuges, state parks, local parks, lands owned by the Nature Conservancy, etc.*
- Always consider that removal of a plant from a population could have serious consequences for the population. Be aware of plants that are rare or endangered, and never collect them. Many botanists follow the 1 in 20 rule, i.e. don't collect a plant unless there are at least 20 plants of the same species in the population.
- All specimens to be deposited in the herbarium should have complete collection data associated with them: country; state; county; scientific name; exact location (city, name of park, etc.; road, with distance from intersection with another road, mile marker, etc.; Township, Range, and Section Number; latitude and longitude or Global Positioning System – GPS- location if possible); habitat; elevation; associated species; size if a woody plant; abundance; a note of any traits that may change with drying, e.g. color or odor; collector's name; collection number; and collection date. Specimens collected by a particular collector are numbered sequentially throughout the lifetime of the collector. Duplicates of a specimen (collected on the same date at the exact same location) are given the same collection number.
- The collector's notebook, or copies of pertinent pages out of the notebook, should be deposited in the herbarium.
- Herbaceous plants should have underground parts – roots, rhizomes, bulbs, etc.
- All specimens should be in reproductive condition; flowering plants should have flowers, fruits, or both.
- The more quickly plants are pressed after they are collected, the higher the quality of the specimen. If plants are not pressed immediately, they should be wrapped in moist newspaper, placed in a plastic bag, and kept cool (preferably in an ice chest or refrigerator) until they can be pressed.

Directions for pressing plants are as follows:

- Within a plant press, which consists of a pair of wooden frames, specimens are placed in folded newspaper sandwiched between blotters, and then between corrugated cardboard ventilators.
- The specimen should fit into a space no larger than 11 x 16 inches so that it will fit on a sheet of mounting paper.
- Large plants may need to be pressed in more than one piece of folded newspaper.
- The collection number is written on the newsprint.
- Specimens may be trimmed, but all parts should be represented.
- Specimens may be folded, and if necessary the folds may be secured with a notecard with a slit into which the fold is inserted. This technique is particularly useful for grasses.
- The plant press straps should be tightened as much as possible. During drying, the plant press straps should be checked and tightened daily.
- Specimens are generally dried at 105-110o F. for at least three days. Specimens should be thoroughly dried before they are mounted; thick or succulent plant parts may take longer than three days to dry.
- A good reference for preparing plant specimens for deposit in a herbarium can be found here: <https://www.floridamuseum.ufl.edu/herbarium/methods/vouchers/>

HERBARIUM
UNIVERSITY OF WISCONSIN - GREEN BAY

Carya cordiformis (Wangenh.) K.Koch Juglandaceae

Marinette County, Wisconsin. Town of Silver Cliff
Latitude: N45.24356 longitude: W87.64753

Growing in a young upland forest of mostly *Acer saccharum* with *Tilia americana*, *Fraxinus americana*, *Ostrya virginiana* and a few *Tsuga canadensis*. The understory is largely comprised of saplings of *Acer saccharum* and a few *Cornus alternifolia* and *Ostrya virginiana*. Ground layer species include *Trillium grandiflorum*, *Caulophyllum thalictroides*, *Allium tricoccum*, *Carex pedunculata*, *Carex arctata* and *Schizachne purpurascens*. A few trees of *Carya cordiformis* were found, the largest to about 8 inches diameter and no seedlings were observed.

Asa Gray #14899

14 May 1977

B. Specimen Label Preparation

A label template is in a file on the herbarium computer. Labels should include the following collection data:

- Country, state, county
- Scientific name and author
- Exact location (city, name of park, etc.; road, with distance from intersection with another road, mile marker, etc.; Township, Range, and Section Number; latitude and longitude or Global Positioning System – GPS- location if possible)
- Habitat
- Elevation
- Associated species
- Size if a woody plant
- Relative abundance
- Description of any traits that may change with drying, e.g. color or odor
- Collector name
- Collection number (if a single plant has been mounted on more than one sheet,

then after the collection number this is indicated by adding “1 of 2”, “2 of 2”,

“1 of 3” etc.)

- Collection date

Specimen labels should be printed on acid-free paper. Examples of herbarium labels can be found on the left, and also at: <https://www.floridamuseum.ufl.edu/herbarium/methods/vouchers/>

Herbarium of the University of Florida, Gainesville, Florida, USA

PLANTS OF FLORIDA

<Scrophulariaceae>

***Striga gesnerioides* (Willd.) Vatke**

det. D. W. H.

POLK COUNTY: Just S. of Bartow city limits, ± ½ mi. E. of US 17, along S. side of Clear Springs Rd. 2 populations: ± 1800 ft. E. of railroad tracks and ± 45 ft. S. of center line of rd.; ± 400 ft. further E. and 95 ft. S. of center line. Flws. lt. purple; infrequent.

coll. David W. Hall # 1946 17 August 1993
with Chuck Nance and Allen Ake

C. Mounting Specimens

Before specimens are mounted, the Curator or Collections Manager will approve the mounting of all specimens to ensure that they were legally collected, in reproductive condition, free of mold, and are of high quality. Specimens are mounted on standard-sized (11.5 X16.5 inches) archival, acid-free paper.

An example of procedures for mounting specimens are as follows:

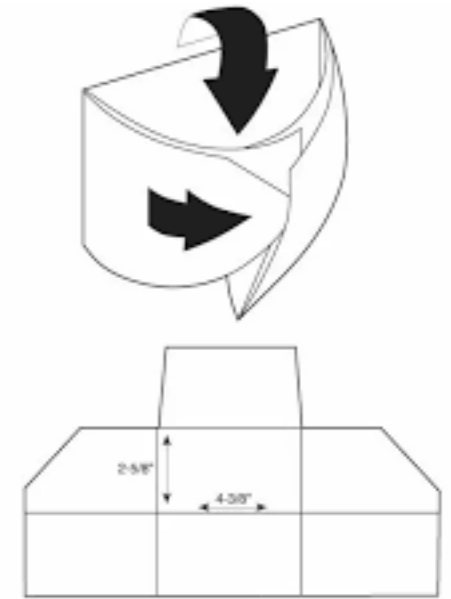
1. Pour archival quality, clear drying white glue or Elmer's® glue onto a glass plate, adding water to thin it until it is the consistency of milk. Using a paintbrush, spread the glue over the glass.
2. Place a piece of mounting paper on a cardboard ventilator.
3. Using an acid-free white glue stick or undiluted white glue, glue the specimen label in the lower right hand corner.
4. Before gluing the specimen, aesthetically arrange it on the mounting paper so that there is white space around the specimen. The best side of the specimen should face up, but try to expose upper and lower leaf surfaces, flowers, and fruits. Trim excess branches so that branches do not overlap. If the plants are small, more than one specimen may be glued to a sheet. Leave room for annotation labels above the specimen label, and space for the specimen's serial stamp in the upper left corner.
5. If a specimen must be split onto two or more sheets, the label should indicate, after the collector's number, that the sheets are "1 of 2," "2 of 2," "1 of 3," etc.
6. Extra flowers and fruits may be placed in a packet (see packet instructions below) attached to the mounting paper.
7. Large specimens may be folded into a "V" or "W" to fit the sheet.
8. Lift the specimen from the mounting paper and push it completely into the glue on the glass plate using a pair of tweezers, probe, or small card. Pick the specimen up with a pair of tweezers, and add glue to the underside with a small paintbrush if needed to ensure that the entire underside is covered. Then carefully lay the specimen on the sheet in the position planned earlier, and do not move it! Dust will adhere to any glue exposed on the paper by moving a specimen.
9. Cover the specimen with waxed paper. Use lead weights, if necessary, to weigh down parts that don't lay flat. Place a piece of blotter paper on top of the waxed paper, then a cardboard ventilator.
10. Place a piece of mounting paper for the next specimen on the cardboard, and continue as above.
12. Books may be placed on top of the stack of mounted specimens to apply pressure for about 24 hours.
13. For specimens with stems that do not stay glued down after following the above procedures, a strip of glue may be placed from one side to the other across the stem. Place the mounted specimen on a cardboard ventilator, add the strip of glue, then place small wooden blocks near the corner of the mounting paper to keep the glue from contacting the cardboard above it. Place a cardboard ventilator on the blocks, then place the next specimen on top of the cardboard ventilator and continue. Let glue dry for 24 hours.

D. Packet Preparation

When small pieces of material are or become detached from the specimen, fold packets to hold those small pieces of specimens according to *The Herbarium Handbook* 3rd ed. (Bridson and Forman, 1998). Use the alternative economic version made from a rectangle of acid-free paper. Glue only the center of the back side of the packet so that all edges are free to manipulate without damage to the specimen inside.

E. Deep-freezing Specimens

After the specimens and their labels have been mounted on the herbarium sheet, the specimens should be frozen for 72 hours at -30°C as recommended by *The Herbarium Handbook* 3rd ed. (Bridson and Forman, 1998) before being accessioned and filed in the herbarium. The specimens should be placed in the freezer. After 72 hours the specimens are removed, and after returning to room temperature (approximately 1 hour), are accessioned and filed, or placed in a temporary herbarium cabinet until they can be accessioned.





12. Procedures for Accessioning, Filing, and Deaccessioning of Herbarium Specimens

A. Training

Training from the Curator and/or other trained staff will be completed before any of the following activities are undertaken by new staff members.

B. Applying an Herbarium Accession Number

Mounted specimens will be labeled with a barcode for accession as directed by the curator. The serial number is stamped with the University's name and the Index Herbariorum designation "SCL". Place specimen's serial number along the bottom edge herbarium sheet. Any specimens marked "1 of 2," "2 of 2," etc. should get their own barcode. When specimens come from other collections and already have a serial number from that herbarium, our serial number should be stamped as close as attractively possible to it. Note and set aside any specimens in need of repair.

C. Entering Specimen Data in Herbarium Databases

Data will be entered into the Excel Databases as follows: Country, State, County; Scientific Name; USDA Symbol; Locality; Township, Range, and Section Number; Habitat; Morphology; Associated Species; Collector; Collector's Number; and Collection Date. If the specimen has been annotated, the original scientific name and USDA symbol are also entered.

D. Filing Specimens

Accessioned specimens, as well as returned loans or specimens removed for study, are filed by family, genus, and species into the herbarium cabinets. Our current arrangement corresponds to an out-of-date family organization and will be updated in the future.

It saves time if specimens are first sorted into Minnesota specimens, out-of state specimens, out-of-country specimens, type specimens, and cultivated specimens, then by family, genus, and species.

As specimens are filed, the following guidelines should be followed:

1. Carefully handle specimens; always keep them in a horizontal position.
2. Do not fill folders thicker than 1-1/2 inches. If there is more than one folder for a species, put the specimen into the thinnest folder.
3. Rearrange folders in a cabinet if needed because shelves are becoming too full; notify the Curator if a cabinet is becoming too full.
4. Make and label new family and genus folders as needed. If a new genus folder is needed, be sure that corrections are made to other genus folders so that the specific epithets of the specimens within each folder are correctly indicated on the labels. If you cannot find a folder for a genus, check to be sure it has not been misfiled on an adjacent shelf. Inform the Curator when a new genus cover is made.
5. Watch for misfiled specimens and folders, and place them in their appropriate locations.
6. Watch for any evidence of insect infestation; immediately report it to the Curator and take steps outlined under “Integrated Pest Management” in this manual.

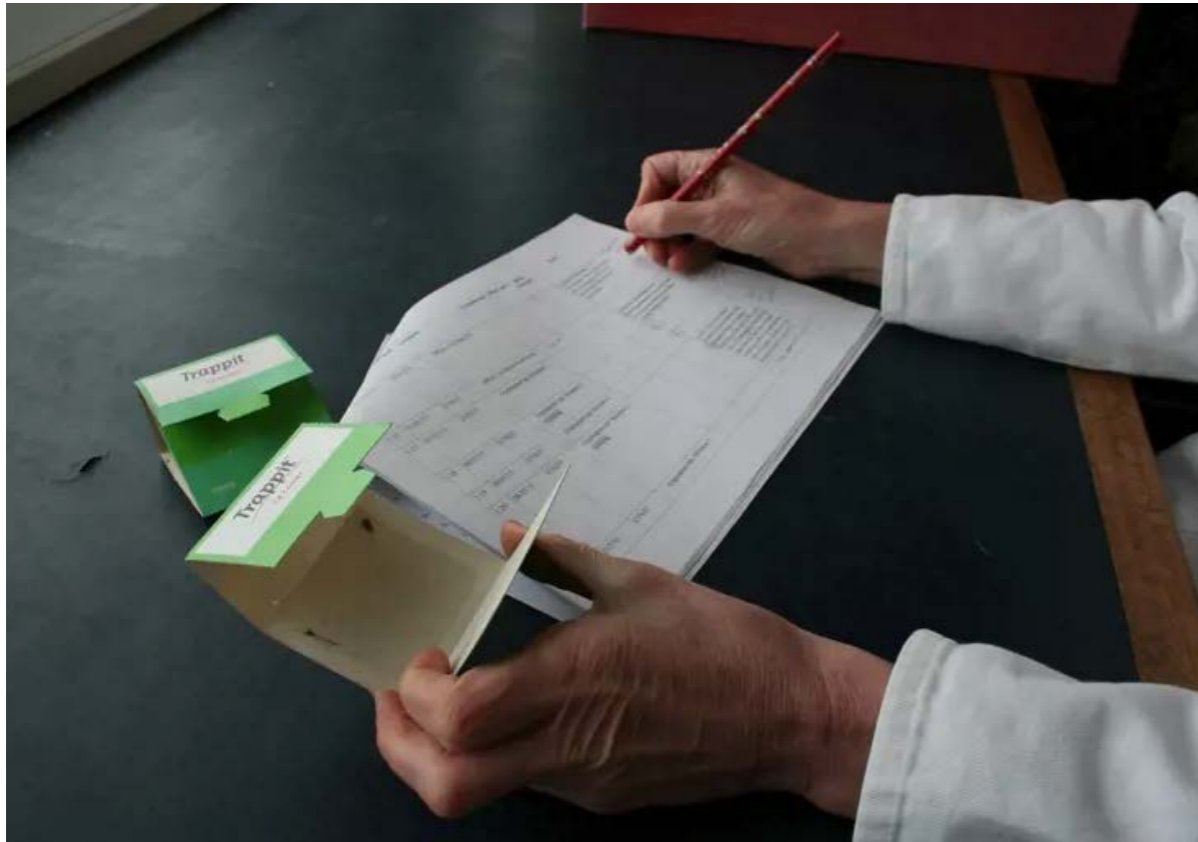
E. Data Backup

Our Data are stored in OneDrive and locally, as a backup.

F. Deaccessioning or disposal of specimens

With approval from the Curator, duplicate specimens may be exchanged with herbaria of other institutions, donated to the teaching collection, or discarded. The Curator may designate that specimens with inadequate data or duplicates may be used in teaching labs where details of collection are not pertinent. Deteriorated specimens may be discarded with the approval of the Curator and should see that the specimen’s data are removed from the database or a note is added that the specimen has been deaccessioned.





13. Integrated Pest Management

Cabinets must be free of debris and evidence of insects. Insect traps are to be set and replaced as directed on containers. Traps should be checked weekly. To help prevent insect infestations, specimens should not be left out of cabinets when not in use, and should never be left out overnight. When insect evidence is observed (insects or insect parts, parts that have apparently been eaten, or powdered material), the Curator should be notified. The cabinet will be thoroughly cleaned, and its contents deep-frozen. Place a sign in the cabinet that says “specimens in freezer”. Then the cabinet should be fumigated with “Tri-die” or other pyrethrin and silica gel. Place an insect trap in the bottom of the cabinet. In 72 hours, check the insect traps and if there are no signs of pests, place the specimens from the freezer back into the cabinet.

Some families should be particularly monitored because they are more attractive than others to insect pests (Bridson and Forman, 1998): Asteraceae, Apocynaceae (including Asclepiadaceae), Apiaceae, Brassicaceae, Ericaceae, Capparaceae, Caprifoliaceae, Valerianaceae.

14. Dust Control

Herbarium surfaces should be dusted and swept weekly in addition to housekeeping services’ scheduled maintenance.

15. Collection Security

The herbarium must be locked whenever they are not occupied.

16. Computer Use

Use of the computers available in the herbarium is limited to the Curator, and student staff. The computer should generally be used only for work associated with the herbarium and/or student research related to their botanical studies.

