

Where and What to Collect

Only native and naturalized plants may be collected. By state law, no collecting is allowed in any state or county park; by federal law no collecting is allowed in any National Park or on any National Park and Planning property. As a matter of courtesy, collecting on private property should be avoided. This leaves roadsides (but not along Interstate highways) and state forests - at first sight a rather limited set of choices. Nonetheless, you may collect on county property (unless posted) and there are numerous public sites which are not part of any park property. A reminder, while it is possible to collect on wildlife refuges, it does require prior permission from the local administrative office.

In general, a good rule of thumb is to collect only a small set of samples from a large population. You should avoid collecting all of something and the last of anything. While only a few samples of a species may be in flower, a review of the local habitat may show that they are several individuals not yet in flower, or past flowering. In such cases, a small collection would be reasonable. One of the field rules followed by many plant collectors is the one in twenty rule for herbaceous perennials - for every twenty plants, only one can be sampled.

In the case of annual plants, a similar guideline is usually well to follow, but as annuals tend also to be weedy, one can consider a larger area for the one in twenty rule. As for trees and shrubs, it is best to selectively trim a few pieces from different individuals so as not to damage, in any way, the long-term survival of any individual.

In collecting annuals, one should attempt to gather roots, flowers and fruits. Some groups, such as *Brassicaceae*, require fruits for identification. All dirt should be removed from the plant. If you are collecting a biennial, both the first and second year forms are useful, but at least flowers are required (again, *Apiaceae* requires fruits). As for herbaceous perennials it is best to avoid taking the root system. A small piece of the root, or a single bulb, may be necessary for proper identification in some groups (*Poaceae*, *Liliaceae*), but there is rarely any need to actually destroy the plant to make a good collection. While flowers are required, some species may also require fruits or mature seeds. When collecting members of *Poaceae*, *Cyperaceae* and *Juncaceae*, for example, it is well to make observations regarding rhizome, the presence of which can be critical in the identification of the plant. Many other groups may have stolons or rhizomes, and while a piece of the stolon can easily be gathered, the presence of a rhizome in some other groups might better be just simply noted rather than collected.

When collecting trees and shrubs, reproductive structures are vital. Cones, catkins and similar structures need not necessarily be new. However, every effort should be made to collect fresh flowering and fruiting parts if possible. Several species will actually flower before leaves are produced. Such individuals may be collected, but for proper identification in some groups (for example, *Fagaceae*), leaves and even mature fruits may be necessary.

How to Collect and Some Remarks on Safety

The fun of being in the field can turn to misery if all of your efforts are ruined because you fail to process your material promptly, or you or others with you are hurt. How one goes about collecting is important.

When going into the field, wear field clothing - long pants, long-sleeved shirts, stout boots or shoes. This is not a trip to the beach or a stroll along some path. Watch where you put your feet

and hands. We have rattlesnakes and copperheads, and while the large spiders in the forest are generally harmless, finding one creeping up your arm can be distracting. Wasps abound and chiggers and mosquitoes are common. Plan ahead.

In the field you should carry a pocketknife, your hand lens, a small ruler, your field notebook and an array of plastic bags. When you find something you wish to collect, it is best to jot down lots of notes: flower color, size, and anything else that you might need to know in the future. **The exact location of the collecting site should be noted and a detailed description of the biotic and abiotic environment should also be provided.** Be sure to include:

- locality: be precise, if possible include the longitude and latitude and also a sketch map if useful
- habitat and ecology: terrain characteristics, vegetation type, associations with other plants
- plant habit: describe the overall size and shape of the plant (tree, bush, epiphyte etc.)
- stems and trunks: height and diameter; color, texture, thickness; the presence of thorns and spines
- leaves: deciduous or evergreen; color, texture and overall aspect; orientation; exudate or glands
- inflorescence and flowers: note of everything that could be undetected in prepared specimens; color; monoecious or dioecious; different behaviour (open / closed) during the day; glands; pollinators
- fruits and seeds: size, shape, color, texture; smell
- underground organs: take some samples or describe them (size and shape, tap root, tubers, bulb etc.)
- scent: record any particular scent, especially of cut parts and flowers
- sap or latex: note the color, smell, consistency etc.
- name: record the locally used name(s)
- uses: record the uses, getting confirmation

Collect only enough plant material to fill an herbarium sheet and to identify the plant. Put each species in a different plastic bag, place a moist paper towel around the specimens in the bag, number the bag, and tie it shut. Keep the bags out of the direct sun. This will work for the vast majority of plants you will encounter.

Aquatic and succulent plants may require special handling. For *Lemnaceae* and other small aquatic plants, these can usually be "flicked" onto the newsheet for drying without any type of special arranging. Members of *Cyperaceae*, *Potamogetonaceae* and related families that are found in aquatic habitats often can be placed directly in a plastic bag without a moist towel. It is often necessary to actually wash the roots and lower stems to remove mud; this should be done before going into a bag as otherwise the entire plant will get muddy. As for succulent plants, the thick, fleshy leaves or stems should be cut in half and hollowed out. Thin cross-sections of the succulent portion can be prepared to show the overall shape of the structure.

Taking Pictures

Taking color pictures of each plant in its natural environment is also something which could substantially enrich the quality of your herbarium, not only aesthetically, but also from the scientific point of view. In that way the dried specimen can be placed together with one or more photographs, which are very helpful for bulky plants like trees or bushes, which obviously can not be entirely included in a herbarium! Also the habitat of a plant can be well described with a photograph, taking care not to be too distant from the nearby bushes or trees. The suggested equipment is a 35 mm. single lens reflex camera, with a standard lens and a macro-lens, the latter very useful for close-ups of flowers and other specific features. Also a tripod can be very important if many close-ups have to be

made, allowing the camera to remain steady. A tripod can also alleviate the need for a flash, which may be used when taking pictures in low light, but has the disadvantage of giving quite unnatural looking images. The speed of print films can range from 64 - 100 ISO to 200 or 400 if pictures in the woods are planned. Each photograph you take should be recorded in a note-book to provide further data for the classification and to include in the herbarium. Be careful that your camera and films are not damaged by rough handling and do not become wet.

Preparing a Specimen for the Plant Press

By now you have seen numerous herbarium specimens. One key to a good specimen is the way the specimen was prepared. All material is pressed, flattened and dried. To aid in the flattening and drying process, it is often useful to trim away thick or bulky material with a pocket knife. Thick roots and stems should be cut in half; an over abundance of leaves trimmed away; fleshy fruits sliced into sections. The goal is to have a representative specimen that is not too bulky.

Small annual plants are the easiest to prepare. Except for removing dirt from the root, usually nothing else needs to be done. Large annuals may require the root and stem to be trimmed, however. As for herbaceous perennials, the proper thinning of excess leaves and stems, without destroying the aspect of the plant itself, usually results in a good specimen. All dirt should be removed from the roots, and occasionally dead leaves. Tree and shrub should be collected using nippers or a knife with the actual trimming process done on the plant itself. There is no need to cut off a large branch just to get a few pieces; collect only what you need initially.

Remember, bark of certain trees and shrubs is useful in ascertaining the species. Care should be taken when gathering bark, and thin strips are nearly always adequate. Dry fruits, cones and seeds may be placed in a paper bag and submitted when the dried specimen is turned in. Such items will be placed in boxes in the herbarium. The bottom line is that you want a flat specimen showing all aspects of the plant.

Pressing Plants

A good specimen is made in the field, not in the herbarium. It is therefore necessary to keep in mind what it is that you are preparing and how it will look on a sheet of herbarium paper. The standard herbarium sheet used in most North American herbaria is 12 x 16.5 inches. Thus, when preparing specimens, it is critical to remember that both the label and the specimen must fit within these limits.

The individual specimen should be trimmed as appropriate and sized to fit the sheet. Tall specimens may be bent so as to allow the entire plant to fit on the sheet without its actually being cut into sections. In some instances it might be necessary to prepare bottom, middle and upper portions if the individual is too tall to fit on a single sheet. In some cases, two or more sheets may be necessary to best show the features of the plant. However, this should be avoided.

Remember to work in a dry and ventilated room, avoiding damp, which could easily harm your specimens. It is not difficult to build a home-made press, keeping in mind that what must be accomplished is to keep the specimens squeezed between layers of paper (newspapers or blotting paper) until they are totally devoid of the original content of water, that is dried. The upper and lower parts of the press might be made of heavy cardboard or thick plywood or equivalent material. The specimens will be placed between the layers of paper, which will be pressed by the

two pieces of wood; these two pieces must be held tight by putting some heavy body on top, i.e. bricks or large books (Fig. 3).

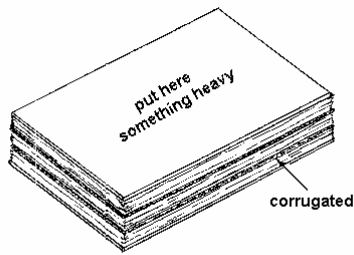


Fig. 3 - Simple drying press

One of the most difficult steps is gaining the right arrangement of the specimens in the herbarium. The arrangement must be carefully considered, since when you place the specimens into the press they will acquire a shape and appearance that will last after the drying process, and so be similar or identical to the specimen's shape in the herbarium. Because of size and thickness limitations, it will probably be necessary to remove certain branches, leaves and bunches of flowers, or to carefully section them, always with the goal of obtaining a more suitable specimen to be placed in the press. Carry out this delicate job with the help of a knife and tweezers, trying to arrange the flowers in the best possible manner, letting them show the most natural shape and all their features. During this process care should be used to avoid the elimination of relevant elements, especially those which were important for the taxonomic classification. Any loose part may be kept inside paper envelopes which will be placed on the same mounting sheet as the specimen.

Each species should also display both sides of its own leaves; if only one leaf is available, you may cut off a part, so that the other side can be observed. If you have more than one flower available, you can arrange some to show the back of the flower also. Depending on the size of your herbarium folders, you will be able to dry more or less large specimens; anyway it is almost sure that some plant will have to be cut or bent, due to its excessive size. When bending a stem, form an acute angle and always try to give a not too unnatural appearance to the whole.

While arranging the specimens on the paper layers, various plants can be placed on the same piece of paper, but remember not to superimpose two or more specimens upon each other. It is better to choose specimens of the same thickness so that the pressure on that layer will be equally distributed.

It is often useful to open your press after about twelve hours and rearrange individual leaves or parts of the plant so as to make the best possible specimens. This added bit of effort is often the difference between a good specimen and a great one.

Drying Plant Specimens

As soon as possible, the press should be placed in an electric drier. Remember, the sooner your plants dry, the better your specimens will be. Flowers that lack color or leaves that are not green are often an indication that the specimen was poorly dried.

It will take at least two to four days for your specimens to dry. Because moisture is being driven off by the drying process, it is necessary to come in at least once each day to tighten the straps. As

noted above, that first day it is important to check, and if necessary, rearrange your individual specimens so that the leaves are in the proper position and the flowers are right. If your papers are damp, change them at once (probably once a day).

To determine if your specimens are dry, touch each plant with the meaty part of your hand at the base of your thumb. You can sense moisture in this way.

Identification of Your Specimens

All collections should be identified as soon as possible. If you are actively collecting, it is often impossible to process and identify your material at the same time. It is best to collect specimens in plastic bags, keeping them in the dark and cool, and then press your plants out of the wind at home. Specimens kept cool, moist and out of the sun will last for ten hours or more even without roots. Collect enough in the field to both make a good, full sheet and to have enough left over to identify. Good field notes enable you to recall height of the plant and other observations you have made while collecting. It is a good idea to record the number of sepals, petals, stamens and note the condition of the ovary. Indicate if the corolla is sympetalous or if the stamens are epipetalous. Also note the nature of any zygomorphic condition you might spot. Sketches of the flower made in the field are often extremely useful.

Using an appropriate manual, identify the plant to family, genus and species, adding the author to the binomial. If it is a subspecies or variety, then the infraspecific name and authorship should be recorded into your notebook as well.

Leaving your identifications to the very last often means that you will be unable to make critical observations without doing harm to your dried specimens. While bits and pieces of plants can be kept in the frig for a few days, after about three days they tend to become more like slimy lettuce than one of mother nature's wild flowers.

Mounting the Plants on Paper

Once the specimens have been dried, they will be mounted on a paper sheet. Doing so, you will display the specimens and its data in the most clear possible way, and the specimens will be carefully preserved being attached to strong mounting paper.

It is very important that the plant be arranged so that you can immediately see all the main characters of that particular species, at least if you want a scientific kind of herbarium; so do not look only at the aesthetics of the mounted specimens. For that reason the dried specimens which do present their characteristics well will be further arranged, bearing in mind that a dried plant can easily broken if handled without care (it is advisable to arrange them before being placed in the press).

The best manner to place the plants on the mounting sheets is to align them with the right side of the page (or diagonally if space is required) and to have the heaviest parts and specimens at the bottom. The longest specimens can be folded if that can prevent the cutting the stem into pieces. It is better to leave an empty space at the borders of the mounting sheets. You can arrange your specimens (along with the labels and envelopes for small parts) in a regular way from page to page.

The best permanent support is good white or cream cartridge-type paper, in particular 100% rag or chemical wood pulp. It is up to every collector to choose the most suitable size, which depends also

on the cabinet or box which will contain the bundle of plants. The most delicate mounted specimens could be covered with a protective sheet of translucent paper, which must be rather strong and easy to fold.

Small paper envelopes can contain particular portions (e.g. seeds) or very small plants; when these envelopes are folded and glued to the sheet it should be possible to open them flat and close them without clips; besides they must securely hold their contents.

There are different ways to mount the specimens to the herbarium sheets:

- Strapping: this method will let you to remove and examine the specimen every time is needed, but will allow a certain degree of movement which can cause some trouble. The specimens can be strapped with linen or cotton thread, that will be knotted on the reverse side of the sheet, where it is better to add some gummed paper to avoid contact with underlying specimens. Also gummed linen tape, like the one used by bookbinders, can be used; it must be placed where the specimens have greater strength, avoiding covering delicate details such as flowers.
- Gluing: if glue is chosen to mount the specimens, try water-based woodworking adhesive or library pastes or latex adhesive, which must be applied quickly, taking care of not using an excessive amount. You can employ a brush or a nozzle applicator, otherwise the specimen (especially if it is a small one) can be put in contact with a plate full of glue then attached to the sheet. Be always careful not to detach any fragment or part from the plant and not to soil the specimens during the process. Glued material should then be left under pressure overnight, covering each sheet with waxed paper and with drying paper. With aquatic plants only latex glue is the right solution for gluing the specimens, as these plants can take up water from the glue.
- Pins: some herbaria have their specimens mounted using small paper bands which fix the plant to the sheet with the help of pins. The strip is placed on the stem (or other crucial parts of the specimen) and the pin joins together the mounting sheet, the stem and the strip, passing below the specimen. As for strapping, this manner leaves a remarkable freedom of movement for further examinations.
- Nothing: some collections have been made leaving the specimens free on the individual sheets, avoiding strapping and gluing. You can do so, just be careful every time you handle the sheets, and place the bundles in safe boxes where they can not move.

The Label

Each specimen must be accompanied by a typed label. We will provide you with printed labels if you wish, but if you have the proper computer equipment, you can generate your own labels if you wish.

A typical label looks like this:

Ranunculaceae

Aquileja canadensis L.

GARRETT CO.: Along the county road from Grantsville to Savage River Reservoir via New Germany State Park, 1.4 miles north-northwest of Big Run State Park on a moist limestone outcrop on the west side of the road, associated with *Chrysoplenium* and *Asplenium* under an overstory of *Quercus*, *Tsuga* and *Betula* at about 2650 feet elevation. Rare.

Plants 1.5-2 dm tall; flowers yellow with red spurs; seeds small, numerous and bright black.

James L. Reveal, 7890 15 May 1992
C. Rose Broome

Norton-Brown Herbarium (MARY)
University of Maryland, College Park, MD, U.S.A.

A label should contain the following items:

- Regional or national location where the plant was collected, its scientific name and the family name, ecological and habitat data, information about the plant, collectors and collection number, date the collection was made, and an indication of the institution of origin for the specimen.
- Family name: On the line below the printed header.
- Scientific name: In *italics* or *underlined* and centered. If there is an infraspecific name, it will be on the next line and centered.
- Location: Indicate, in caps, the county where the plant was found followed by a colon (:). Then give the location where the plant was found so that (a) the spot might be found by someone else, and (b), a person with a generalized road map could find the location again. Avoid such references as "hill near my house" or "front of grandfather's barn". Remember, someone in the distant future may well be trying to find this spot again.
- Habitat: Try to indicate where, at the locality, the plant can be found. This can often be done by noting the type of soil or rock outcrop, exposure, or general condition where the plant is found. You can amplify this by indicating the associated plants. In some cases, elevation is useful. Likewise, a general statement about the abundance of the plant may be helpful, especially to those in the future studying plant distributions.

- Descriptive information: Information about the plant that either can not be seen or might be lost in the future should be recorded on the label. Some taxonomists add local common names if they learn them. Observations are often useful and can help future scientist better understand the plant.
- Collector(s) name(s) and number: All person involved with the collecting of specimens should be recorded within reason. Mostly the names of two to five additional collectors are recorded on labels. However, the primary collector's name appears first and the collector's collection number is reported. All collectors assign a collection number to their specimens. As most of you will be collecting for the first time, your numbering system will likely start with 1. If you continue after this class, you should continue your numbers in sequence. Some collectors have elaborate numbers like 940101 for first plant and the first collecting site in 1994. A large number may seem impressive, but simplicity is best here. Start with one and go from there.
- Date: The date the collection was made should be recorded on the label. Avoid using 08/09/94 as in the United States this usually means 9 Aug 1994 while in Europe this would mean 8 Sep 1994. The taxonomic community has largely adopted the mode of giving the day of the month first, followed by month (first three letters if abbreviated and then without a period) and finally the full year (1994, not 94).
- Field notebook and Fieldbook: It is often useful to take a small pocket notebook into the field to record notes. This is for your personal use only and is not something that becomes part of a permanent record. A field-book, however, is a bound notebook from which the pages can not be easily torn. Many taxonomists use surveyor's fieldbooks as the paper is excellent, the book is solid, and the paper is waterproof. Here you should make a permanent record of your collections. The notes should be well organized, the writing readable, and a minimum of abbreviations. Remember, this is a record that is to last well into the future, and others may well wish to consult it in the future. Your fieldbook will be returned to you at the end of class.

Homework

By next week in lab:

Visit a local, natural setting and identify **5 NATIVE** plant species NOT identified in class today.

In your field notebook, provide the detailed information on the plant listed above!

Draw a picture of the plant OR take a picture and include it in your field notebook.

INTRODUCTION

FIELD BOOK

WARNING

First and foremost, be legible! We do make MO collectors rewrite their field book if necessary. Since numerous people work from or need to consult field books, the more legible and precise the data, the easier it is to transcribe or extract.

SIZE OF FIELD BOOK

The advantage of a smaller field book lies in the fact that one does not carry as much information into the field, so that if it is lost, the total data lost would not be as great. Experience has shown that it is easier to write into and type labels from a larger field book. Better quality paper is more readily available in larger field books. It is important to have a size that can be photocopied easily.

PAPER

The quality of paper in field books is highly variable, and may be dependent on what is available locally. Ideally, they should contain pages of acid-free, long-lasting paper written in permanent ink. Field books should be prepared with permanent, archival storage in mind, since they may contain notes and marginalia that do not appear on labels.

PENCILS, PENS, AND INKS

Pencil lead is permanent and can be erased and changed. It is, however, more difficult to read and at times impossible to photocopy. Fountain pens and rapidographs have better ink but they tend to leak when one changes altitude rapidly. Ball points with black or dark ink can be photocopied and do not leak, but they are not permanent. Over time some ball point inks will fade or etch into the paper (especially in poor quality field books), while some inks run if the field book becomes wet.

CARE OF FIELD BOOKS

During field work, carrying field books in clear plastic bags will provide extra protection in case of sudden showers or immersions. Remove field books from luggage when in cars or hotels in case the luggage might be stolen. Most thieves would not bother with a loose book. Care must be taken, however, to remember where you put the field books for safekeeping, and not forget them when traveling.

ARRANGEMENT OF INFORMATION IN FIELD BOOKS

They should be legibly written, and without abbreviations (except metric) and compass directions, e.g. N, S, NW, etc. Be especially careful to correctly spell all proper names. All localities should have latitude, longitude, and elevation. If exact figures are unknown, use the best approximation.

Field data should contain the following information at a minimum:

LOCALITY DATA:

Locality data should be as specific as possible. Someone reading the locality data should ideally be able to find their way to that general site using your description alone. This should include: 1) Country, State, Province or County. 2) Distance and direction (km or mi, N-S-E-W not "from", or "near") from nearest city or major landmark that would appear on a map. Habitat or vegetation type. 3) Dominant, typical, or associated species. 4) Note if plants were preserved in alcohol, or received any other chemical treatment before drying. 5) Latitude/Longitude and/or Township/Range. 6) altitude (m or ft). 7) GPS reading if available. 8) Date. 9) Collector(s).

FOR EACH PLANT COLLECTED:

FAMILY (capitalized). Genus species Author (Leave space if unidentified, and for future changes)

Describe plant: Tree, shrub, liana, vine, herb etc. Flower and/or fruit color, scent, height, and unusual features, such as shaggy bark, buttressed trunk, colored sap, **any attribute which cannot be obtained from the prepared specimen**. More specific notes on locality and habitat (near stream, on rock, in water, etc. [information that is specific to this number]).

MARGINAL NOTES FOR EACH COLLECTED PLANT: (noted when describing and pressing plants).

Collection No. (periodically check to make sure these remain sequential) Number of sets and sheets contained in each set. For example: (1 set of 3, 1 set of 2, 2 sets of 3)** L-3: This indicates the number of live specimens made. C-2: This indicates the number of color pictures made. P-3: This indicates the number of black and white pictures taken. A : Indicates if material was preserved in alcohol [pickled]. Chem: Indicates if the material is a voucher for chemical analysis.

Always write out the complete locality each time it is used. It is not correct to write "Same data as No. _____" or "as above". When collecting over extended distances along trails or when making transects, the general area should be stated in the locality data with more precise locations for individual collections given under their respective collection numbers, e.g., Locality: 13.7 km NW of San Pedro on the road to Incahuara, trail to 12 de Octubre. Specific Information: Ca. 2 km N of trail head.

Abbreviations should not be encouraged. Typists should be typing, not looking up abbreviations and spellings. Specimens are sent on exchange to many parts of the world and your standard abbreviations e.g.: BCI (Barro Colorado Island) may not be readily understood.

Always leave one or two blank lines between collection numbers in the field book so that the original identification, and later name changes and notes can be added.

It is useful to include information about live specimens, color or black and white photographs, pickled parts, seeds, phytochemical material, or any special collections in the specific information so that it is included in label.

The collecting institutions and their acronym(s) should be on the label. That will make it easier to return determinations later.

Begin numbering your collections with 1 and continue sequentially throughout your botanically active life. Do not start over when collecting with other people or in another country or when beginning a new year. Especially, do not use a complicated formula or letters (except for A. B. C. suffixes for divided collections). See Gentry, 1984 (Taxon 33: 355-358).

When mass collecting, write the field book clearly and without delay. Do not depend on "remembering" field data hours or days later. It is always inefficient to rewrite field notes.