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# Collection and Preparation of Vascular Plant Specimens

James P. Smith Jr

Humboldt State University, [james.smith@humboldt.edu](mailto:james.smith@humboldt.edu)

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# COLLECTION AND PREPARATION OF VASCULAR PLANT SPECIMENS

James P. Smith, Jr.  
Professor Emeritus of Botany  
Department of Biological Sciences  
Humboldt State University  
Arcata, California

The principal reasons for collecting plants are to document their occurrence at a particular location and to provide permanent, representative specimens for future study. In the case of smaller vascular plants, such as annual herbs, the specimen often consists of one to several complete individuals. In larger plants, such as trees or shrubs, a specimen usually consists of representative portions of vegetative and reproductive material.

Many of these specimens will eventually become housed in an herbarium, a permanent collection of pressed and dried plant specimens. Here the plants will be examined by botanists interested in such matters as distribution, verification of determinations, blooming and fruiting times, general morphological features, and anatomical details. Plant parts may also be used in chemical and genetic studies. Herbarium specimens are frequently loaned to experts doing monographic work and duplicates are often exchanged among herbaria.

## EQUIPMENT

The following items are useful. While few of them are absolutely essential, having the proper collecting gear close at hand can result in greater efficiency and better specimens.

**Field press.** A temporary plant press, often smaller than the standard 12" x 18" format of the full-sized press, that can fit into a pack back, smaller suit case, bicycle rack, etc. It often consists of two end pieces of press board or some similar material, newspaper, and ropes or straps. You will be surprised how many plant specimens can be held in a field press of only modest size. When you get back home or to campus, you then transfer the plants into a full-sized plant press.

**Plant press.** This can be thought of as the "real" press. It consists of two wooden or metal end pieces, corrugated cardboard, blotters, and newspaper to hold the plant specimens. Most plant presses are about 12" x 18." They may be purchased from a variety of sources (often at an unreasonably high price!) or you can make your own. A sturdy plastic bag is also very useful.

**Digger.** You will often need an implement, such as a geologist's pick, a dandelion digger, a gardener's trowel or a large screwdriver.

**Clippers, pocket knife,** or a **small saw** to remove portions of larger plants.

**Notebook.** There are several possibilities here – all the way from a small note pad that fits conveniently in a shirt pocket or a steno pad to a notebook, waterproof field note book, or an electronic data storage device, such as a smart phone.

**Maps** are needed to provide location data, such as road designations, names of counties, latitude and longitude, townships, elevation, etc. Hand-held global positioning system devices now provide that same information.

**Plastic bags, coin envelopes,** and small plastic or glass **vials** are useful in collecting additional fruits, seeds, or to preserve tissues for additional study.

**Camera.** Images are useful to document the location, habitat, and features of the plant itself. Slides, prints, or digital images have both scientific utility and they may also have a personal, aesthetic appeal.

## FIELD PROCEDURES

**Collecting.** You should be guided by one overriding consideration – you want to collect and prepare a permanent specimen that is as much like the living plant as possible, given the constraints of the pressing and drying techniques. Flower color may fade or change and three dimensional forms are flattened, but a wealth of scientific information and even a certain aesthetic quality remain intact.

Always keep in mind that the specimen that you collect must be identified eventually. Most keys and descriptions rely heavily upon the structure of the flower and fruit. Collecting herbaceous plants in the vegetative state is probably futile. I suggest that you collect extra flowering and fruiting material for use during the identification process. In this way the specimen itself can remain intact. This additional material should be submitted as a part of the specimen. It will be placed in a fragment folder and mounted on the herbarium sheet along with the plant. In certain families, such as the sunflowers, crucifers, and umbels, fruiting material is essential. As you become more familiar with plant families and genera, you will learn what plant features are critical for accurate determination.

With herbaceous plants, it is also standard practice to gather underground parts. The nature of the root system or subterranean stems may be critical. "Top-snatching" is a dreadful habit. Roots and other

underground plant parts should be cleaned carefully to remove soil or mud.

A major problem facing the inexperienced collector is what constitutes enough plant material to make an acceptable specimen. In the case of small annuals, a specimen is not a single plant, but a few to many, depending upon their size. A single larger annual or smaller perennial is usually sufficient. With experience comes the almost unconscious habit of deciding that a particular plant will make a suitable specimen because it will fit on an herbarium sheet of 12" X 18". However, many larger herbs and most woody plants are too large to accommodate within these limits. Special techniques are used here. These will be discussed later.

**The Plant Press.** Although specimens may be stored temporarily in plastic bags or other containers, they should be pressed as soon as possible. Pressing flattens the plants so that they do not curl or wrinkle and it also brings the plant parts into direct contact with newspapers and indirectly with blotters and corrugates, thereby beginning the drying process. There are two types of plant presses. One is the temporary field press. It is usually small, light-weight, and easy to carry in a pack. You don't buy a field press; you make your own out of cardboard or pressboard end pieces, newspapers, and perhaps a few blotters, the whole thing being bound up by a strap or belt. The backpacker will find that he can accommodate an amazing number of plants in his field press. Specimens will last for a few days in such a temporary press until you can transfer them to a regular press.

A standard plant press (12" X 18") is too bulky and heavy to carry about in the field. Although you can construct your own, most of them are purchased, from one of the biological or herbarium supply houses. A regular plant press has wooden or light metal end pieces called frames. Between the two frames is a series of blotters, and corrugates or ventilators arranged in a particular sequence. Two common arrangements are repeating units made up of corrugate-blitter-blitter-corrugate, and corrugate-blitter-blitter-blitter-corrugate. In the first plan, a specimen in a single fold of newspaper is inserted between the two blotters (corrugate-blitter-specimen-blitter-corrugate). In the second option, two specimens are inserted in each basic unit of the press (corrugate-blitter-specimen-blitter-specimen-blitter-corrugate). An empty plant press has about a foot or so of pressing material in it.

I also keep a few 12" x 18" x 1" foam pads close at hand. They go directly on top of bulky plant specimens to make for better contact between the plant parts and the pressing materials.

**Pressing.** Plants are first placed in a single fold of newsprint. One of the most common errors is to assume that if a single fold of newspaper is good, then an entire section will be just that much better. All you accomplish is retarding the drying process by having several layers of wet newsprint. Tabloid newspapers, the ones in the racks at your grocery checkout stand, are just the right size. If you use a full-sized newspaper, then tear it down the middle to yield two single fold sections of

about 11" X 15". Do not exceed this size or the plant specimens may not fit on the herbarium sheet. Do not use slick, clay-finish newsprint from magazines or catalogues. It will not absorb moisture from the specimen.

Annuals and small perennials fit nicely in the newspaper and present no particular problem. But, some herbs are too tall and/or broad to be accommodated properly. If the problem is mainly one of height, consider folding the plant. This works well if it is no more than about a half meter tall. Fold the plant in such a way that the parts do not obscure one another. Too much bulk may also impair proper drying. Make sharp bends, not gently rounded ones. These may be held in place during the drying process by using "flexostats". You make your own by cutting an index card or something similar into segments about 4 cm x 8 cm. Cut a slit about 3 cm long in each and slip the "knee" of the plant through the opening. After the plant has dried, remove the flexostat and reuse it. Still larger plants may be subdivided into two or more sections. Such a suite of specimens is often the most practical method of collecting larger herbaceous plants.

It is important that you put only one kind of plant inside the newspaper. The collection number (see below) for that particular plant should be written prominently along one margin. This will assist you later in sorting material and in finding a particular specimen. Some arranging of plant parts and trimming can now be done. Leaves and stems should be positioned so that they do not overlap unnecessarily. Leaf blades should be turned so that some of them have the upper surface exposed, while in others the lower surface may be seen in the final specimen. Specimen quality can often be improved by some judicious pruning of excess bulk. If parts are removed, leave a short stub so that it is evident what has occurred. This is also a good time to get rid of the dirt or mud trapped in the roots. It can ruin the specimen and label if allowed to remain.

This process of putting specimens in a single fold of newsprint, trimming and arranging, and assigning collection numbers (see below) is done until the press is filled or you have run out of plants. The plant press is now closed by tightening the straps, belts or ropes. It must be cinched tight enough to flatten the specimens and bring them into firm contact with the pressing materials. Presses will loosen as the plant dries. Tighten the straps from time to time.

There is nothing wrong with attempting to position the plant and its various parts in a visually pleasing way. The finished product will then be both scientifically useful and pleasant to behold.

### **SOME SPECIAL PROBLEMS**

Some plants are more difficult to collect and to process. Here are a few special techniques that you may find useful.

- Very small annuals, such as duckweeds, tend to get lost. Place them in a paper towel or envelope.

- Fleshy leaves and stems don't dry well. Cutting slits, subdividing material into left and right or front and back sections, or even removing major portions of internal tissues from plants can help. They will require additional drying time.
- If you attempt to pull submerged aquatics out of the water, the delicate leaves often collapse on themselves. The finished specimen can have the grace and charm of boiled spinach. A useful technique is to position a piece of waxed paper under the plant while it is still in the water. By lifting the paper, the plant will spread over its surface as you remove it from the water. The plant and the waxed paper are put into the plant press.
- Specimens taken from woody plants may be quite bulky. The frames of the plant press may become warped, corrugates crushed, and poor contact made between some plant parts and the pressing materials. I have found cotton pads and sheets of foam rubber very useful.
- Bulky fruits and cones may be separated from the rest of the specimen and allowed to dry outside the plant press. They may also be pickled. Number the parts carefully so that they can be associated with the vegetative portions.

### FIELD DATA

At the same time that it is vital to collect and prepare adequate plant specimens, it is just as critical to take down the necessary field data. Without them, the specimens are scientifically worthless. Data may be recorded in permanent notebooks carried into the field or written in temporary pocket notebooks. Either method has its advantages and disadvantages. The important point is, however, to write down your field data, rather than relying on your memory.

The collection site is probably the single most important bit of data. This should be as precise as possible. I suggest the following sequence: state, county or parish, quadrangle name, township, range, and section or latitude and longitude, reference to a more or less permanent location, such as towns, highways, rivers, particularly those that can be found on ordinary maps.

Quadrangle names, townships, tier, range and section coordinates, and latitude/longitude are found on topographic maps available from the United States Geological Survey. Some of this information may also be found on U.S. Forest Service and Bureau of Land Management maps. Mobile GPS devices have made this task much easier. I use Google Earth to confirm lat-long data.

Other data that you should enter include:

- habitat information (vegetation type, associated species, geology of the site, soil type, etc.)
- elevation
- remarks on the frequency of the plant at that site

- remarks on the plant itself (size, flower color, odor, etc.) that are not evident from the specimen itself
- collection date, your personal collection number for that plant specimen

### COLLECTION NUMBERS

The personal collection number is the one that you assign to this particular specimen. A different collection number is given to each different collection of a particular kind of plant that you make during your career as a field botanist. Your first collection bears the number "1". You will now use a different number anytime you collect a new plant at this site, anytime you move from one location to another, or anytime you collect on a different day. Perhaps a few illustrations will help to clarify this matter.

- If you collect ten different kinds of plants at a particular site, you will have ten collection numbers.
- If you collected each of the ten plants in duplicate or triplicate, you will still have only ten collection numbers, each in duplicate or triplicate. This is the only situation in which a collection number is used more than once.
- If you move to a second site and collect five more plants, you will have five more collection numbers. This is true whether or not any or all of the five plants duplicate species collected at the first site. New numbers are assigned because this a different collection site.
- If I should return to any of these sites at a later date, all of the plant collections made at that time would get new numbers.

Sometimes you are not certain whether two plants belong to the same or different species or varieties. If in doubt, assign them different numbers. After all, there is an endless supply of them. Should they later turn out to be the same thing, combine them under the first collection number. If what you thought in the field to be duplicates are later determined as two or more different taxa, then call one of them 682 and the other 682A or 682A and 682B.

### DRYING SPECIMENS

Once plants have been put into the plant press, they must be dried. Presses may be left out in the sunlight or they may be strapped into rooftop racks on automobiles, much to the curiosity of fellow motorists. But the usual method is to put the plant press in an electric or steam drier. These are found on many college campuses, including Humboldt State.

How long should plants remain in the drier? Until the plants are dry and no longer. The length of time will depend upon the kind of drier, the types of plants collected, the arrangement of pressing materials in the press, and how many other presses are in the drier. While 24 hours is often sufficient for most plants, it is critical to check the presses. Are the newspapers still

slightly damp? Does the plant still feel and smell wet? Will your thumbnail leave an impression in a stem or petiole? If the answer is "yes" to any of these questions, then the plant needs to remain in the drier. If you take them out too soon, the plants will mold. If, however, they are dried too long, they may discolor badly and become very brittle. Remember to check the straps periodically. Presses will loosen during the drying process and curling of plant parts can occur.

## LABELS

If specimens are to be deposited in an herbarium or submitted as part of a class requirement, they must be accompanied by a label that gives the pertinent collection data for that plant. Labels should be made from high quality paper, preferably 100% rag content bond paper. Most herbaria supply them to collectors. Label information should be typed. Permanent ink is an acceptable alternative, but not ballpoint pen or soft lead pencil. Labels should provide at least the following information:

- scientific name of the plant
- location data
- collection date
- your name
- collection number for the specimen

The scientific name, for purposes of completeness and accuracy, typically include the authority. Location information has already been discussed. Dates should be presented as 12 March 1979 or March 12, 1979, not 3-12-79. In the last example, was the plant collected on March 12 or December 3? In 1979 or 1879? Use your first name or initials, not just your last name, unless you are Linnaeus, Jepson, or another equally famous departed botanist. Put the collection number beside your name.

In addition to these essential elements, you may also wish to provide habitat data, along with commentary on the plant itself. Once completed, the labels are slipped inside the newspaper with the plant specimen. Do not glue, tape, or staple either the plant or the label to the newspaper. Both will eventually be removed and mounted on an herbarium sheet for permanent reference.

Traditionally, the collector provided these labels. The HSU Vascular Plant Herbarium is a participant in the Consortium of California Herbaria. Software developed for this project allows you to enter label data that will then be incorporated into the database and it will format those same data to generate labels.

## MOUNTING SPECIMENS

The pressed and dried specimen, along with its label, remains loose in the newspaper. Never glue, tape, or staple it. Specimens are now ready to be glued or otherwise attached to high quality herbarium paper. This is usually done by the receiving institution where the plant specimens will be deposited. Each herbarium has its own way of mounting specimens. The traditional "glass plate" method involves placing the dried plant on

a sheet of glass or a cookie sheet that has been coated with paste, and then transferring the plant from the plate to a sheet of herbarium paper. The label is also glued to the paper, typically in the lower right hand corner. Specimens may be secured further, especially bulky ones, by strapping them with thin strips of cloth tape or by sewing them to the herbarium paper.

A more recent method involves placing the specimen directly on the herbarium paper and gluing it in place with a plastic mounting medium. One common recipe for the glue is: 75 g of Dow Resin 276V2, 250 g of ethyl cellulose, 720 cc of toluene, and 180 cc of methyl alcohol.

## SOME LEGAL & ETHICAL CONSIDERATIONS

While there are certainly valid educational and scientific reasons for plant collecting, important questions should be considered before taking specimens. Will the collecting of this plant contribute to educational or scientific advancement? What will be the impact on the population of the removal of this plant? To assist in the development of a collecting ethic, the California Native Plant Society has adopted the following guidelines:

- Collecting should be done inconspicuously. Casual observers may not understand the reasons for such activities and may feel they can do likewise.
- The CNPS disapproves of undirected and excessive collecting by students in botany classes. It may result in unknowingly taking rare plants and thereby possibly reducing already critically small populations.
- The Society encourages all botany instructors to use common plants, especially weedy or garden species, for demonstrating collecting techniques, structures, and taxonomic features.
- Students in advanced botany classes should be made aware of the rare and endangered plants in their study areas. Of even greater importance is engendering in such students an ethic which emphasizes the impact of collecting on populations.
- The primary justification for collecting plants for herbaria is that they contribute to increased knowledge of the California flora. Repeated collecting in well known areas may serve no useful purpose. While it is important to document the distribution of plants, including rare species, it is critical to evaluate the impact of collecting.

There are also legal considerations that must be observed. Have you obtained permission to collect plants on private property? What regulations do the U. S. Forest Service, the Bureau of Land Management, the National Park Service, a state or county park, etc. have in place? In the strictest sense, even collecting along state highways requires you to have an Encroachment Permit. Plants that enjoy state and/or federal protection because they are rare, endangered, or threatened can be taken only with special written permission from one or more agencies.

## **A FEW CLOSING WORDS**

These overheard statements may help you keep some of the joys and frustrations of plant collecting in mind.

"No, let's not stop here. There will be lots more of them down the road".

"No reason to collect this one. It's just a weed".

"I really shouldn't take the last one, but ...".

"This stuff lasts forever in a plastic bag. We'll press all these plants when we get home".

"Sure, dump everything in the same plastic bag. We can sort it out later".

"Are you kidding? Why number them now? We'll never get these specimens mixed up".

"Let's not take the time. We'll be able to find all of these locations on the maps when we get back home".

"No, this plant press isn't too high".

"Why anchor this stuff down? There's no wind".

"Oh well, you probably didn't need the bulb anyway".

"Get that one. It'll fit the press".

"Where is my digger?"

[Minor revisions: 15 February 2017]