

Basic Techniques for Field Documentation of Vascular Plants

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For many people, the basic concept of an herbarium and the rationale for collecting herbarium specimens remain elusive. Why would anyone collect a plant, press it and dry it, mount it on paper with information about it, and then store it indefinitely as a reference? The information presented here is intended to clarify the concept a little bit, explain some of the ways in which herbarium specimens are used, and provide guidelines on the type of material to collect and the information to record in order to produce a more valuable herbarium specimen. The content is intended for those who might want to collect some herbarium specimens of their own but aren't sure how to go about it.

As with many of the natural sciences, field botany is an area in which conscientious amateurs can often make significant contributions. The quality of the product, however, has a lot to do with the care that goes into collecting a good, representative plant specimen, as well as the precision and reliability of the observations that are then recorded on the label that accompanies it. If you are planning to collect some herbarium specimens, take the time to learn how to do it properly so that your collections will contribute accurate information and will become a valuable part of an herbarium collection.

What an herbarium specimen looks like.

An herbarium specimen is basically a plant (or several small plants, or a portion of a large plant) that has been collected, pressed as flat as possible, dried fairly rapidly to prevent molding (but not so quickly that it's cooked), then affixed to an herbarium sheet by gluing or sewing (Figure 1). An herbarium sheet is acid free (pH neutral), archivally

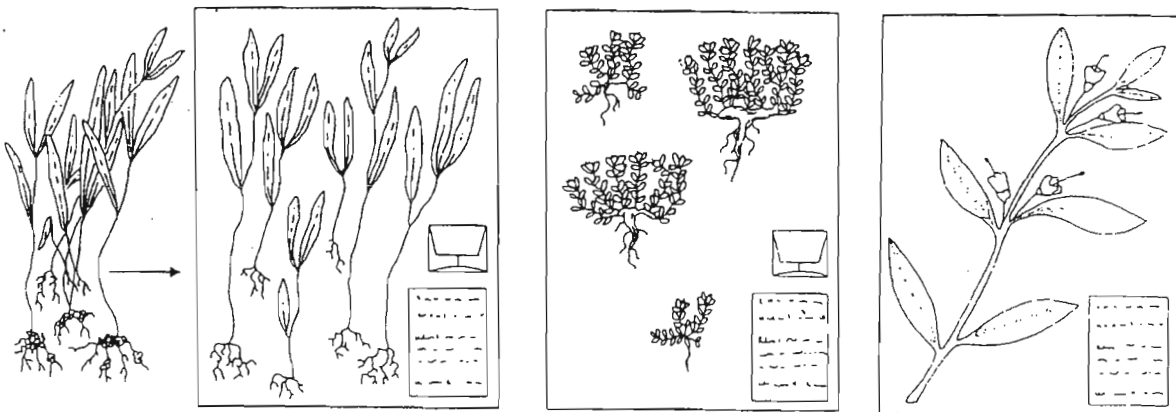


Figure 1. (From Forman & Bridson, 1989).

stable paper that is generally high in cotton rag fiber and measures approximately 11.5 × 16.5 inches (American Standard size). Onto the same sheet, with the plant specimen, a label is glued that indicates *who* collected the specimen, *when* it was collected, *where* it was collected, and *what* the plant is. Labels often provide additional information that make it a more useful or purposeful collection, such as the *growth habit* of the plant and its *flower color*, the *habitat* that the species was found in; the *elevation*; degree and direction of *slope* where the plant occurred; the *type and coarseness of soil* that the plant was growing in; *etc.*. It may also include information about *why* the specimen was collected (*e.g.*, a *voucher* for floristic studies, for a chromosome count, or for a seed collection). Generally, the more information that a label provides for a collection, the more potential use that specimen has (provided the information is *relevant and accurate*). An herbarium specimen may also have a *fragment packet* (a small envelope for putting loose pieces of the plant into), an *accession stamp* indicating which herbarium it belongs to (this often includes an *accession number*), and one or more annotations or *annotation labels*. Annotation labels are small slips of paper that are attached to the herbarium sheet and which generally confirm the identity of the plant or provide a re-identification. They may also provide additional information about that specimen or may indicate that a piece of plant material was removed for detailed studies.

Why collect herbarium specimens?

Botanists -- amateur and professional alike -- may have various reasons for collecting plant specimens. As a starting point, many botanists collect specimens as an aid in learning the plants of a particular region. By collecting a good, representative specimen, one can use the best available botanical references to find out what it is. After collecting similar specimens and keying them out, one may discover that there are several similar looking plants in an area that actually represent different species; or, one may collect several plants that look slightly different and discover that they are really the same species, but they look different because of environmental conditions. Perhaps one was growing in full sun, another was growing in a moist, shady situation, and still another was much larger than usual because it was growing on a burned slope where there were more available nutrients in the soil and less competition from other plants. If you do not collect those representative specimens, or you collect them and throw them away, then you effectively have no provable record of the diversity that you observed and no primary material to examine again later. Collecting and preserving representative plant specimens, along with carefully recording information about them, contributes to a better understanding of their distribution and variation by preserving a permanent record that can be observed and verified by others.

Of great importance, herbarium specimens often serve as a historical record: a single humble specimen may provide documentation that a particular species once occurred in a particular area that is now completely urbanized or converted to agriculture. This kind of distributional information is particularly valuable to conservationists who are interested in studying the decline of a species, as well as to biogeographers who, by studying natural plant distribution patterns, can often learn about the migrations of plant species over geologic time, and gain insight into evolutionary trends and potential relationships among various species. In an area like southern California, there have been so many profound changes through the historical sequence of grazing, agriculture, and urbanization, that it is now very difficult to reconstruct our understanding of past plant distributions and vegetation assemblages in the areas that have been converted to concrete, asphalt, and introduced weeds. In this regard, our window into the past is often provided by historical herbarium specimens that record the presence of a species at a

particular place at a given point in time. Many people are oblivious to the trends of habitat destruction. If you get an opportunity, look at a map of the Los Angeles Basin from around the turn of the century or the 1920's. There are roads and railway lines between small population centers, but it's likely that few if any people of the time could have envisioned a nearly solid carpet of urban development from the Santa Monica Mountains to the Santa Anas and San Gabriels, with the low network of hills covered in housing tracts. It would be nice to preserve areas of natural vegetation for all time, but because of population growth trends, land use decisions, and the destructive behavior of short-sighted individuals, there are probably no habitats immune to destruction. With this inability to conserve areas *ad infinitum* in order to study them, other methods are often necessary for documenting some of the natural diversity that they house. In the case of plants, herbarium specimens provide a useful means.

One of the most important uses of herbarium collections is in their value for revisionary taxonomic work. Many botanical researchers specialize in one or more specific groups of plants. By bringing together and carefully examining a broad assortment of specimens from numerous herbaria, they can get a good idea of the range of variation in the group of plants that they are studying. Each specimen or collection can often contribute additional information to the overall picture. One specimen, compared with several similar specimens collected over a broad geographical area, may provide information about the natural distribution limits of a species, or an unusual habitat that the species was not known to occur in, or the elevational range in which the species can grow, or the typical vegetation assemblage that the species occurs with, or an unusual leaf size or form that occurs in a given geographical range or habitat, *etc.* A single collection that "seems" to be a particular species but doesn't quite fit the description may turn out to be a previously unknown variety, subspecies, or species. If the original field botanist had walked past that plant and never collected an herbarium specimen, its existence might never be made known. The collections of scores of botanists thus contribute cumulatively to improved knowledge of a particular species or group of plants. After studying the diversity of herbarium specimens, a conscientious taxonomist will append an annotation label to each one indicating whether it is correctly identified or re-identifying it if it isn't. Providing the taxonomist is competent, this annotation generally increases the useful value of the specimen by verifying its identity. Some botanists may try to do taxonomic work in a particular plant group without consulting the great diversity of specimens housed in herbaria, choosing instead to try and formulate a classification scheme based on the few specimens that they have personally seen in the field. Because they are oblivious to the broader range of variation in a species, or group of species, they may end up with a skewed, unrealistic taxonomic concept. Consequently, they may write a key to the species that is idealistic, based on a very small sample size, and that has no relevance to the range of variation exhibited by the species in the real world. The end result is a key to the species that "doesn't work". By consulting the diversity of herbarium specimens, however, a researcher can examine a cross-section of the natural variation found in a particular plant group and can often begin to distinguish between the consistent nature of some characters, plasticity of other characters, and the patterns that are exhibited over a broad, geographical area. This results in a better, more realistic understanding of the group they are dealing with.

Herbarium specimens provide much of the basic information that is found in regional published floras. A floristic botanist (or floristician) relies heavily on the specimens and label data in an herbarium. With physical specimens to study, the botanist can usually verify that the specimen is what the label says it is and, by examining a broad assortment of collections of that taxon, can get a good idea of the natural morphological variation of the plant, its appearance at different developmental stages, its geographic

distribution pattern, the habitat or vegetation assemblage(s) that it typically occurs in, the elevational range, what time of year it is typically found blooming in the field, *etc.* In order to compile a worthwhile regional flora, however, the total diversity of an area must be sampled and documented. Some people may only collect the most obvious (trees and shrubs) or the prettiest plants in an area. If 93% of the plants in that area are subtle annuals and herbaceous perennials or don't have "showy" flowers, then what do we ultimately know about the plant diversity in that area? Sometimes the most interesting plants in a particular habitat are the very small annuals -- variously known as "knee-plants", "belly plants" (because you have to get down on your knees or belly to see them), or "dinkophytes" (dinky plants). A few botanists may get so engrossed in the small herbs that they are oblivious to the trees overhead. If a geographical area has been visited by various botanists over time, chances are that their diversity of collecting styles will help to "even-out" the representation from that area. However, if you are botanizing in an area that has not been visited and documented before (and especially if you are the only one to botanize there before it is destroyed) you should make an effort to document as many of the species as possible. A good field botanist will critically examine and document the full range of plant diversity in an area.

An herbarium specimen can also provide documentation for ecological studies such as parasite/host relationships and insect/plant interactions. For example, many species of mistletoe (such as *Arceuthobium* and *Phoradendron* species) are fairly host specific. Consequently, the label on a specimen of *Phoradendron densum* may indicate the host plant as *Juniperus californica* (preferably with a sprig of the juniper attached to the same herbarium sheet for proof), or may record it on *Pinus monophylla* (single-leaf pinyon pine) as an unusual occurrence. Conversely, an entomologist studying butterflies may collect an herbarium specimen of *Phoradendron densum* as a voucher to document it as the food plant of The Great Purple Hairstreak larvae (*Atlides halesus corcorani*). That voucher specimen serves as a documenting basis for their observations. It can be examined by a botanist and its identification confirmed, or it could turn out to be another species of *Phoradendron* that the Hairstreak was not previously known to feed on. In the latter case, without a voucher to examine and confirm, the error would not be found out.

Herbarium specimens also provide documentation for other forms of research. In a sense, they provide a degree of accountability. For example, an herbarium specimen may consist of an identifiable plant with a label indicating that seeds from that plant were used to obtain a chromosome count for the species. Without that documenting specimen, there is no way to know that the plant whose chromosomes were counted was accurately identified. Someone could publish a paper stating that *Lotus scoparius* ssp. *scoparius* has a chromosome count of $n=8$. Without an herbarium voucher as proof, no one might ever know that the plant whose chromosomes that researcher counted was actually *Melilotus indicus*, a common weed that they had mis-identified. A voucher provides the necessary documentation to prove what plant was being studied. This kind of accountability is very important for a diversity of studies. One botanist from the New York Botanic Garden recently stated the simple rule: "no voucher: no data". A researcher who does not collect voucher specimens or annotate specimens that they have studied may be able to hide their shoddy scholarship for years (this is a warning -- not a helpful hint). They may publish an article, or dissertation, or monograph in which they state their profound observations and conclusions, but if they have left behind no evidence of the plants that they purportedly studied then their results must be viewed with necessary skepticism.

Herbarium specimens are also used as primary resources for plant locality data. The locations given on herbarium labels are often used by conservationists to compile known localities for rare plants so that they can be monitored. A horticulturist may use herbarium label data to locate a particular species for the purpose of collecting seeds or

cuttings for cultivation. A researcher may use the data to find out where they can go to study living plants in the field, or collect material for laboratory studies. Consequently, the better the locality data on a specimen the more useful it will ultimately be.

Continued advances in research methods may also make new uses of herbarium specimens. In recent times, for example, researchers have been able to extract DNA from some well-preserved herbarium specimens in order to perform comparative molecular studies. Using such material, they can learn about genetic variation within species as well as make inferences about the potential relationships among groups of species. It is preferable to collect such material from living plants in the field or greenhouse, but there may be instances in which the plant in need of study is so rare that it can no longer be found in the field, or the area where the plant occurs may be closed to outsiders, or traveling several hundred miles to find and collect material may not be worthwhile. Using herbarium specimens in this manner is a *consumptive* process, since it consumes a portion of the specimen. While herbarium specimens are meant to last indefinitely, using a portion for molecular, anatomical, palynological, or other studies may sometimes be allowed if it is clearly justified and does not destroy the specimen. However, a courteous researcher will first seek the permission of the Herbarium Curator prior to removal of material and, when permission is granted, will annotate the specimen indicating the portion and quantity removed from the specimen for their study.

It is clear that herbaria house a tremendous amount of information and continue to be a rich, primary reference for plant studies. There is no substitute for an original plant specimen that can be examined, dissected, and compared with others. By carefully collecting and preserving representative plant specimens, amateur and professional botanists incrementally contribute to a better understanding of plant diversity, variation, and distribution.

Preparation / Basic equipment for collecting and pressing plant specimens.

If you are going to be a serious and effective plant collector, you should get in the habit of carrying everything you'll need. Make a checklist for yourself, if necessary, just to make sure that you aren't forgetting anything in particular before you head out to the field. Some people botanize within a few feet of their car, but remember: the plants won't come to you; you have to go to the plants. With that in mind, be prepared to do some walking, hiking, climbing, crawling, and maybe even some wading. There are two basic categories of needs when you go out into the field: 1) human comfort and survival needs (food, clothing, shelter); and 2) the tools and supplies to effectively perform your task. A third category involves optional, or luxury, items that may be carried along.

Category 1: Items relating to human comfort and survival are essential to keep in mind before you go to the field. You cannot effectively concentrate on your task if you are dehydrated, out of water, suffering from hypothermia, and separated from the comforts of your automobile by five miles of dense chaparral. Always plan ahead for the type of field conditions that will be encountered. Dress appropriately for the type of vegetation and weather that may be encountered. If you're going to be pushing through brush, wear jeans or similar resistant clothing. Sturdy hiking boots are usually essential. Carry a jacket or coat that'll keep you warm if you get caught out late or intend to stay overnight. Light-weight rain gear takes little space, but can make a great difference when that unexpected storm front comes rolling in. It is always a good idea to carry a flashlight (with fresh batteries) even if you don't *plan* to be out after dark. Carry adequate amounts of food and water (one gallon per person per day, as a general rule of thumb), the quantity dependent on the duration of the field outing. It is preferable to carry a little *too much* food and water, than to find out later that you've taken *too little*. As an animal that has and carries belongings, a backpack will be essential to storing and transporting your extra

comfort and survival items as well as many of the tools and supplies for performing your task. If your backpack is too small to fit everything into it, *don't* leave behind half your water; either buy a bigger backpack or re-assess whether your itinerary is realistic.

Category 2: For making good field collections of plants you will need to carry several items. The first is a field press. Since the specimens that you collect will look their best if they are pressed while fresh (prior to wilting and collapsing on themselves), carrying a field press allows you to make better looking and more useful specimens. Field presses may come in various forms. Perhaps the most common (Figure 2) consists of two oak-wood frames measuring 12 × 18 inches between which are several sheets of corrugated cardboard (often called "ventilators") of the same dimensions. The frame, with its corrugates, is generally held together by two straps that are used to cinch it tight when pressing plants. Another form of field press is becoming increasingly popular. It is generally made of water-resistant nylon pack cloth and its rigidity is provided by inserting corrugates (ventilators) into two lateral pockets to provide a backing (Figure 3). It can be used to field-press numerous specimens, then the internal flaps are folded inward and fastened over the material and the press is closed and carried like a briefcase. The press should be stocked with plenty of pressing-papers. Newsprint is generally the pressing paper of choice since it is cheap and readily available. A double-folded

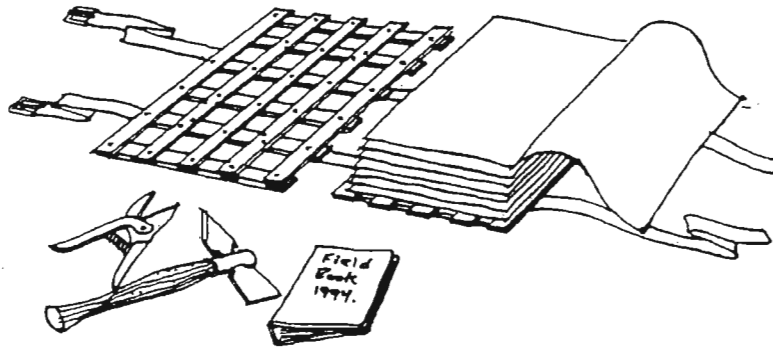


Figure 2. Traditional field-press with a lattice-type oakwood frame, pressing papers, & cinching straps, as well as a few tools of the trade. (illustr. from USDA, 1971.)

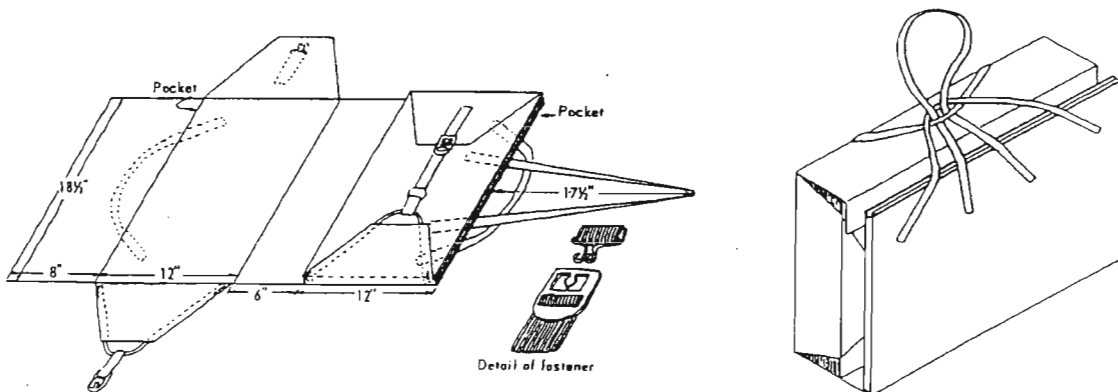


Figure 3. Newer style field-press with nylon shell and internal compression straps (corrugates and pressing papers not shown); right, folded closed for carrying. (Savile, 1962.)

newspaper, when fully opened, generally measures about 22.5 × 27.5 inches. Each of these full sheets is cut in half down the center fold to give you single pressing papers that measure about 22.5 × 13.75 inches. When this single sheet is folded over, it gives you a pressing paper measuring about 11.25 × 13.75 inches with the fold along the long edge. This is generally a satisfactorily-sized sheet to press material in. The "Calendar" section of the Los Angeles Times generally is single-folded and comes in the right format for use as pressing-papers. The larger double-folded sheets should be cut in advance to save time in the field. A single sheet of newsprint is used for each specimen, unless the specimen is particularly thorny, stiffly branched, or bulky, in which case you may want to double the paper to prevent ripping or puncturing of the pressing-paper.

An *essential* part of your collecting will be the keeping of accurate observations and data in your Field Notebook. This may be simply a spiral-bound notebook or a fancy, bound book with blank pages. Always carry it with you into the field, even when you think that you *probably* won't collect anything. Field notes must be written down at the site of the collection -- *do not* rely on your memory. Associated with your field notebook, you must always have pens and/or pencils. Pens should have *indelible ink* in case you and your notebook fall into a stream or you find your collecting venture interrupted by unexpected rain. A pencil is considered indelible, but may tear through the paper fibers if the notebook gets wet.

An indispensable part of your collecting venture will include Maps. Since the accurate location of your plant collection is of utmost importance, you should always plan ahead to have a map for the area that you'll be collecting in. If you are collecting along roads or in developed areas, road maps may be adequate. AAA maps and Thomas Bros. Guides are often quite good in this regard. If you are collecting in an undeveloped area such as in the mountains or out on the desert, make a point of obtaining topographic maps for the area. If you want to reduce wear-and-tear on your topographic map, photocopy the portion of the map covering the area where you intend to botanize and carry that into the field with you. Learn to read maps so that you always know where you are relative to topological features.

When going into the field to collect herbarium specimens, you should always take collecting bags. Rather than opening up your field press for every plant that you collect, it is often easier to accumulate several collections in a plastic bag and then make periodic stops to put those several collections into the press. A few decades ago, botanists used to carry a cylindrical metal container called a *vasculum* into which they would put their collections in order to keep them fresh. The advent of plastics, however, has largely obviated the need for a heavier, bulkier vasculum. Particularly useful are large plastic garbage bags for specimens taken from woody plants and larger herbs; Ziploc® bags in gallon and quart sizes are ideal for keeping collections of small, delicate annuals separate and fresh until they can be put into the press. For the large collecting bags, trash compactor bags are sturdier than normal trash bags since they are several mil thick and can stand up to the brush better without ripping. Always carry an assortment of plastic collecting bags in your backpack or with your field press. If you are collecting during the summer and the air is particularly hot and dry, some water can be sprinkled into the collecting bag to keep your collections a little fresher.

In order to collect good specimens, you will need digging and pruning tools to facilitate the collecting. A good herbarium specimen is representative of the entire plant; therefore, annuals should be collected whole, with their tap roots, and herbaceous perennials should also include the root system whenever possible. Getting at the root system will usually require a sturdy digging utensil such as a large, thick-bladed knife, a rock pick, or some other similar tool. Do not dig up or disturb the root systems of nearby

plants that you do not intend to collect. In order to collect specimens of woody plants such as large shrubs or trees, a pair of sharp hand pruners are best. This is preferable to pulling and twisting a branch until it finally breaks. As in your second-grade art class, the neatness of your work counts for a lot.

Finally, as part of your pre-planning, you should make sure that you carry along any necessary collecting permits for the area that you'll be collecting in. These are generally required for collecting on public lands such as on National Forests, in National Monuments, in State Parks, and on land overseen by the Bureau of Land Management (BLM). General permits on National Forest lands usually exclude Wilderness Areas, so make sure that your permit covers your intended collecting area. Do not collect on private land unless you have the permission of the land owner. Again, by knowing how to read maps accurately and being able to place yourself confidently at a given locality on the map, you may be able to avoid trouble with suspicious locals by pointing out that you are on public land -- not on theirs.

There are also **Category 3** items that might be viewed as optional items to take into the field with you. Among these are a local flora that you can use to key-out plants in the field, if you want to try and identify your plants in advance. Other luxury items that many botanists drag into the field with them include a magnifying lens (usually 10×); a camera with plenty of film; water purification tablets or a manual water pump with fine filter (necessary if you may run out of water); an altimeter; a pair of binoculars; a snake-bite kit; a sleeping bag and a tent if you're going to be out overnight. There are a diversity of other items that may be carried with you, depending on the nature of your excursion. In my backpack, I also tend to take 2.25 × 3.5 inch manila coin envelopes for collecting seeds. This way I can collect mature seeds of native plants that I want to grow *when* I encounter them, rather than having to try and guess when they'll be mature and making special trips to collect them. Extra plastic bags can also be carried for collecting cuttings for propagation, or collecting other plant materials for research.

How to collect useful specimens:

Where to collect. --

Where you collect is important. Some people only collect plants at roadside. The end result is often a skewed collection of plants that occur only in disturbed areas. This is not entirely "bad", however. Somewhat under-represented in herbarium collections are plants of empty, undeveloped lots and other disturbed areas. If you are a perceptive collector, botanizing in such localities may allow you to document weeds that were not previously known for the county or state and may also reveal weeds that have not been seen for decades, thus providing evidence that the plant is still a part of the local flora. Documenting interesting native plants, however, usually requires getting away from anthropogenic disturbances and hiking away from roads and habitations into relatively undisturbed vegetation. Hiking through brush or woodlands or along streams may present some challenges to human comfort, but very often it results in a much better understanding and appreciation of native plant communities, habitats, and diversity. You'll rapidly discover that botanizing at the open door of your car is *very* limiting.

The greatest satisfaction comes in botanizing in a wide diversity of habitats and gradually gaining familiarity with the equally diverse plants that occur in them. When collecting in a new area, make an effort to explore and document each of the different habitats represented there. Some people have the faulty idea that plants at a site are evenly mixed and distributed. They'll collect in an area a few yards square, think they've seen it all, and drive elsewhere. In fact, even in an area that looks relatively uniform, if

you take the time to wander around over the whole site you'll often discover isolated small colonies or individuals of species that you didn't observe earlier. A good field botanist is mobile. In your attempt to discover the broader range of plant diversity at a site, you will need to explore the flats, the puddles, the washes, the draws, the canyon bottoms, the stream beds and margins, the bases of the slopes to the ridgetops, the gradual slopes *and* the steep slopes, the different slope exposures -- north, south, east, west, and points in between, the various substrates -- clay, sand, gravel, cobbles, scree, boulder outcrops, and humusy leaf litter, grasslands, shrublands, woodlands, understories, and the myriad microhabitats resulting from countless variables, whether seen or imperceptible. Even a thorough field botanist can go back to an area where they've botanized before and still find plants that they'd overlooked previously.

Some people will go back repeatedly to a popular collecting sites and document the same plants that have been collected there a dozen times before. This adds little to the overall picture. In the meantime, areas that haven't been explored often continue that way. Pick an area that isn't very well known botanically, and systematically document the plants in it. No one will ever know about that area's plant diversity until someone takes the first step of exploring it and collecting vouchers.

Type of material to collect. --

Collect representative material with flowers and/or fruits. Avoid collecting "sterile" material whenever possible. The term "sterile", in this context, does not mean that the plant is incapable of reproducing; it simply means that the material lacks reproductive parts. Since plant classification schemes rely heavily on the arrangement and features of reproductive parts, collecting representative material that is in "good" flowering or fruiting condition is your best assurance of being able to accurately identify what plant you have. Exceptions are occasionally made to this rule. The primary exception is when you are documenting the flora of an area and happen to encounter an unusual plant or an unusual occurrence of a plant that is in sterile condition at the time. If it is in an area that you very likely will not be able to return to later (due to remoteness, for example), and the plant is distinctive enough that it can potentially be identified based on vegetative features alone, then it may be worth collecting as a sterile floristic voucher. That way you will have a physical specimen that can be re-examined or shown to an expert at a later date. If you find yourself in a similar situation, but doubt that the plant is sufficiently distinctive to be identified on vegetative characters alone, you may want to collect propagation material to grow it at home until the plant blooms and can be identified. This is an advanced technique only for those whose "desire to know" equals their desire to document. I have occasionally done this in order to get fertile, identifiable material when collecting in a remote area. This requires some basic horticultural skills and effort but is a satisfying -- if not fun -- way of learning a new plant.

Collecting "representative material" means taking a voucher that is typical of a particular species that you want to document. If botanists only collected and preserved "freak" plants, we would ultimately have a fairly skewed idea of what they look like in the wild. There is nothing wrong with documenting unusual forms of a plant, but they should supplement, not replace, a normal collection. A good representation of a species in an herbarium will include numerous fairly "typical" specimens, some depauperate (small, poorly developed) specimens, and some unusually large plants, collected from throughout the species' range.

A good, representative collection also implies taking an appropriately sized sample with important or relevant diagnostic features. Little snippets or pieces of plants that are non-representative are called "top-snatches", and are frowned upon in herbaria. Top-snatches tend to be typical of many student or amateur collections but are usually

just a reflection of a lack of proper training in collecting technique. If you are hiking down a trail with a group of people, you all stop to look at a very interesting shrub in full bloom, and before moving on you pinch off a 2-inch stem tip with three small leaves and a flower and press it in your notebook, then you have just taken a classic top-snatch. It's fine if you just want it as a bookmark, but if you try to pass it off as an herbarium specimen then you're performing a dis-service. Most herbarium curators would fling it in the trash and this, unfortunately, has been the fate of many student collections around the world. Take the time to collect worthwhile specimens.

Becoming a good field botanist requires a familiarity with *all* the plants encountered in the field, so make a point of collecting and learning both the weeds *and* the natives. If you do not know what a plant is and it's in good condition, *collect it and find out what it is*. I have been in the field with people who will only collect plants that they already know, and will *not* collect a plant if they *don't* know what it is. This is illogical and incomprehensible. Particularly frustrating is when one of these people comes in without a specimen and tries to describe the interesting plant that they saw so that they can be told what it was. If you see something that you don't know, collect so that it can be identified. Next time you see it in the field you'll know what it is... and if you never see it in the field again, you at least have that first voucher that you collected. Remember: *no voucher = no data*.

How to collect and press the specimens / What kind of information to record while collecting.

[See Category 2 under the heading "Preparation / Basic equipment for collecting and pressing plant specimens", above.] When you arrive at a new site where you will be collecting, crack open your field notebook and begin by writing down the following: date, location, names of any other people that you are collecting with, overall vegetation-type and physiological features, and the names of the *visually dominant* plants in the area (*i.e.*, those that contribute to the overall vegetation-type. If you do not know what the dominant plants are, start by collecting them. It is easiest to keep track of your specimens and their related records by assigning collection numbers *as* you collect them. Keep track of your consecutive collection numbers by writing them at the top of each new page in your record book. That will prevent you having to leaf back through several pages to see what the last assigned number was. When you collect a plant, write its assigned number in your field notebook, then write down your "field ID". The field ID is simply your best guess as to what it is. If you already know the plant, great. If you don't already know it, your field ID and collection number will serve as a "handle" on that collection until you can key it out. As you collect each plant, write down the relevant information about its microhabitat, size, growth habit, fruit or flower colors, abundance, associated species, and anything else that will help you to identify the specimen later and also make the collection more useful. [See "Important information to include on all labels", below.]

For annuals, collect the whole plant including the taproot; if they are small, collect several representative samples or a representative range of sizes at the site, so that you can "fill" at least one herbarium sheet (see Figure 1, first two illustrations). For herbaceous or smaller suffrutescent perennials, collect the whole plant if possible and if there are portions of the plant that you can't collect, make notes on them. Longer plant collections may often be folded in the press so that they will fit, in their entirety, onto a herbarium sheet (Figure 4). Alternately, very large or tall specimens can be cut into lengths, if necessary, and pressed individually. This will result in a multiple-sheet collection (*e.g.*, sheet 1 of 2, sheet 2 of 2). You will probably learn the hard way that if you only collect the top of the plant, the key that you are trying to use will ask for

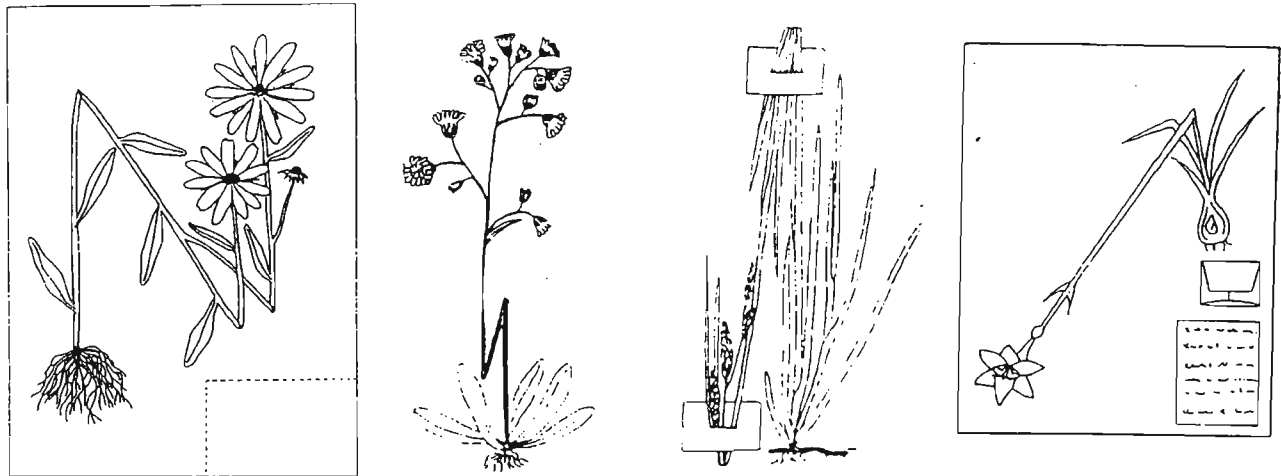


Figure 4. Plant specimens folded during pressing in order to fit onto a herbarium sheet. This is variously known as an N-fold, a zigzag fold, or an accordion fold, the latter of which is frequently used with grasses and sedges that have long leaves and culms. (Left, MacFarlane, 1985; center two, Savile, 1962; right, Forman & Bridson, 1989.)

characters relating to the root system or the basal rosette of leaves. Get in the habit of collecting *representative* specimens. Remember -- top-snatches are a no-no. When collecting a representative portion of a larger, woody plant -- whether tree or shrub -- make notes in your fieldbook on any potentially valuable characters of the plant that will not be evident from the pressed specimen itself.

Some novices to botanical collecting are often confused by what constitutes a "collection", or what assortment of plants to assign discrete collection numbers to. A collection consists of all the plants of the same taxon that you collect on one date in one small area. If you collect the same species twice on the same day while hiking a 20-mile trail -- once on the west base of the mountain and again on mid-slope of the east side of the mountain -- those are two separate localities and constitute two separate collections. Even if the species is the same, the habitat, locality, associated species, and other details will change. Make sure that your labels reflect that difference. It doesn't matter how many duplicates of that species you collect at one of those sites; at one site they all represent the same collection number.

The actual collecting process is straight-forward. Take a pressing-sheet of newspaper, write the plant collection number on the margin (you will already have written all the data into your field notebook next to the assigned number and your field ID), place the open newsprint in the field press, carefully organize the specimen(s) on the sheet, close the sheet, hold it down while preparing the next newspaper, and press the next specimen in the same fashion on top of it. When you have pressed several plants in this fashion, you may insert a cardboard corrugate on top to even out the pressure on the plants below. After field-pressing all your current collections, close and tighten the press, and proceed onward.

How many specimens should be collected?

Before you collect plants in a given area, assess the potential impact of your collecting. Some plants may be locally or globally rare. If the plant has already been documented at this site, then another collection is likely unnecessary. If it represents a previously unknown population of a rare plant, then collect a good representative

specimen as a locality voucher. Have any necessary permits. If a population is so small that collecting in it will cause irreparable damage, *don't collect*. When collecting in an area in general, assess the local population of a species before collecting. If the plant is locally abundant then there should be no problem with collecting a specimen and some good duplicates. A single collection of a plant ("unicate") is better than no collection because you at least have a documenting voucher. Duplicate specimens are nice because they can be sent to other herbaria to broaden their collections in exchange for duplicates from their herbarium that can strengthen the breadth and representation in your own herbarium. There is also a practical side to duplicate specimens: if a herbarium burns down or is destroyed in an earthquake, all of its unicates are lost. If there are duplicates distributed elsewhere, however, that record remains extant and available to researchers.

How to dry the specimens.

When you return from your collecting trip (if only one or two days), do not leave the pressed specimens in a field press any longer than necessary or they may mold or rot. At first opportunity, they should be put into a Drying Press and placed into a plant dryer. If you are on a longer collecting trip than a couple of days, take along drying presses and plenty of corrugated cardboard ventilators. Transfer specimens from the field press(es) into drying presses when your field collecting is through for the day.

This process simply involves alternating ventilators (corrugated cardboard) with individual specimens into the drying press. Optionally, additional felt or paper blotters are included in a drying press (Figure 5). This often results in a very tall press, but it compresses considerably when it is cinched down. The drying press is then layed on its side in a plant dryer (Figure 6) where bottom heat can rise through the fluting in the corrugates and drive off the moisture from the specimens. Some botanists who collect in the desert may sometimes mount the plant press on top of their vehicle so that the hot, dry desert air flows through the flutings (like a radiator) as they drive from one collection site to another.

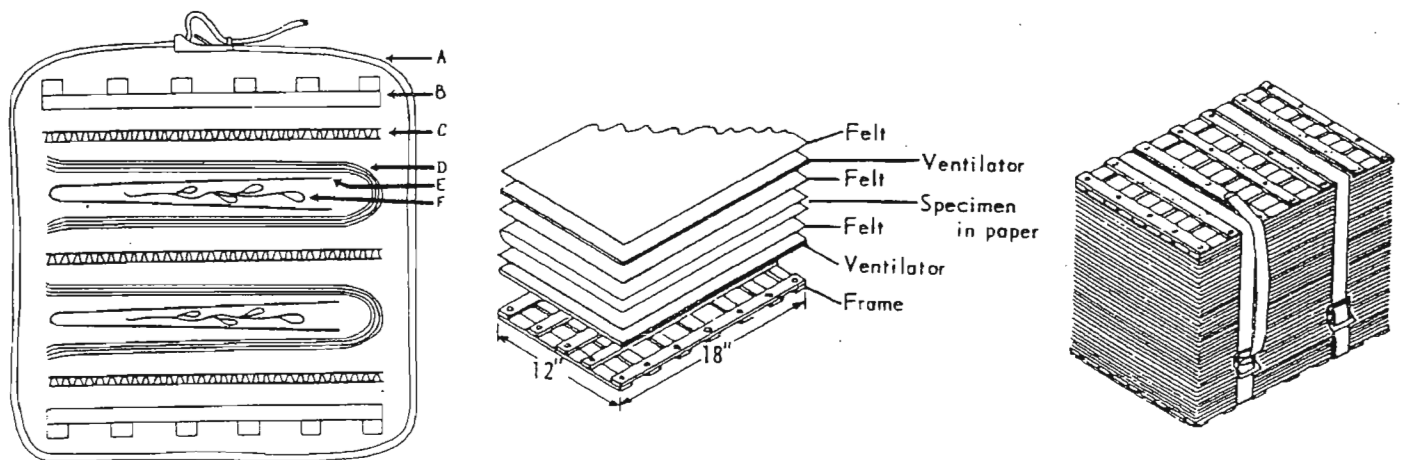


Figure 5. Arrangement within a drying press. Left Illustration: A, binding strap; B, plant press frame; C, corrugated cardboard ventilator; D, thick newspaper used as a blotter (optional); E, single sheet of newspaper folded; F, plant being pressed (MacFarlane, 1985). Center: exploded view showing optional felt blotters; and right: drying press cinched with compression straps (Savile, 1962).

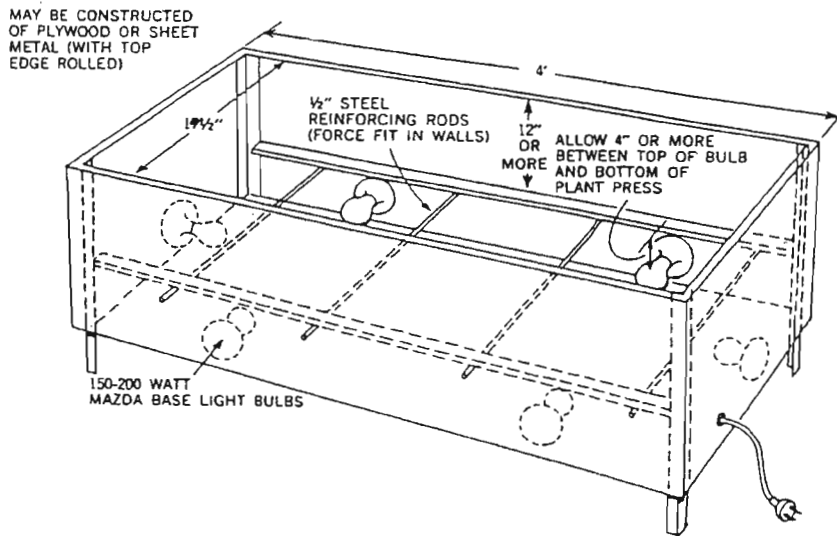


Figure 6. Plan for a plant dryer that can have a press up to 46 inches long laid in it. The heat is provided by light bulbs installed beneath. (USDA, 1971.)

Identifying your specimens.

In order to identify your plant collections more accurately, try to identify them using a respected flora that covers the geographical area where you did your collecting. Use the keys and look critically at the diagnostic characters of the plants. Avoid trying to identify your plants by comparing them with picture books as this can lead to awful mis-identifications at times. Although intimidating and sometimes frustrating, the best way to learn plants is to key them. By using the keys, you will become familiar with some of the technical characters that taxonomists use to differentiate major groups of plants as well as closely related taxa. Some of the terminology used in describing plant features will be unfamiliar, but a good flora will provide a glossary of terms and some will also provide simple illustrations of the terms being defined. It is important to take the time and learn these terms as they are encountered because many of them will occur repeatedly in botanical descriptions. If you skim through descriptions but do not bother to look up and learn the unfamiliar terms, you will not be able to accurately visualize what is being described. Such an approach often results in erroneous identifications. When you have arrived at a final species name in the key, do not automatically assume that you've keyed it correctly. Go to the entry for that species and read the description carefully, comparing it to the characters of your plant. If the description doesn't seem to fit, go back through the key, watching carefully for any terms that you may have misunderstood or plant features that you may have mis-interpreted. Resist the temptation to try and force a plant to key out to what you think it is; judge the specimen on its own characters. It may turn out to be an unfamiliar species similar in appearance to the one you thought it was. When you identify your plant, cross-out the "field ID" in your field book if it is incorrect, and write in the correct name including the authority name [e.g., *Cynodon dactylon* (L.) Persoon].

To examine and measure inconspicuous or hidden diagnostic characters on a specimen, you will often need a source of magnification such as a dissecting microscope or a hand-lens (10-30 \times), some fine dissecting tools (needles, scalpel, tweezers), a wetting agent (to soften the dried plant parts that you wish to dissect), and a small metric measuring rule. Not all plants need to be dissected in order to be identified, but, for those

Important information to include on all labels:

1) **Plant name (if known):** *i.e.*, genus and species, as well as subspecies and variety, if relevant. (Family name is optional information, but helpful.) The authority (person who named and described the plant and/or transferred it to its current status) is also part of the plant name and should always be included. Floras and scientific works provide this information; many "popular" works do not.

2) **Locality data.** Always give country, state, county, and follow it with any other information which would help another person to actually find the site. Make sure that points of reference used are fairly permanent (*i.e.*, "boulder outcrop on NE ridge of Harper Mtn at 4775 feet"; not "about half mile beyond Ernie's farm".) Elevational information is often useful, especially in undeveloped areas. Remember that specimens may be sent out of state or out of the country on exchange, and if all you've indicated for locality is a town or county name, the origin of the specimen may be undecipherable and the specimen be considered useless.

3) **Collector's name.** Try to use your full name rather than initials only unless you are thoroughly ashamed of your specimen and want anonymity. "Collected by B.L.T." is better than nothing, but less than desirable. Also list those people who were with you and helped you to collect the specimen.

4) **Collection date.** This information should never be neglected. Indicating day and month as well as the year informs others as to what time of year the specimen was found in this condition (flowering or fruiting) at that particular locality and elevation.

5) **Descriptive information.** The pressed plant specimen will remain with the label, but there are some characteristics of the plant that will usually be lost. Flower or fruit color should usually be written down, for example, since these will normally fade when the plant is dry. General plant growth habit is often no longer recognizable after the plant is pressed into two dimensions. Try to indicate "upright," "spreading," "prostrate," as well as general height and breadth of the plant. If you collect the entire plant (a small annual, for example), you needn't indicate the height of the plant since that will be obvious enough from the specimen. This information is helpful, however, if you have only taken a portion of the plant. For trees, d.b.h (diameter at breast height) is often helpful info. Indicating whether a plant is an annual, herbaceous perennial, shrub, tree, vine, rhizomatous, tuberous, *etc.*, is always useful if that info is not necessarily obvious from the specimen itself.

Optional but useful information:

6) **Distributing Institution.** In the example above it is RSABG. This info is helpful in a collection since it indicates where the specimen came from. In herbaria, since many of the specimens are received on exchange from other institutions, it is always helpful to know where your specimen came from. If the collector needs to be contacted (and not too many years have passed since the collection date) the collector can usually still be found in association with that particular institution.

7) **Habitat information.** Info about the **local vegetation type** (chaparral; coastal sage scrub...), **soil type** (clay; schist; granite; serpentine...), **slope and exposure of the site** (steep southerly scree slope; open desert flats...), **moisture level** (riparian area; seepage; xeric ridgetop...), **light level** (deeply-shaded canyon bottom; dappled shade under fir trees...), and **associated plant species** (growing with *Artemisia douglasiana*, *Salix lasiolepis*, *Juncus rugulosus*, *Mimulus cardinalis*, and *Alnus rhombifolia*...) can all help to provide valuable data about the plants requirements and tolerances. This collective data about a particular species can then be used to understand its distribution patterns, among

other things. Any info of this sort that can be included on a label will be helpful *provided it is accurate*. Such notes should be made *at the site* on the basis of observation.

Attempting to remember this information later-on can lead to faulty recollections, and faulty information is best left out altogether.

8) Collection numbers. Sequential numbering of specimens is helpful if you plan to collect many specimens over a period of time. Numbering each different plant may help you to keep your records in order. If you number your plants as you collect them or at the end of the day, you can cross-reference the numbered plant specimens to your numbered field notebook where you have written all of your critical information.

Without numbers or a carefully kept code to indicate which plants were collected at what locality and when, you may find that you don't remember if *this* is the grass that you collected up on Mt. Doggy on Thursday or the grass that you collected down in the valley the next county over on Friday. If your information is that fowled-up, you should not guess. Specimens with inaccurate ("bad") information only cause confusion and are less than worthless since they misinform. By using collection numbers and keeping carefully organized field notes, you should be able to pin-point the locality, date, and pertinent info for each numbered specimen. Numbering your collections can also help you to keep track of how many different collections you have made. For some people this becomes an egotistical problem. Remember that the important thing is to collect *quality* plant specimens (well prepared and accurately labeled), not the greatest *quantity* possible. People who collect bad specimens develop reputations very quickly.

Points to remember: Always carry a field notebook when you collect plants and write the information down as promptly as possible while the plants and your memory are still fresh. The more information you can provide on your label, the more useful your specimen will be in an herbarium collection; but be concise. Do not put information on the label that will be obvious enough from the pressed specimen (leaf shape, for example). Numbering your plant specimens and writing the number in your notebook next to the relevant info will save you potential confusion later on. Collect material that is identifiable (flowers and/or fruits whenever possible) and in good shape. Collect enough to "fill" an herbarium sheet. Process your collections promptly.

Sample labels -- good and bad (or, learning by example).

Following are a dozen selected herbarium specimen labels that offer an idea of some of the great diversity in label formats. They have also been chosen to illustrate the quantity and quality of information that may appear on labels and how that reflects on the potential value of the specimen. Keep in mind that there is no such thing as a *perfect* herbarium specimen label. Nevertheless, there are definitely *good* labels and *bad* labels. If you are going to collect herbarium specimens, strive to be one of those collectors who develops a reputation for *quality* plant collections and *dang good* label data.

Figure 8.

UNIVERSITY OF SOUTHERN CALIFORNIA HERBARIUM	
Name	<i>Ranunculus californicus</i> Benth
Locality	<i>Contra Costa Co. Cal.</i>
Habitat	
Collector	<i>Dr. H. de Forest</i>
	<i>3/11 11/11</i>

Fig. 8 -- This collection of *Ranunculus californicus* ("California buttercup") provides the name of the collector, the date of collection, a general locality, and the distributing institution (USC). It also indicates that the specimen was identified by "F.D." -- presumably Freda Detmers. The paucity of information given leaves a lot to be desired. There are even a couple of lines provided on this label format for information about the habitat, none of which is given. It seems likely that this specimen was casually collected by Dr. de Forest "somewhere" in Contra Costa County, and brought in to the USC herbarium for identification. In general, a collection with this kind of information is of little value, overall. If the plant specimen itself is a good one, it may be useful (in comparison with other specimens) for seeing the morphological variation in the species. Most herbarium curators are reluctant to process these types of collections because detailed information has not been taken at the collection site and is rarely forthcoming from the casual collector. Information like "Oh....I think I grabbed that one on Mt. Diablo..." is *not good enough*. Vague locality information such as this may also lead one to wonder whether even the county is correct. If this species was not otherwise known to occur in Contra Costa County, and this was the only specimen citing it from there, many botanists would not hesitate to dismiss it as a labeling error. Hence, the precision of the locality data is important.

Oregon State University Herbarium	
<i>Claytonia perfoliata</i> ssp. <i>mexicana</i> (Rydberg) Miller & Chambers	
John M. Miller May-July 1991	

COLOR	HERBARIUM	SP. NO.
white	EDWARD P. TERRY	
Ord.	Portulacaceae	Height. 15"
Gen. & sp.	Montia perfoliata	
Loc.	San Dimas Cañon	
	Alt. 2000	Date May
Coll.	T	Det. by Tracy

Fig. 9 -- The old label for this collection of *Claytonia perfoliata* ("Miner's lettuce") suggests that it was gathered between about 1895 and 1920; however, there is no collection date given other than "May". The collector is given as "T" -- presumably Mr. E.P. Terry -- and identified by "Tracy". Mr. Terry was probably one of the many amateur local botanists of the time who kept a personal herbarium, but later turned it over to Pomona College. Fortunately, because the specimen has stayed in the area, we know where "San Dimas Cañon" is. However, if this specimen had been sent elsewhere in the country (as often happens, particularly with duplicate collections) the locality would be ambiguous since no state or country is cited. The vague locality name and the species identification would not preclude someone's assumption that the plant came from Mexico. Although the information provided is minimal, the specimen may still serve as a floristic voucher indicating that the species occurred (and likely still occurs) in San Dimas Canyon of the San Gabriel Mountains, and also contributes to the kind of phenological information that can show up in a good flora (the plant could be found in bloom in May). This historical collection has been recently examined and annotated by an expert in the genus *Claytonia*. The annotation label provides their name, the time-frame during which they examined the specimen, the institution that they were associated with, and their determination of the taxon.

HERBARIUM

LOS ANGELES STATE COLLEGE
OF APPLIED ARTS AND SCIENCES

Anemopsis californica Hook.

Herb about 3 ft. tall with white flowers. Chaparral
Community, elev. 3500 ft.

Hwy 399, one mile southeast of Gorman
Los Angeles County
California

Date: 5 July 1963 Collected by: Brian C. Miller

46875 8-61 10M SPO

Fig. 10 -- This label for *Anemopsis californica* ("Yerba Mansa") is fairly simple, but provides reasonably good, concise information. The collector, date, locality information, elevation, and general plant description seem fairly straight-forward. The description of "white flowers" probably refers more to the overall appearance of the inflorescence, however, since the individual flowers are insignificant in appearance but are subtended by large, showy white bracts. Somewhat more ambiguous, though, is the citation of the habitat as "Chaparral Community", since *Anemopsis* typically grows in low, wet (often swampy) areas. In this habitat, any shrubs that occur are most likely to be willows since chaparral plants do not typically tolerate a water-logged root system. When giving habitat information, remember to observe it carefully and state it clearly. The habitat information given on this label might have stated it more clearly as "low, marshy meadow with chaparral on surrounding slopes".

RANCHO SANTA ANA BOTANIC GARDEN

Arenaria paludicola Robinson

Det. Timothy S. Ross iii 1994.

PLANTS OF SOUTHERN CALIFORNIA

No. 941.

***Arenaria palustris*, Watson.**

In swamps, San Bernardino Valley.

May, 1882.

Coll. S. B. & W. F. PARISH, San Bernardino. *Al. v. s.*

Fig. 11 -- One of the most important uses of herbarium specimens is in historical documentation of plant distributions. This is evident in this label example for *Arenaria paludicola* ("Marsh sandwort"). This label is not greatly detailed, but provides concise locality and habitat information (Southern California: San Bernardino Valley: in swamps), an indication of the collectors (the Parish brothers, Samuel and William, of San Bernardino), the collection number for the specimen, and the date. This rare species used to occur in freshwater marshy areas near San Bernardino, in the Los Angeles Basin, and northward to Washington

Fig. 13 -- This collection of *Platystemon californicus* ("Cream cups"), a very pretty member of the poppy family, also serves as a historical document. It was collected in 1922 in a bare area on a sandy hillside (possibly a burn) in or near Culver City. One would be hard-pressed to find a single *Platystemon* growing at Culver City today. Such specimens provide valuable insight into past plant occurrences in areas that have now had their natural vegetation destroyed. The label indicates that the plant was both collected by and identified by Frances Morey. "Det." simply means "determined by". If a specimen label provides the name of the plant, but there is no additional indication of who identified it, the general assumption is that the person who collected it also identified it. If you collect a plant and someone else identifies it for you, it is common courtesy to indicate on the label who identified it for you. Also, if you re-identify someone else's specimen, you should use an annotation label that clearly indicates who provided the re-determination. In the specimen above, the label is accompanied by a recent annotation label giving the researcher's name, the acronym of the herbarium that they are associated with (EMC), the date of the annotation, and their confirmation that the specimen is correctly identified.

RANCHO SANTA ANA BOTANIC
GARDEN (RSA)

Keckiella antirrhinoides (Benth.) Straw
var. *antirrhinoides*

Det. Timothy S. Ross 1993

PLANTS OF LOS ANGELES COUNTY
Scrophulariaceae

Keckiella ternata (Torr. & Gray) Straw ssp. *ternata*

San Fransquito Canyon Pump House 2 1500'
Chamise Chaparral with riparian woodlands.

~~Uncommon red-flowered 2' tall perennial~~

Wandale^e_A Thompson 3 4-11-64

Fig. 14 -- The example here for a specimen of *Keckiella antirrhinoides* ("Yellow-flowered bush-penstemon") illustrates several bad "no-no's". The specimen represents one of several plants that were collected by Wandalee Thompson in 1964 and stored by her, unprocessed, until they were obtained by another amateur botanist. With a paucity of information available for the plant collections, the botanist then put names on the collections, generated labels, and turned the specimens over to our herbarium. Let me point out a few problems... First of all, the botanist misspelled the collector's name, which is no grave error but certainly a dis-courtesy. Secondly, the botanist who identified and processed the collections made no indication on the label, or by means of an annotation label, that the material was processed by someone other than the collector; consequently, it looks like "Wandale" Thompson identified the plants and made the labels. Thirdly, the date should never be written in this short-hand form. *Always* give the full year. Some herbarium collections are well over 200 years old and, if herbarium specimens last indefinitely as they are intended to, a date like this will become more ambiguous as time goes on. *Always* spell out the month or use roman numerals for it. A duplicate of this specimen, if it were sent to Europe, would be assumed to have been collected November 4th, not April 11th. Most seriously, however, the botanist who processed the collection quite clearly did not bother to examine the specimen closely when they "identified" it. At a quick glance, they mis-identified it as *Keckiella ternata*, a species with a narrow-tubed, reddish-orange corolla. Then, based on their mis-identification, they made up the descriptive information as "Uncommon red-flowered 2' tall perennial". Examination of the specimen prior to filing it into the herbarium revealed that the plant was actually *Keckiella antirrhinoides*, a species with a short, broad, clear-yellow corolla, smaller leaves, and different leaf arrangement -- hence the annotation label. *Never, never, never* make up

state, but is now nearly extinct due to habitat destruction. The last known locality is on the Nipomo Mesa near Black Lake (San Luis Obispo County) where the few plants are threatened by development.

This label also serves to illustrate something about plant names and their authors. The species was originally described as *Alsine palustris* in 1863 by Albert Kellogg of the California Academy of Sciences, based on a collection from San Francisco. In 1876, the species was transferred to the genus *Arenaria* by Sereno Watson, in which case the name for the species would properly be written *Arenaria palustris* (Kellogg) S. Watson [the parenthetical author has been left out on the Parish label, as was usually done in that era]. However, the botanist B.L. Robinson realized that the name *Arenaria palustris* had already been used for a different species by Claude Gay in 1845. The rules of nomenclature require that each species have a unique name in order to avoid confusion; consequently, since Gay's name preceded Watson's nomenclatural combination by 31 years, it had priority and was retained for the species that Gay described. Robinson then proposed the new name *Arenaria paludicola* for Kellogg's species in 1894. Robinson was apparently sensitive to the potential disruption of name changes, since the specific epithet that he proposed, "*paludicola*", and the epithet that it replaced, "*palustris*", both mean the same thing: "inhabiting marshes". The Parish label, above, uses the species name that was considered correct in 1882.

14831

FLORA OF UNITED STATES.

MINNIE REED.

Erigeron Philadelphiaicus *Linna*

Loc. Pomona Valley, Cal.

Coll. Apr. 2, 1896

Fig. 12 -- The label above, for a collection of *Erigeron philadelphicus* ("Philadelphia fleabane") from 1896, serves as another example of a historical collection. The amount of information provided is minimal; nevertheless, the specimen serves as our only document that this species used to occur here in the valley. Historically, this species had a broad distribution -- from Labrador to British Columbia and Florida to California -- but despite this distribution pattern it tends to be locally rare and nowhere abundant. Other herbarium vouchers indicate that, in Los Angeles County, this species used to occur at Puddingstone Canyon in the San José Hills, and along the San Gabriel River at El Monte and Long Beach. In our area, it tended to occur along low elevation riparian margins. It has not been documented in the county since 1934, and apparently has fallen victim to the channelization of our streams and rivers and the urbanization that followed in subsequent decades.

FLORA OF NORTH AMERICA
(EMC)

Platystemon californicus Benth.

Annot.: Gary L. Hannan Aug 1991

UNIVERSITY OF SOUTHERN CALIFORNIA
HERBARIUM

Name *Platystemon californicum*, Benth.

Cream Cup

Locality *Culver City*

Habitat *Base of Sandy Hillside*

Date *Apr 14, 1922*

Collector *Frances M. May*

the information that you put on a label. Always write down your observations when you are in the field and can examine the fresh plants and their surroundings directly. In this case, the botanist couldn't even rely on his faulty memory because he had never been at the site when the plant was collected. Making up information in this manner is an inexcusable sloppiness that leads to confusion and -- worse yet -- may result in mis-information ultimately getting into the literature.

Rancho Santa Ana Botanic Garden
PLANTS OF CALIFORNIA

No. 114 SW San Bernardino County

Viola douglasii Steud.

SAN BERNARDINO MTS, ARRASTRE FLAT; near 34d 1m N, 117d 5m W;
Elev. 7450 ft. Sparsely vegetated clay soil w/ pavement of
Saragosa Quartzite pebbles. Spotty distribution; loose
patches. Assoc. spp.: *Arabis parishii*, *Arenaria ursina*,
Artemisia nova, *Draba douglasii*, *Lewisia rediviva*, *Lomatium*
nevadense, *Poa incurva*.

Mary H. O'Brien April 29, 1978

Insect visitors (1978): Visited occas. by *Bombylius*
major (bombyliid fly), pierid butterflies, syrphid flies.

Fig. 15 -- Moving on to a much better label, this collection of *Viola douglasii* ("Douglas' violet") illustrates the kind of information that results in a useful collection. The label is well-organized with information presented in discrete areas. The label indicates the distributing institution (RSABG), the collector's name and their collection number, the date of the collection with the full year and the month spelled-out, the locality (state, county, mountain range, named locale) supplemented with latitude and longitude coordinates to degrees and minutes, elevation, a description of the substrate, local abundance information for the species, and a selected list of species that the plant was growing in association with -- all of which contribute to a better visualization of the habitat. In this case, the label also provides information on insects that were observed visiting the flowers of the violet in 1978. A specimen with this kind of label data can provide valuable information to Floristic Botanists, Taxonomists, Entomologists, and Ecologists, among others.

PLANTS OF THE WESTERN STATES

Viola douglasii Steud.

gentle_rocky and gravelly slope just east of
Doble cemetery, 0.5 air mile ESE of site of
Doble; SW $\frac{1}{4}$ of S. 31, T. 3 N., R. 2 E.
Common in gravelly soil near pinyons.
Foodplant of *Speyeria coronis semiramis* in
this area (Lepidoptera: Nymphalidae).

STATE: California COUNTY: San Bernardino
DATE: May 11, 1980 ELEV.: 6800 ft.
COLL.: John F. Emmel No. 708

Fig. 16 -- For comparison of style and purpose, this collection from 1980 of the same species, *Viola douglasii*, serves as a voucher documenting it as a food plant for the larvae of The Semiramis Fritillary. The collector, John Emmel, is a Southern California entomologist primarily interested in butterflies. When he and Thomas Emmel published their book, "The Butterflies of Southern California", in 1973, the foodplant for this species of butterfly was listed as "unknown" because it had not yet been documented. Making an herbarium specimen of the plant provides a permanent, primary reference that can be examined and verified by other researchers for decades to come.

RANCHO SANTA ANA BOTANIC GARDEN
 Plants of San Diego County, California, USA
 SALICACEAE

Salix laevigata Bebb var. *araquipa* (Jeps.) Ball

Southern Santa Ana Mountains, San Mateo Canyon Wilderness Area. Devil Canyon at the confluence with "Miller Creek", T8S R5W NE1/4 SW1/4 sec. 15. Elev. ± 1760'. Surrounding slopes with chaparral of *Adenostoma fasciculatum*, *Ceanothus crassifolius*, *C. spinosus*, *Quercus dumosa*, *Rhamnus ilicifolia*, and *Heteromeles arbutifolia*. Canyon bottom with *Quercus agrifolia* woodland on higher benches and riparian woodland of *Platanus racemosa*, *Salix lasiolepis*, and *Baccharis salicifolia* along active stream channel.
 Tree, infrequent along stream.

Steve Boyd 7550 . June 4, 1992
 Tim Ross, Mike Wall

Fig. 17 -- This collection of *Salix laevigata* ("Red willow") serves as a voucher for floristic surveys that were conducted in the south end of the Santa Ana Mountains -- an area that was very poorly known botanically. Since wilderness areas often have very few named points of reference, Township, Range, and Section data, as well as elevation, have been used on the label to provide greater precision in the locality information. The general vegetation of the collecting locality is characterized by specifically naming the dominant plants along the canyon bottom as well as those on the surrounding slopes. This allows other researchers to better visualize the habitat. Since only a portion of the plant was collected and pressed, the label indicates that the plant grew as a "tree", not in bush form. On this label, three collectors are named. Note that when collection numbers are used and there is more than one collector, the number is placed next to the collector whose number was used so that there is no confusion. The collector whose number was used is usually also the individual who bore the responsibility of identifying and processing the collection. It is generally unethical to put your number on a plant that someone else collected and brought to you unless you and the collector agreed upon such an arrangement in advance.

HERBARIUM OF U. C. RIVERSIDE
 Plants of Riverside County, California

Oxytheca trilobata Gray PLG
 Det. by A. C. Sanders, Aug. 1990

SW Durasno Valley, S of town of Anza. (Near 116°42'W, 33°28'N). Elev. ±4500 ft. Chaparral, with Adenostoma sparsifolium, Bromus tectorum, Cercocarpus betuloides, Eriogonum fasciculatum, etc., on gentle, gravelly open slope. Annual with branches spreading; 2½-3 ft. diam. canopy.

Chet McGaugh 8 Aug. 1990

Fig. 18 -- This label for a collection of *Oxytheca trilobata* ("Three-lobed oxytheca") gives a general locality based on named locales; the approximate distance south of Anza would have added some precision, but the locality is honed a bit with latitude and longitude coordinates and elevation. Since the pressed specimen accompanying the label consisted of one inflorescence branch removed from the basal rosette of the plant and pressed, the growth form of the plant is not discernable. Consequently, the label specifies that the plant was an annual with the inflorescence branches spreading to form a 2.5 - 3 foot diameter canopy (very robust for this species). This is an example of how information on the label complements the pressed specimen by providing additional data that would not otherwise be evident. Note also that while Chet McGaugh collected the specimen, it was identified by A. C. Sanders and the credit for the determination was recorded on the label. As an aside: when the determiner's name is being placed on the label, the best place for it is immediately below the plant name as shown here. The letters "PLG" that appear on the label are a three-letter abbreviation for the plant family, Polygonaceae. Some botanists use these abbreviations to save space on the label.

PLANTS OF THE CALIFORNIA ISLANDS

Polemoniaceae

Linanthus androsaceus (Benth.) E. Greene

Corollas white with yellow throat; anthers yellow.

Santa Barbara County: Santa Cruz Island. Upper portion of Cañada de los Sauces, 1.2 miles W of intersection with S Ridge road. Locally common on NW-facing slope in grassland; Blanca Volcaniclastics. Elevation: ca. 800 feet.

Associated species: *Avena*, *Hypochoeris glabra*, *Triodanis biflora*, *Corethrogyne filaginifolia*, *Mimulus longiflorus*, *Bromus diandrus*, *Pityrogramma triangularis*.

Steven A. Junak SC-731 5 Jun 1983

SANTA BARBARA BOTANIC GARDEN (SBBG)

Fig. 19 -- Finally, this label for a collection of *Linanthus androsaceus* ("Common linanthus") shows the information broken down into discrete units in order to facilitate reading. In this case, the name of the distributing institution is placed at the bottom. Locality information starts at a broad level (California Islands: Santa Barbara Co.: Santa Cruz Id.) and channels down to a general locale (Upper portion of Cañada de los Sauces) with the site specified more closely by elevation and direction and distance from a particular point. Habitat information is defined/refined by giving us the substrate type, vegetation type, direction of slope at the site, and a selected list of other plants that this species was growing with. Since an entire specimen of the plant is mounted on the herbarium sheet, it is not necessary to include a lot of descriptive information. Here it is limited to flower and anther color. As with most other types of information, get in the habit of writing down the flower color of the plant when you have the fresh material in front of you. For some groups of plants, having notes on the flower color will prove helpful, and occasionally indispensable, when you are trying to key it out. With the genus *Gilia*, for example (a close relative of *Linanthus*), the key that you're trying to use may ask for the color of the corolla limb, throat, and tube, as well as the color of the pollen or anthers. If you've taken the time to write that information down in your notes, you will be in a much better position to identify what you've collected.

While most botanists who number their collections will use one consecutive series of numbers for all of their collections, Steve Junak has used a modified collecting number. His number "SC-731" indicates that it is his number series from Santa Cruz Island, and distinguishes it from the series of plants that he has collected on the other islands or on the mainland. His series of collections on Santa Rosa Island, for example, would have the number preceded by "SR-". There are various types of numbering systems that can be used for keeping track of your collections. The important thing is that you consistently use one well-organized system that allows you to un-erringly correlate your plant specimens with their respective collection information.

References

Although not on any best-seller lists, the books listed here provide additional details on collecting, preparing, and/or caring for herbarium specimens.

Anonymous, 1971. Preparing herbarium specimens of vascular plants. Agriculture Information Bulletin No. 348. U. S. Dept. of Agriculture, Washington, D.C.

Forman, L. and D. Bridson. 1989. The herbarium handbook. Royal Botanic Gardens, Kew, Great Britain.

MacFarlane, Ruth B. Alford. 1985. Collecting and preserving plants for science and pleasure. Arco Publishing Inc., New York.

Savile, D.B.O. 1962. Collection and care of botanical specimens. Publication 1113. Plant Research Institute, Central Experimental Farm, Canada Dept. of Agriculture, Ottawa, Ontario, Canada.

Herbarium Supplies

Although there are several suppliers of herbarium materials in the U.S., the following address is given as a convenient local resource for plant presses, press straps, ventilators, and other items. A price list is available.

Herbarium Supply Company, 3483 Edison Way, Menlo Park, CA 94025.