

# From Each a Voucher: Collecting in the Living Collections

*Sandra Elsik*

**Arboretum volunteers have been instrumental in collecting and organizing voucher specimens for verification**

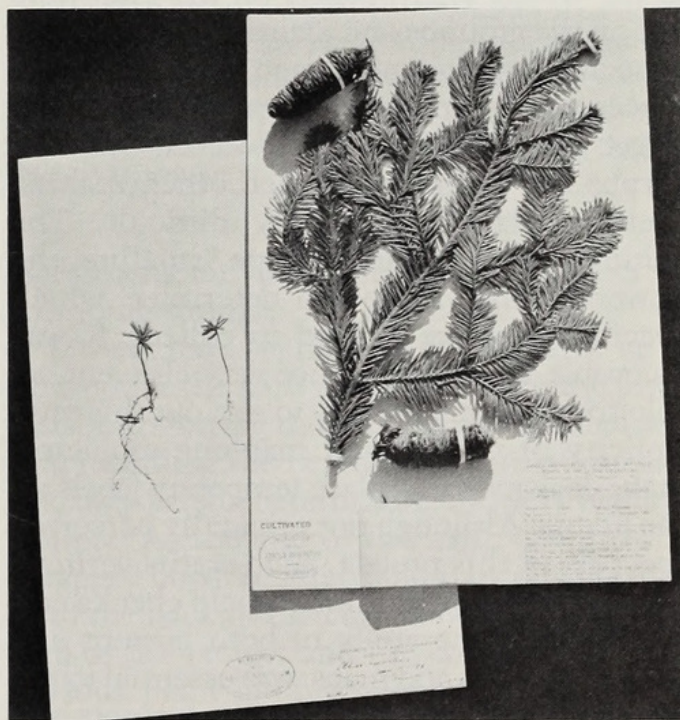
## Tracking Down the Accessions

In January, 1984, the verification project presented us with the challenge of collecting multiple voucher specimens from over 14,000 accessioned, or catalogued, plants on the 265 acres of the Arnold Arboretum. How were we to organize, implement, and complete this monumental project within the six years granted by the National Science Foundation? Taking Director Peter Ashton's suggestion to enlist the aid of volunteers for collecting specimens, we recruited, trained, and organized a large group into crews of three, each crew working three-hour shifts.

We made a priority list of genera to try to collect during the first season; it consisted primarily of those that were to be identified by an out-of-house authority. We decided to collect from only one plant within each accession lot. Although we began collecting from the horticultural cultivars, we later discontinued that practice to concentrate on the naturally occurring species and variants. In an effort to avoid revouchering accessions, we began a tedious, methodical herbarium search to record existing voucher specimens. We found so few that we abandoned the effort. Volunteers later resumed the search, looking for specific vouchers.

We knew the Arboretum had a good series of grid maps, with each accessioned plant's location clearly marked. (See the article on mapping by Ethan Johnson.) I developed a color-coded system of symbols that manually

tracks each plant's collection status on the project's copies of both the maps and the printout (the Plant Sciences Data Center's computer listing of accessioned plants in our collection). The status of record labels on the



*Voucher specimens of Abies nephrolepis. Voucher specimens are cuttings taken from a plant, including leaves, flowers, cones or fruits, and other significant parts. In addition to preserving vegetative and reproductive characters for identification purposes, the specimens also document stages or aspects of the plant's morphology as it existed at a particular date. Note that modern labels record much more information. Photograph courtesy of Rácz and Debreczy.*



plants and the accuracy of the maps are also tracked on this system. We have known all along that our tracking system could be handled very easily on a computer, but *BG-BASE* was still in the planning stages and our project's deadline prevented us from waiting for the system, which is now on-line (see the article on *BG-BASE* by Kerry Walter). The manual tracking system was the precursor for that portion of *BG-BASE* that tracks voucher specimens.

Translating a specific map location into ground reality was not as simple as I had hoped. Due to years of being seriously short staffed because of financial problems, the living collections had become somewhat less than perfectly curated despite the best efforts of the curatorial staff. Some groups, such as the maples and the lilacs, were very well labeled and mapped; others were a nightmare. Record labels were missing or had "traveled" to the wrong plant; plants on the map were not on the grounds and plants on the grounds were not on the map; map locations were inaccurate; large, spontaneous plants of the target group had not been weeded out; and shrubs had layered into each other, making their separation extremely difficult. The volunteers spent a lot of time "smelling the flowers" while I tried to determine which specific plant we needed to collect. It was enjoyable for them but not very efficient, so solo trips became the way to sort out this multiplicity of records and mapping problems, make decisions, and place temporary labels on the plants. Although not originally perceived as a part of this project, such status verification, accomplished through field checks correlated with the study of both current and archival records and maps, was essential to the validity of the project: without accurate status information, any subsequent taxonomic verification is useless. Much-needed assistance to field-check and remap the densely planted areas at the top of Bussey Hill came in the form of a one-year Institute of Museum Sciences grant. At the completion of the grant, one of the curatorial assistants remained on the plant-records-office staff and

has continued to field-check and remap major areas. Additional assistance came from summer student interns and volunteers in the plant records office. It still requires all of us working in cooperation with each other and with the horticulturist, the grounds supervisor, and the grounds crew to make the grounds and maps workable. (See the article on plant records by Jennifer Quigley.)

### Making the Voucher Specimens

To collect and make the voucher specimens, we use a crew of three: a staff map person (usually me), a volunteer press person, and a volunteer label person. The map person must first locate the desired plant, find its record labels, and make sure that the map information agrees with the surrounding plants and their record labels. When finally satisfied that the plant under consideration is indeed the targeted accessioned plant, the map person must then determine if the plant is ready to collect. (Usually this means that the anthers of a flower are shedding pollen, or that a fruit has reached its final color and its seeds are mature. Flowers may be very ephemeral, last-



A *Liquidambar* specimen being trimmed at the time of collection to the size of a herbarium sheet. Extra fruits are included for later dissection or study. Photograph by Sandra Elsik.



ing no more than a day or two. Later, we are often in competition with squirrels, birds, and even humans to collect the fruit.) The map person announces the genus name and accession number, which are written, along with the date, on both the margin of a newspaper sheet and a field-label form.

The first volunteer, serving as the press person, examines the plant for branches with an ample sampling of reproductive material and then makes cuttings for (usually) three specimens. These specimens, arranged to show upper and lower surfaces, are placed inside the labeled, folded newspapers and are folded or trimmed to fit and to reduce overlapping. Large fruits are sectioned to reduce bulk and to show internal structures. The specimens inside the newspapers are stacked alternately with sheets of corrugated cardboard (corrugates) to make a plant press inside the collecting cart.

Meanwhile, the second volunteer, the label person, fills out the field-label form, recording name, number, and location of the plant. Any characteristics not visible in the finished specimen, such as height, habit, and DBH, are recorded. The DBH, or diameter at breast height (four and a half feet above ground level), is measured with a special tape that converts a circumference reading into a diameter measurement. It is measured on the largest stem of the plant, a simple task except when the stem is protected by sharp thorns or prickles or by a dense growth of poison ivy. We need not record characters such as the number of petals or the kind of pubescence because they will be visible in the finished specimen. Characters that are altered in the drying process must be noted; for this reason our field-label form reminds us to indicate the color of various parts and the presence of glaucousness (waxy coating), scent, or exudate.

One early concern was our ability to reach the reproductive parts on tall trees. Fortunately, most of the trees produced flowers and fruits on limbs easily reached with our 12-foot pole pruner. For the exceptions, we were lucky to have the assistance of two members of our grounds crew, who reached the



*The collecting cart stores maps, a clipboard with blank field-label forms, stacks of single-fold newsprint, the press ends and straps (threaded so that the rods will not be caught in the strapped-down press), cardboard corrugates, and other supplies. Within the cart, the stack of corrugates shrinks as they are used to build the press; here Sandra Elsik and Volunteer Sue Avery lower the shelf to allow more room for the growing press. With its flaps chained shut, the cart is easily wheeled to a nearby collecting spot. When the work shift is over, the press is strapped down and is easily removed. Photograph by David Michener.*

specimens for us in the bucket truck or by climbing the tree.

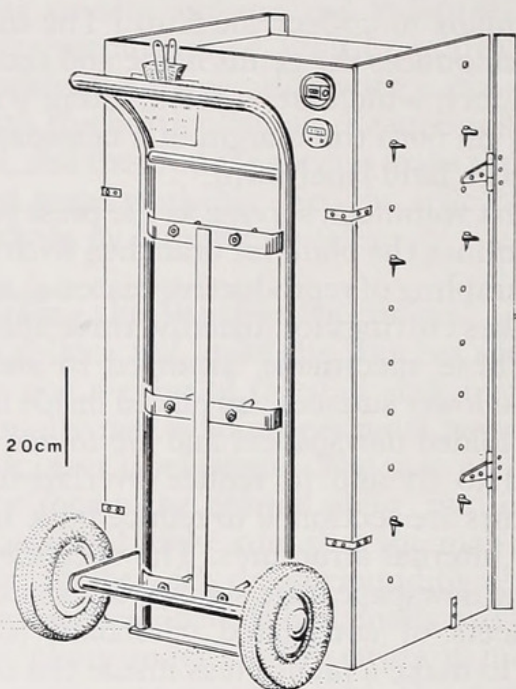
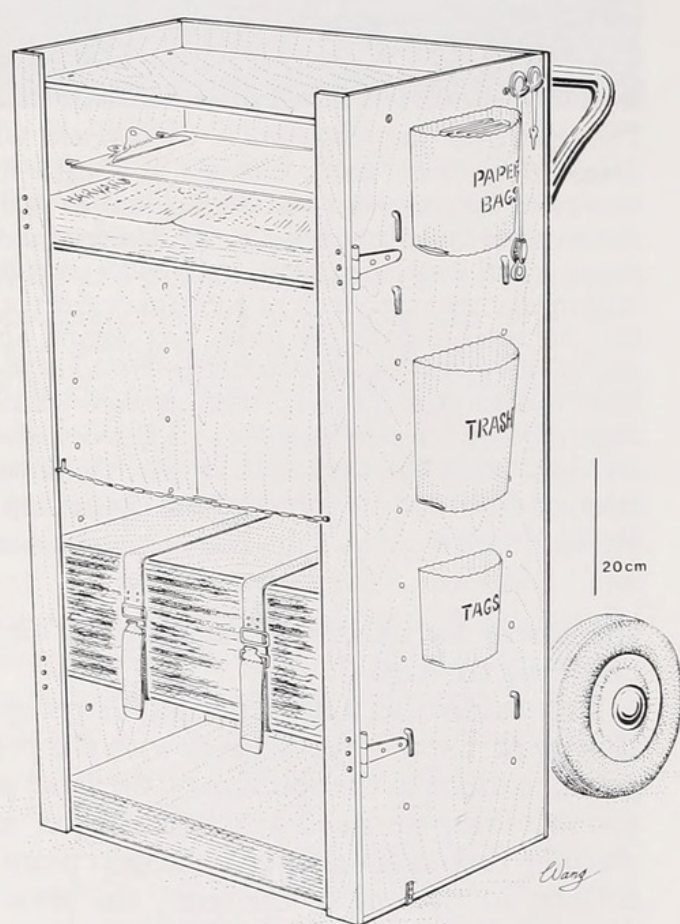
If there have been no major problems up to this point, the shift progresses with the press person collecting the specimens, the label person recording the necessary information, and the map person determining the next plant to collect. At the end of the shift, the press is strapped down securely and the cart is loaded into the back of the car. (As we approach the end of the project and the collecting within various plant groups is completed, we find ourselves moving around the grounds to collect from scattered plants rather than making many collections in a single area. Since it is difficult to move the cart over long distances, we now usually collect into field presses in the back of the car rather than use the cart.)

Back in our basement workroom, foam pads may be inserted between thick specimens to maintain pressure on the leaves so that they



### Construction Details for Collecting Cart

Our collecting cart carries supplies and organizes work space for a three-hour work shift within a restricted collecting area. The box, of  $\frac{1}{2}$ " plywood (or aluminum, if weight is important), is bolted flush to the base of a hand truck. Internal measurements were calculated to provide tight fit for a standard herbarium press. The fixed



wood top shelf is recessed to form a work surface with three sides. All other shelves are corrugates or the work materials themselves resting on pairs of  $\frac{1}{4}$ " metal rods that are longer than the width of the box. Rods, stabilized by a 90° bend at one end and a cotter pin through a hole in the other end, fit into paired holes in the box sides, allowing the shelves to be moved up or down. The flaps and chain allow access yet prevent supplies and the press from falling out. A pencil sharpener and a digital clock are glued on the upper exterior back of the box. Cart design by S. Elsik, construction by R. Famiglietti, illustration by Le-zhong Wang.

dry wrinkle free. The press then lifts right out of the cart, ready for tightening and placing on the dryer. Plant dryers can be constructed of various materials and in different configurations. Ours is a long, low, rectangular, plywood box, open at the top and bottom. It is bolted together and fitted with a strip of incandescent light bulbs that produce just enough

heat to flow upward through the channels in the corrugates. This heated air gently dries the specimens over a period of two days to two weeks (depending on their resistance to drying).

The labeled newspapers containing the dried specimens are removed from the presses by our volunteers, who sandwich together all



the sheets from the same plant. Packaged in plastic, the specimens are frozen to kill any potentially harmful insects or their eggs. The packages are labeled by date of collection and stored in banks of herbarium cases.

Meanwhile, the field-label form is matched with the corresponding entry in the printout in order to record the collection and its date. Several things are checked for accuracy: the scientific name and its spelling, the accession number, and the location. Any discrepancies must be resolved before the labels can be processed. Also copied to the printout are any notes on the record label or map questions encountered in the field. Later all problems of this type are reported to the plant records office.

The field-label forms are passed on to the project typist, who looks up the immediate source information for the accession and the author citation for the name. All the information is then typed into a label-printing computer that creates the required number of herbarium labels. Processing the labels in batches by date of collection makes it easy to match them to their specimens, which were also stored by date. Volunteers assist again by inserting one label into each newspaper/specimen. Specimens are then sorted and stored, this time by genus, in another bank of herbarium cases.

Once the collections representing a genus are complete, or nearly so, all the specimens of that genus are sorted by accession number so that the flower specimen can be matched to the fruit specimen. All the specimens from a given accession lot are spread across the table, and the accession numbers on the newspapers and the labels are checked to make sure that they agree. The specimens are checked against "listgen," the list of vouchers that the label-printing computer says we have collected for the genus; occasionally we have to search for missing ones. The specimens are sorted into sets, each containing one flower and one fruit. One set is for the Arboretum, one is to be used as a gift for the out-of-house authority if any (in return for an identification), and others are for exchange with

selected institutions. Corrections are made to listgen, which then serves as a packing list and a record of what specimens were sent to whom. Eventually listgen's data will be incorporated into *BG-BASE*. The sets are then packaged, refrozen, and mailed out-of-house or delivered to our herbarium for mounting by staff and volunteers. Finally they are ready for taxonomic verification. (See David Michener's article on verification.)

### Sorting out the Accumulated Confusion

With the specimens distributed, the final task is to resolve the various problems now recorded in the project copy of the printout. The variety of difficulties that can occur—everything from missing record labels or transposed accession numbers to very complex problems that involve searching the "dead" card file and archival maps—is always amazing. With misidentified plants being received and multiple chances for confusion to occur, any accurate record is a triumph. (*BG-BASE* on our new computer system will help prevent the repetition of many of these same errors.) After trying several other methods, we have found that it is most efficient to relay the problems in an entire genus or family en masse to the plant-records-office staff. They then make the necessary changes to all the records and prepare any needed metal record labels for us to hang on the plants.

Having all the collection activity recorded on the project copy of the printout allows quick scanning of a genus to determine which specimens still need to be collected. Often the targeted plant cannot be found on the map; further searches may reveal that the plant died some time ago but was never cleared from the records, or that the plant is still on the grounds although its map entry has been inadvertently deleted. The most frustrating and unresolvable problem is the number of plants that do not flower, or that flower but do not produce mature fruits. Whatever the reason for this functional sterility, we must look at the plant again and again, season after season, on the chance that it will eventually become reproductive.





*Susan Hardy Brown prepares herbarium specimens by gluing the pressed, dried material to archival-quality rag-paper sheets. Susan, formerly a volunteer and now a staff member, advises the volunteers who perform this specialized task. Photograph courtesy of Rácz and Debreczy.*

When we have both the flower and the fruit specimens from a given accession, its accession-number entry is highlighted on the project printout with a yellow marker. Since the accession-number entries form a column of their own in the printout, our goal is to highlight the entire column. Any entry needing a specimen is marked with a color-coded sticker, which makes the scanning procedure even easier. Volunteers copy the highlighting and the collection stickers to the project maps. The map stickers are especially help-

ful in seeing at a glance what is needed from a particular map. Often we write the expected date of collection on the sticker. Our volunteers particularly enjoy copying the highlighting to the maps, since it means that one more plant's collections are complete. The goal is to highlight the entire map. As this process nears completion, occasionally a plant turns up on the map (and the grounds) that is not in the printout or the "live" card file—just one more way in which the dual tracking system allows us to double check, or verify, the



accuracy of our record entries. The concluding map procedure will be to compare our project maps to the official plant-records maps to assure that they are in agreement.

### **Realizing Our Goals and Looking to the Future**

As the 1988 collection season came to a close, our collection goals, as originally defined, were essentially complete. We have made a total of 7480 collections averaging three sheets apiece. Immature plants, most cultivars, and certain hybrids were excluded. Now our volunteer crews eagerly anticipate fresh computer-generated lists and maps, complete with collection markers, as we begin collecting specimens from newly maturing plants as well as those previously sterile.

Highlights of five years of field-checking, status verification, and detective work have included resolving major problems with accessions on Peters Hill, in the Center Street Beds, in the Weld Street Tract, and along Linden Path. A variety of special collections, such as the honeysuckle family, the legume family, the rose family (especially the cherries, hawthorns, and mountain ashes), the hollies, the rhododendrons, and the willows presented complex mapping and records problems. As

a result, by the end of the grant period, 1743 missing plants, 1346 plants needing record labels, and 1349 other miscellaneous problems will have been reported to the plant records office. There remain a few plants, mostly vines on fences, that are still mapping or records mysteries.

Working on the verification project has been very satisfying. Breaking the project into small parts gave us a multitude of small goals to accomplish and provided important built-in rewards for both staff and volunteers. Our achievements (complementing the work of the plant-records-office staff and everyone else working with our living collections), plus implementation of *BG-BASE*, have helped us realize an exciting and long-sought objective. How rewarding it is to be out collecting in an area that had previously been a problem and to be able to find our targeted plant, complete with record label, exactly where the map says it should be! Our future visitors, whether amateur plant lovers or professional plant researchers, will be able to access and use our living collections with ease and confidence.

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Sandra Elsik supervises the collecting phase of the verification project.



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