

## **DESERT BOTANICAL GARDEN HERBARIUM COLLECTIONS POLICY**

### **Desert Botanical Garden Mission Statement**

The Garden's commitment to the community is to advance excellence in education, research, exhibition and conservation of desert plants of the world with emphasis on the Southwestern United States. We will ensure that the Garden is always a compelling attraction that brings to life the many wonders of the desert.

### **Desert Botanical Garden Herbarium Mission Statement**

The herbarium program represents the pursuit of excellence in the ongoing process of acquisition, curation, and long-term preservation of plant specimens and associated data collected from arid and semi-arid regions. Access by a wide audience of users to these scientific collections and information directly supports the creation, dissemination, and application of knowledge about these plants and the unique environments that sustain them.

### **Statement of Purpose**

The purpose of this collections policy is to guide the process of acquisition, curation and long-term preservation of the collections and data necessary for the creation, dissemination and application of knowledge.

### **Legal & Ethical Consideration**

Desert Botanical Garden Herbarium's collecting policies, procedures and activities will strive to comply with all relevant international, national, state and local laws, and trustee policies and directives regarding these collections and collection activities (e.g. CITES, ESA). In addition, all staff members of the Desert Botanical Garden must follow any Intellectual Property policies. Plants that are known to have been collected illegally cannot enter the collection.

### **Scope of the Collection**

For the purposes of this document, the Desert Botanical Garden's Herbarium collections are interpreted to include those materials owned outright by the Garden.

The Herbarium Collections are divided into eight categories:

Type specimens: the nomenclatural type collection include specimens that are important elements of botanical nomenclature, as the name of a taxon is permanently attached to the type, whether as a correct name or as a synonym. DES has 98 types of which there are 21 holotypes and 77 isotypes.

**Taxonomic:** the taxonomic collections focus on major plant families or groups of plants, including Agavaceae (*sensu lato*) and Cactaceae, having an important presence in arid and semi-arid regions from primarily New World regions, but are not limited to these geographic regions.

**Geographic:** the geographic collections focus on plants from the arid and semi-arid regions of the southwestern United States and adjacent Mexico, and other warm deserts of the world. Plants outside of the geographic definition may be included taxonomically as part of the familial collections.

**Rare:** the rare plant collections focus on plants within the taxonomic and geographic collections deemed susceptible to imminent danger of being extirpated. Special concern will be given to those species listed by federal and international agencies. Herbarium specimens will include those of the Garden's rare living specimens. Plants from which seed is collected and plants grown from collected seed will also be vouchered as a herbarium specimen.

**Horticultural:** horticultural collections focus on plants in the Garden's Living Collection that are accessioned, including wild-collected plants introduced to the trade and man-made varieties having horticultural interest.

**Ethnobotanical:** the ethnobotanical collections include taxa that have played an important part in the lives of arid and semi-arid region peoples, these uses established by historical, ethnographic or archaeological information and/or present-day documented use. Important ethnographic collections include those of Leonora Curtin, Amadeo Rea, Gary Nabhan, Howard S. Gentry and plants associated with Plants and People of the Sonoran Desert trail.

**Historic:** the historic collections are a link to the Garden's own historical development. Important collections include those of E.R. "Jim" Blakely, W.T. Marshall, Rose Collom, George Lindsay, George Hinton, A. A. Nichol, Hubert Earle, Howard S. Gentry, and Edward Anderson.

**Synoptic:** the synoptic collections include plants that will be dedicated for use in symposia/conferences, classes or exhibits only (ex., life-long learning education classes, Botanical Art and Illustration Program). Synoptic specimens will be indicated as such, without a DES accession number and not accessioned, stored separately from the main collection.

The Herbarium collections also have specimens that are not pressed and dried.

- 1) "spirit" or wet collections
- 2) box specimens

## **Acquisition Requirements**

Acquisitions concentrate on:

- a) Specimens from arid and semi-arid regions of the southwestern U.S. and northern Mexico that have received little botanical attention and other areas in which a DBG staff member is working actively
- b) Specimens of taxonomic groups studied by DBG staff members
- c) Living Collections
- d) Other acquisitions of less priority are arid and semi-arid regions of the Old World and Old World succulent taxonomic groups
- e) Specimens that support other various Garden functions in education, exhibits and interpretation (ex., ethnobotany, Plants and People of the Sonoran Desert)
- f) Synoptic Collection for teaching/interpretation purposes only

Sources of new additions are:

- a) Specimens collected by staff members or volunteers
- b) Specimens received on exchange from institutions that maintain a formal exchange with DES
- c) Specimens received as a gift or gift for identification

Staff will strive to develop a herbarium with collections that contain substantial information and associated data that can be readily attached to a herbarium sheet (e.g., associated ecological, environmental, ethnobotanical information). Specimens should be of the highest quality possible and represent an adequate sample of available material necessary for identification. Specimens will be prepared using appropriate techniques as described under Appendix V, "Methods of collecting and processing specimens."

## **Exchange Program**

Exchanges are the formal reciprocal transfers of specimen(s) between DES and other herbaria, and are designed to build and augment the herbarium collection. DES requests specimens from certain taxonomic groups or from specific areas that meet the area of concentrations as outlined above. All exchanges will be on a one-to-one basis, with the exception of complete specimens representing Agavaceae and Cactaceae. Because of the substantial time required to prepare specimens within these families, they will be exchanged on a one-to-two basis (each specimen will count as two specimens rather than one), but must be negotiated with participating institution. Exchange records for each herbarium will be kept and include 1) address of herbarium, 2) type of material to be sent and received, 3) specimens (with collection number) exchanged from DES, and 4) status of exchange.

## **Access/Utilization of the Herbarium's Collections**

Herbarium staff is charged with the care and growth of DES, with the long-term preservation of the specimens being its highest priority. Collections within DES are also to be accessed and used by as wide an audience as feasibly possible, as the collections

represent a wealth of information that is to be shared. In managing its collection, DES seeks to balance the necessity of specimen preservation with the opportunity of specimen utilization for research and dissemination of information.

The Herbarium is open to any visitor, professional or amateur, with approval of the Curator of the Herbarium or Assistant Curator to consult the collections. All visitors must make previous arrangements with Herbarium staff for visiting the Herbarium. Visitors must check in with, and be oriented by, a member of the Herbarium staff after signing the guest book. Food or drink is not allowed in the Herbarium.

### **Desert Botanical Garden Herbarium Services**

The following services are provided without charge to all non-profit organizations, governmental agencies and the scientific community:

- Plant identification; providing an acceptable duplicate to the herbarium in return for determination (specimen must have appropriate collection data) is strongly encouraged
- Photograph identification
- Database access
- Access to the collection, under curatorial assistance and with prior scheduling (including tours)
- Photocopies or printouts of collections data

Desert Botanical Garden members are entitled to the following services without charge, provided that they do not receive commercial profit based on these services:

- Plant identification (up to five specimens);
- Photograph identification
- Database access
- Access to the collection, under curatorial assistance and with prior scheduling (including tours)

As of 1 January 2012, services provided by the herbarium staff to all for-profit organizations, book authors, private consultants and contractors are subject to a fee of \$75 - \$125 per hour (one hour minimum), depending on the nature of service rendered:

- Plant identification
- Photograph identification
- Limited database access
- Specimen processing
- Miscellaneous inquiries that require herbarium staff to search the collection and retrieve specimens
- Photocopies or printouts of collection data

A record will accompany all transactions and include name of visitor, date of and service rendered and fee charged. Funds received (cash, checks) will be remitted within one business day, with associated receipts, to business office.

All services are at the discretion of the herbarium staff.

### **Arrangement of collections**

Specimens are arranged within ferns and fern allies, gymnosperms and angiosperms (monocots and dicots). Within these groups, families, genera and species are arranged alphabetically within geographic regions in color-coded folders:

1. Arizona (white)
2. Outside Arizona but U.S. (yellow)
3. Mexico (orange)
4. Central and South America (red)
5. Old World regions (blue)
6. Horticulture (green)

Type specimens are stored in a cabinet designated for types only, each taxon in its own genus folder with corresponding publication.

### **Loans**

Loans are the formal, temporary transfer of specimens to only recognized herbaria and to qualified botanists for the purpose of serious taxonomic research, with the Curator's approval of a written or verbal request (see appendix III, "Loan Policies").

"Dummy sheets" are inserted in the appropriate slot of the herbarium case to indicate that such specimens are on loan.

Specimens may be loaned for use in Garden exhibits or teaching purposes; these should be retrieved from the "Synoptic Collection" whenever possible.

All out-going loans will be recorded, including 1) name of institution and investigator, 2) contact information (address, email address, phone number), 3) purpose of loan, 4) number of specimens and 5) return date. All associated correspondence will be included with records as well.

Incoming loans. All incoming loans are first verified for number and condition of specimens, noting any damage. Upon verification of the number and condition of specimens, the enclosed invoice is signed, dated and returned to loaner institution. The acronym of lending institution should be included on the specimen, or if not, written in pencil on the specimen (to avoid confusion when returning the loan).

Specimens are to be frozen for a minimum time of 10 days at -30 degrees F. as a method of insect control, then stored in air-tight herbarium cases and returned safely and efficiently, within the specified or permitted extension loan period.

### **Handling of Specimens**

Specimen sheets other than type specimens. Only a few specimens or a single folder at a time are to be taken out of the herbarium case and carried out on a firm surface such as cardboard. Type specimens will be provided to the visitor one at a time, and filed by herbarium staff only. Specimen sheets are not to be bent, turned over or shuffled. Removal of plant material from a fragment packet is allowed as long as all material is returned to the packet after use. Removal of any material from a sheet other than the contents of a packet is forbidden without permission from the curator (see appendix IV, “Destructive Sampling”). Specimens needing repair or showing any type of damage by insects or abuse should be brought to the immediate attention of the herbarium staff.

Herbarium case doors are to remain closed after retrieval of the specimens and opened as little as possible, to prevent entry of dust and pests. Visitors are to be fully acquainted with the organization of the herbarium and to re-file their specimens correctly after use. If there is any question as to the re-filing of specimens they must leave them for a herbarium staff member to re-file. Specimens are not to be left on countertops or in open storage for extended periods of time. Any specimens accidentally left out over a few hours will be re-frozen before being filed.

### **Annotation of specimens.**

(Adapted from Perkins 2006, Perkins and Zomlefer 2006; refer to Appendix III, “Loan Policy” for additional information)

The value of herbarium specimens is improved by careful annotation. Annotations also serve to document the use of specimens in research studies. This cross-referencing is integral to the scientific method and is important for future researchers.

With approval of Curator, annotation is the courtesy expected by the lending institution for the cost of processing and mailing loans and the wear and tear on the specimens. Annotation is especially encouraged when a determination can be improved or updated. Annotations can also 1) correct or add information obtained from duplicates from other institutions, 2) correct locality data, 3) indicate mixed collections, 4) indicate mixed labels, and 5), determine specimens as a type and what kind of type (e.g., holotype, isotype, etc.).

Example of one type of annotation label correctly identifying the specimen by Wendy Hodgson as *Agave murpheyi* Gibson on 23 March 2001:

**DESERT BOTANICAL GARDEN HERBARIUM (DES)**

*Agave murpheyi* Gibson

Wendy Hodgson, DES

23 March 2001

Flora of North America & Vascular Plants of Arizona Projects

Annotation labels may also document the use of a specimen in a special procedure even when updated taxonomic information is not provided:

**DESERT BOTANICAL GARDEN HERBARIUM (DES)**

Small portion of pollen removed for pollen analysis for project:  
Phylogenetic Analysis of the Opuntioideae (Cactaceae).

Raul Puente, DES

22 May 2003

**DESERT BOTANICAL GARDEN HERBARIUM (DES)**

Small portion of stem material removed for DNA analysis for project:  
Phylogenetic Analysis of *Ariocarpus* (Cactaceae).

Charlie Butterworth, DES

16 November 2004

Annotation of Type Specimens. Nomenclatural type specimens are important elements of botanical nomenclature and will be given extra care and protection. Type specimen annotations require more detail than most other annotations (refer to Appendix III, "Loan Policy"):

**DESERT BOTANICAL GARDEN HERBARIUM (DES)**

*Andropogon glomeratus* (Walter) B.S.P. var. *glomeratus*

**ISOTYPE** of:

*Andropogon macrourus* Michaux var. *corymbosus* Hackel  
DC. Monogr. Phanerog. 6: 409. 1889

Dixie Damrel, DES

26 February 2005

Upon studying the type specimen of *Andropogon macrourus* var. *corymbosus*, Dixie Damrel, of DES, updated its correct name to *Andropogon glomeratus* var. *glomeratus*, but still cited original publication of the first validly published name of this taxon, *A. macrourus* var. *corymbosus*.

Annotation labels are glued to the sheet, above or near the original label whenever possible. A polyvinyl acetate white glue or DucoCement are acceptable. If other annotations are present, it is best to position the new one above the most recent, unless it will not fit or the most recent is in an unusual position. When there is not sufficient blank space, an annotation may be glued only at one end and overlap mounted plant material.

Existing annotation labels, notes, etc. on the sheet must never be removed or obscured. Any wet, boxed or digital collection should also include the corresponding annotation label.

## **Publication**

The investigator agrees as a requirement for use of the collections that reprints/copies of all journal publications resulting from the use of the DES collections will be provided to the herbarium. The investigator also agrees to cite DES in all publications resulting from research that included the use of the collections. Specimens should be cited by the acronym of the lending herbarium as accepted in Index Herbariorum (Holmgren et al. 1990; Holmgren and Holmgren 1998).

## **Records/Accession Process**

The Herbarium Curator establishes the overall priorities for acquisition of new materials to ensure that acquired specimens fall within the scope of institutional needs. All specimens coming into DES must have adequate and accurate information. Minimum information required is: full scientific name of plant and author (if known), name of collector, locality and date of collection (see appendix V, “Methods of Collecting and Processing Specimens”) for additional information on collecting and processing specimens). Specimen information, including those incoming and those already a part of the collection, is entered into the SEINet database program. A summary of accessions is entered into Word format, with hard copies filed in the Herbarium and Library. A digital backup file of the SEINet database is updated daily with the two copies kept in fireproof safes; the second copy will be held at an off-site location. Specimens are accessioned with the Garden Herbarium number and acronym (DES) affixed to the bottom of the specimen sheet and the left of the label, if possible. Sheets are numbered consecutively. Routine acquisitions will be accepted with the approval of the Herbarium Curator. Unusual acquisitions (large number, special or unusual groups) will be addressed to the Herbarium Curator who will request input from the Director of Research, with recommendations made to the Executive Director for final decision. A report as to the recommendation and final decision will be made to the Research/Collections/Horticulture committee. All gifts accepted for the Herbarium will be in accordance with gift acceptance policy of the institution. All pertinent information regarding exchanges and loans will also be recorded (see under “Exchanges” and “Loan Policy” above).

A “State of the Herbarium” report will be generated by the Herbarium Curator yearly, which will include total number of accessioned specimens.

## **De-accession Process**

De-accessioning is the process of actively removing an accessioned specimen from the Herbarium by the Curator. De-accessioned specimens are disposed of through exchange or as a gift to other herbaria. Specimens may be de-accessioned from the collection for a variety of reasons, such as the specimens not being a part of the herbarium’s scope of collections or are duplicates. As with accessioning specimens, routine acquisitions will be accepted with the approval of the Herbarium Curator. Unusual acquisitions (large number, special or unusual groups) will be addressed to the Herbarium Curator who will request input from the Director of Research, with recommendations made to the Executive Director for final decision. A report as to the recommendation and final decision will be made to the Research/Collections/Horticulture committee.

## Literature Cited

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## **Appendices:**

- I. Glossary
- II. Collections other than Herbarium sheets
- III. Loan Policy
- IV. Destructive Sampling
- V. Methods of Collecting and Processing Specimens
- VI. Label Preparation and Specimen Mounting
- VII. Pest and Particulate Management
- VIII. Long Range Preservation Policy

## **Appendix I.**

### **Glossary**

Acronym – the abbreviation assigned a herbarium and cited in Index Herbariorum (Holmgren & Holmgren 1990, 1998); Desert Botanical Garden Herbarium is DES.

Annotation – a note written on or attached to a herbarium sheet indicating a correction or change in identification or other information; any note attached to a specimen.

Annotation Label - small slip of paper on which an annotation may be written and then glued to a herbarium sheet.

Accession (and Accession Number) – the consecutive sheet number assigned to a specific herbarium specimen.

Basionym – first valid scientific name applied to a taxon, i.e., the name on which combinations, if any are based.

Case – the cabinet in which herbarium specimens are stored.

CITES – Convention on International Trade in Endangered Species; regulates and controls the trans-shipment of many groups of plants of conservation concern, including Cactaceae.

Collecting – the gathering of specimens in the field.

Collection – the storage of specimens in a herbarium; the specimens collected on a single expedition; a single gathering of a particular species at a given time and place; a specimen plus its replicates (“duplicates”).

Collection number – the number assigned to a collection in the field, the same for all of its replicates; refers to the data recorded in the collector’s notebook.

Curator – person responsible for the growth and care of the collection

Determination – ascertaining the correct name for a specimen; identification

Distribution (pertaining to allocation of herbarium specimen, not locations of plants) – refers to filing of specimens as well as the sending out of duplicates on exchange, loan, etc.

Dummy sheet – a blank herbarium sheet or manila paper the same size of a herbarium sheet or genus cover inserted in the herbarium for cross reference purposes.

ESA – Endangered Species Act (1973), U.S. Fish & Wildlife Service; Listed: LE, listed endangered (imminent jeopardy of extinction), LT, listed threatened (imminent jeopardy of becoming endangered); Proposed for listing: PE, proposed endangered, PT, proposed threatened; Candidate species: C, species for which USFWS has sufficient information on biological vulnerability and threats to support proposals to list as Endangered or Threatened but such actions are precluded by other listing activity; SC, species of concern, all taxa whose conservation status may be of concern to the USFWS but does not have official status.

Envelope, or packet – a piece of paper folded and affixed to a specimen to contain fragments.

Exchange – the process of distributing duplicated (replicates) to other institutions in return for their duplicates.

Field notes – information recorded about collection or specimen in the field and usually includes locality, habitat, description, as other features of the plant not discernible from the dry specimen (i.e., height, habit, etc.).

Field press – light plant press carried in the field when collecting, into which the specimens may be placed as they are gathered.

Filing – the insertion of mounted specimens, dummy sheets, and other materials into the herbarium cases.

Fragment – a part of a plant; any detached portion of a specimen, also used to refer to an incomplete or poor specimen; extra materials collected for dissection and placed in the packet or envelope on a mounted specimen.

GenBank – is a comprehensive public database of DNA sequences and supporting bibliographic and biological annotation, built and distributed by the National Center for Biotechnology Information; there are over 60,000,000 sequence records.

Genus cover – a heavy manila folder slightly larger than a herbarium sheet in which specimens belonging to one genus are filed; often in various colors indicating geographic regions.

Herbarium – a collection of dried plants.

Herbarium accession number – the sheet number on a specimen; numbers are consecutive.

Index Herbariorum – a series of indices to herbaria and collectors of the world, indicating staff, focus of collections, availability of exchanges and material requested, number of specimens and correspondence information.

Mounting – the process of affixing dried and pressed specimens of plants to herbarium sheets of heavy paper.

Plant dryer – an apparatus for drying plant specimens by artificial heat, commonly consisting of a frame to support the presses and an electric heater and fan.

Preparation – the process of getting specimens mounted and ready for insertion in the herbarium.

Press – an apparatus for flattening and drying plant specimens.

Replicate – one of the specimens of a series or suite collected at the same time and place, under a single collection number, to represent a particular species, often called a duplicate.

Reprint – a separate copy of a journal article, specially printed for private distribution.

SEINet – a database for Arizona natural history collections, including herbaria in the state; Southwest Environmental Information Network.

Sheet – a standard sheet of heavy paper 11-1/2 inches x 16-1/2 inches or other standard size on which a dried plant specimen is mounted; often used to refer to the specimen that is or will be attached to a sheet.

Staff – collective term to apply to all the employees of the herbarium.

Synonym – an incorrect name for a taxon; usually a legitimate name that was validly published but later than the correct name (the first name to be published as priority).

Taxon – any taxonomic group such as variety, subspecies, species, genus, family and higher rank; taxa, plural.

Type Specimen – is a preserved specimen selected to serve as a permanent reference point for a scientific plant name. Type specimens are extremely important to botanists in determining the correct application of botanical names. There are a number of different categories of types recognized under the International Code of Botanical Nomenclature and include holotype, isotype, paratype and neotype. Holotype is the single specimen designated as the type of a species (or subspecies or variety) by the original author at the time the species name and description was published. Isotype is a duplicate specimen of the holotype, i.e. part of the same collection. Syntype is any one of two or more collections cited, by the author at the time of publication, when no type was designated; or any one of

two or more specimens designated as types. Lectotype is a specimen chosen by a subsequent author from amongst syntypes to serve as the definitive type. Neotype is a specimen chosen by a subsequent author to act as type when all of the specimens available to the original author of a name have been lost or destroyed. Paratype is a specimen not formally designated as a type but cited along with the type collection in the original description of a taxon.

Voucher – a specimen preserved to substantiate recorded observations, and to which reference may be made in the future to verify the identity of the plant on which studies were made.

Wet Collection – separate collection of plants or plant parts preserved in liquid preservatives.

## **Appendix II.**

### **Collections other than Herbarium sheets.**

#### Wet, or “Spirit” collections.

The fleshy reproductive structures of cacti and agaves often require preservation in “spirits,” or as wet collections, a mixture of water, ethanol and glycerin in the ratio of 6:3:1/4. DES has a relatively extensive wet collection of Howard S. Gentry’s Agavaceae flowers and fruits. Wet collections require special curatorial practices:

- Wet collections will be kept in airtight jars that are compliant with wet collections standards and filled with ethanol/glycerin mixture.
- Fluid levels will be monitored for evaporative loss that leads to specimen desiccation.
- A complete herbarium label will be included inside and outside each jar, with each collection represented by a herbarium sheet. If no herbarium sheet exists, material from the spirit collection, with accompanying and full data, will be processed into a sheet and accessioned with the same accession number. If not enough material can be processed for a herbarium specimen, a “dummy sheet” bearing the plant name and DES accession number will be inserted in the main herbarium collection that cross-references to the wet collection.
- Because the fluid leaches out the colors, detailed notes on color of fresh material will be made.
- Jars are stored according to group or genus, in non-flammable storage units that are separate from the main collection.

#### Box specimens.

Box specimens are useful as they are three-dimensional with minimal damage characteristic of pressed specimens. However, they are extremely bulky, difficult to curate, and are filed separately from the corresponding collections.

- Specimens will be stored in archival polyethylene or polypropylene bags, with the same herbarium label and accession number as the corresponding herbarium sheet, with indication that both collections exist.
- Boxed specimens will be stored in the herbarium cases.
- Dummy sheets will be inserted in the herbarium case if no herbarium sheet exists.