

Rancho Santa Ana Botanic Garden Collection Standards Workshop

Making High Quality Botanical Collections

Collections are the foundation of the botanic garden. Every collection that we add builds the foundation and the better the quality of these collections the stronger the foundation of the Institution.

1. What makes a good collection
 - a. Quality and quantity of the material
 - b. Quality and quantity of the documentation
 - c. Value of the collection

2. Collections
 - a. Seed Collections (Michael)
 - b. Living Plant Collections (Tim)
 - c. Herbarium Collections (Sula and Naomi)

3. Impact, ethics and legalities
 - a. Permits overview (Forest Service, BLM, FWS, DFG)
 - b. Private land (trespass law)
 - c. Collecting impacts and sampling considerations

4. Population sampling considerations
 - a. Smaller populations are the most vulnerable (not necessarily rare species).
 - b. Frequent low intensity harvests rather than infrequent but high intensity harvests produced lower extinction risk. Potential for sampling from other individuals.
 - c. Safe harvest level is 10% of the seed in 10% of the years.
 - d. Seed collections made over a period of years may have advantages in sampling genetic variation that is sporadically available because of the emergence of new genotypes from the seed bank.
 - e. Multiple collections through a fruiting season will sample phenological variation among and within plants.

References:

- [Ex Situ Conservation Supporting Species Survival in the Wild](#). Guerrant, Havens and Maunder 2004, Island Press
- [Germplasm Conservation Guidelines for Australia](#). 1997 Australian Network for Plant Conservation
- [Genetics and Conservation of Rare Plants](#). Falk, D.A. and Holsinger, K.E. 1991, Oxford University Press
- [A Basic Sampling Strategy: Theory and Practice](#). Brown and Marshall, pages 75-91 in [Collecting Plant Genetic Diversity: Technical Guidelines](#). 1995, CAB International for IPGRI, Rome.
- [Guidelines for the Translocation of Threatened Plants in Australia](#). 1997 Australian Network for Plant Conservation
- [Reintroduction of Plants to the Wild. A Handbook for Botanic Gardens](#). 1995 Botanic Gardens Conservation International
- [Collecting, Processing, and Germinating Seeds of Wildland Plants](#). Young & Young, 1986 Timber Press, Portland, Oregon USA
- [Basic Techniques for Field Documentation of Vascular Plants](#). Ross, Tim in *Crossosoma* 22(1), Spring-Summer 1996, pp. 3-39, Southern California Botanists, Fullerton, CA, USA

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COLLECTING SEEDS

1. *Target Quality*—The number of individuals collected from, the maturity of the seed, and the level of documentation all improve the quality of the collection (i.e. herbarium voucher should be associated with a quality collection).
 - a. Target number of individuals to collect from: 30-50 maternal lines.
 - b. Collecting fully mature seeds is always best but not always possible. Fully developed, mature, viable seeds generally are separating from the ovary wall (loose in the capsule), turning dark in color, and/or are easily detached from the plant. (Exceptions: *Sambucus* seeds germinate better when collected green).
2. *Target Quantity*—Collect as many seeds as possible. 2500 seeds is the target number to have enough seed for propagation, horticultural and research distribution, to test seed germination, and have enough seeds to last greater than 10 years.
 - a. Target quantity of 2500 “viable “ seeds without taking more than 10% of seed produced in 10% of the years - or - between 2 - 5% annually in a multiyear effort
3. Materials to use
 - a. Collect dry fruits in paper bags
 - b. Collect moist fruits in plastic bags
4. When to collect seeds and not cuttings
 - a. Plants appear diseased
 - b. When doing so may damage the plant
 - c. When plants cannot be propagated vegetatively (i.e. *Quercus*, *Acer*, *Rhus*)

FIELD RECORD FORM

1. A field record form must be filled out for all living collection accessions
 - a. Collections should be repeatable, so be specific in locality information
 - b. See attached Field Record Form at the end of this document

COLLECTING CUTTINGS FOR LIVING COLLECTION

1. Flowering wood is generally not good for cuttings
2. Use Aseptic techniques
 - a. Prevents spread of disease in the wild and prevents bringing disease into the garden (Alcohol wipes can be used for this)
3. Collect juvenile material from the lowest branches
 - a. Cut stem at node
4. Sampling
 - a. 10-15 individuals is optimal for cuttings (1-2 stems per plant)
 - b. Avoid impacting populations by keeping genotypes in the wild. Avoid taking whole plants.
5. Cuttings are better to collect than seeds when
 - a. Desire to keep identity of clone (potential cultivar)
 - b. no seeds available
 - c. low seed viability
 - d. seed is difficult to germinate

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HERBARIUM SPECIMENS

How to prepare and make quality herbarium specimens

1. Make the collection representative of the population (i.e. don't just collect the most attractive or robust plants)
2. Collect all parts possible (flower, fruits, roots [if annual], etc.), avoid "sterile" collections.
3. Collect in triplicate when possible
 - a. For annuals collect whole plants. These shrink so keep in mind the number of plants you need to collect for an adequate collection.
4. Herbaceous plants that are longer than the sheet can be folded to fit onto a sheet
5. Things to keep in mind
 - a. Certain taxonomic groups require certain parts for proper identification (i.e. *Carex* and *Cryptantha* needs mature fruit)

Cross referencing with Living Collection

1. If collecting for the living collection make sure to collect an herbarium specimen even if at a different time or from cultivated material.
2. Cross reference the living collection accession number with herbarium specimens.

Information to take at field site

1. Basic information to collect
 - a. Date, who with, collector number, locality info (place name and lat long), ecological info, plant specific info (i.e. flower color)
2. Take information at the field site
 - a. Ecological information should always be taken at the field site (do not rely on memory!)
 - b. No need to GPS every plant collected. One GPS point for collecting within 1/8-1/2 mile radius is sufficient.
 - c. Elevation on GPS is likely inaccurate, confirm with topo map or altimeter.
3. Metadata to Remember!
 - a. Management area collected in (Forest Service, BLM, park Service, etc.)
 - b. Datum setting in GPS (NAD 27, WGS 83, etc)
 - c. If you need to interpret data (i.e. lat/long) then record the source (i.e. google maps, topozone).

Protocols for processing specimens

1. Plants are dried in wooden press in a drying cabinet (herbarium workroom) for ca. 1 week (succulents may take longer)
2. Dried specimens are transferred to freezer for 1 week before going into "bug free zones"
3. Specimens should be stored properly in a closed herbarium cabinet
4. Herbarium specimens are accepted into the herbarium only after labels have been made.

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Summary Table of Sampling Considerations for Rare, Threatened or Endangered Plants

Adapted from the 2004 Center for Plant Conservation, 2003 Royal Botanic Gardens Kew and the 1997 Australian Network for Plant Conservation Germplasm Collection Guidelines.

Sampling Question	Considerations or Inputs
Which species should be collected?	<ol style="list-style-type: none"> 1. Degree of endangerment – locally and throughout its range 2. Taxonomic and phenotypic uniqueness - (endemism) 3. Genetic and reproductive stability of the species 4. Ability to store and cultivate the species 5. Existence and condition of ex-situ collections
How many (and which) populations should be sampled per species?	<ol style="list-style-type: none"> 1. Degree of endangerment or threat to a population 2. Genetic and reproductive stability of a population 3. Range and distribution of the taxon 4. Degree of gene flow among populations. (Mating systems) 5. Unique ecotypes 6. Conspicuous polymorphism between populations
<p>How many (and which) individuals should be sampled?</p> <p>Up to 50*</p> <p>*Benchmark to capture genetic variation.</p> <p><i>If seed output is low or when conducting parallel collections for backup storage sampling of more than 50 individuals may be required</i></p>	<ol style="list-style-type: none"> 1. Local abundance 2. Eminent threat(s) to survival of a population 3. Genetic and reproductive stability of the species (seedling establishment, plant vigor and recruitment success) 4. Species method(s) of reproduction, seed (sexual) or vegetative (clonal) 5. Seed viability and production 6. Anticipated splitting of collections for secondary parallel collections - (double number of samples) 7. Conspicuous eco-typical variation within a population habitat or microsite 8. Conspicuous polymorphism within populations 9. Mating systems: self pollinating (up to 50), obligate out-crossers and mixed mating systems (30-50)
<p>How many (and which type of) propagules should be collected?</p> <p>Target quantity of 2500 “viable “ seeds without taking more than 10% of seed produced in 10% of the years - or - between 2 - 5% annually in a multiyear effort</p> <p>Cuttings: between 1 - 10 per individual</p>	<ol style="list-style-type: none"> 1. Seed type (orthodox or recalcitrant) 2. Appropriate facilities to store and/or cultivate the species 3. Availability of seed or vegetative material 4. Seed viability, seed predation, seed germination rate 5. Anticipated success rate in rooting cuttings 6. Storage tolerance of seed collections or survival of plants in cultivation 7. Anticipated splitting of collections for secondary parallel collections - (double number of samples) 8. Long-term use of the collection (anticipated attrition for: viability testing, research, reintroduction attempts)
Under what circumstances is a multi-year collection plan indicated?	<ol style="list-style-type: none"> 1. To compensate for low numbers of individuals in a population; inadequate annual seed or vegetative output; low seed germination rates; demonstrated poor seedling development due to inbreeding depression or other genetic factors 2. To increase genetic diversity in a collection by repeat sampling over a period of years 3. To augment limited or declining ex-situ collections

FIELD RECORD FORM

Accession # _____

Date: _____												Do not disclose locality.		
Scientific Name: _____														
Common Name: _____														
Collector Name: _____														
Collector Address: _____														
Email Address: _____														
Phone: _____														
Voucher Collection		Yes		No		Coll #			Herbarium					
CNDDB EO# (if known): _____ Landowner: _____														
Locality: _____														
County:				State:				Country:						
Quad Name:				Elev:		T	R	S	¼ of					
Datum:		NAD27		NAD83		WGS84		UTM:	Zone 10		Zone 11	GPS Accuracy (meters/feet):		
Coordinates:						OR	Lat	Long						
Species:						Material Collected:								
Sample Population size:		_____		Common		Seed		Division		Plant		Other: _____		
Number of individuals sampled:		_____		Scattered		Spore		Hard Cutting		Bare Root				
				Rare		Seedling		Soft Cutting		Bulb/Corm				
Associated Species (Include dominant species and other rare taxa at this site on this date): _____ _____														
RSA Floristic Province														
Californian			Sonoran: Mojave			Sierra/Cascade								
Great Basin			Sonoran: Colorado			North Coast Ranges								
						Klamath/Siskiyou								
Site Information														
Community						Geology								
Alpine			Scrub (indicate type):			Gabbro			Shale					
Forest						Granite			Volcanic					
Woodland			Chaparral			Limestone			Mixed (alluvium or landslide debris)					
Grassland			Riparian			Sandstone			Other: _____					
			Vernal Pool			Serpentine								
Soil				Slope				Exposure						
Sand			Clay			Flat			Full sun					
Gravel			Humus			Gentle			Semishade					
Rock			Alluvium			Steep			Shade					
Loam			Other: _____			Cliffs			Other					
Moisture						Comments (Describe site condition. Include land use, visible disturbances, threats): _____ _____								
Wet			Dry											
Moist			Seasonally wet/moist											
Aspect (indicate): _____														
Determination:		Keyed:		Specimen:		Where housed:				ID by:				
Photograph:		Slide		Print		Digital		Diagnostic Features:		Yes		No		