Why make such large collections?

A collection of at least 10,000 seeds will enable the fullest possible use to be made of the seed. Seeds are needed for the following purposes:

Activity	Seeds required
Base collection kept in case of loss of wild population	ideally 500 seeds
Developing an effective germination protocol	100 seeds
Viability monitoring over the anticipated 200yr lifespan of the collection	650 seeds
Duplication at another bank for safety	at least 1150 seeds
Distribution to users	5000 seeds (as an indicative figure)
Future propagation and restoration projects	at least 2500 seeds

Setting a safe limit to seed collecting

Do not collect more than 20% of the mature seeds available on the day, unless you have evidence that this level of harvest will not cause harm.

This will ensure that enough seeds are available for natural regeneration and long-term survival of the population. Take care to avoid harming any other flora or fauna at the collecting site.

When targeting critically endangered species with low population sizes, keep seeds from individual parent plants separate. If the collection needs to be bulked up in the future, by growing plants *ex-situ* and harvesting seeds, individuals can be grown from all the maternal lines (i.e. each plant sampled) and cross-pollinated to maximise genetic diversity. This is preferable to picking seeds at random from a combined sample, where two or more seeds of the same parent may be selected.

To collect or not to collect?

If the population does not meet minimum project criteria for seed-sampling:

- Seek another population of the same species on the same trip.
- Return to this population on a later date.
- Take herbarium specimens and detailed notes to confirm the identification.
- Assess the next target species available.

A seed collecting programme should include primary and secondary target taxa.

If the primary target taxa cannot be collected, make collections from secondary targets. Using this systematic but flexible approach, the team remains productive in all situations and will become well-prepared for future collection trips.

Further reading

Guerrant, E., Havens, K. and Maunder, M. (2004). *Ex-situ* Plant Conservation: supporting species survival in the wild. Centre for Plant Conservation, Island Press, USA.

Guarino, L., Ramanatha Rao V. and Reid R. (eds, 1995). Collecting Plant Genetic Diversity: technical guidelines. Commonwealth Agricultural Bureaux International, Wallingford, UK.

Falk, D.A. and Holsinger, K.E. (1991). Genetics and Conservation of Rare Plants. Oxford University Press, UK.

Hay, F.R. and Smith, R.D. (2003). Seed maturity: when to collect seeds from wild plants, pp. 97-133. In: R.D. Smith, J.D. Dickie, S.H. Linington, H.W. Pritchard and R.J. Probert (eds), Seed Conservation: turning science into practice. Royal Botanic Gardens, Kew, UK.

Way, M.J. (2003). Collecting seed from non-domesticated plants for long-term conservation, pp. 163-201. In: R.D. Smith, J.D. Dickie, S.H. Linington, H.W. Pritchard and R.J. Probert (eds), Seed Conservation: turning science into practice. Royal Botanic Gardens, Kew, UK.

Equipment specifications

Description	Model and Supplier
Global positioning system unit (GPS) and maps	GARMIN eTrex Summit GPS or GPS60 www.garmin.com
Compass	Silva Explorer 203 www.silvacompass.com
Altimeter	www.thealtimeterstore.com
First aid kit	Locally available
Field identification guides / flora	e.g. Seed Collection Guides produced by the MSBP Species Targeting Team, RBG Kew, UK.
Pre-collection checklist	See example overleaf

Description	Model and Supplier
Hand lens	Folding magnifier in case (x10 or x20 magnification) www.agarscientific.com
Secateurs	Felco Model No. 2 Original www.worldoffelco.co.uk
Pruners	Wolf Garten Anvil Tree Lopper RCM & Telescopic Handle ZMV4 www.worldofwolf.co.uk
Pocket knife with scissors	Outdoor multi-tools www.swissarmy.com
Leather gloves	Locally available
Retractable tape measure	Draper 50m (165ft) fibreglass tape, www.draper.co.uk
Herbarium press, card and blotter papers	Locally available

Please note that the above equipment is used by the Millennium Seed Bank Project and has been chosen carefully using our many years' experience. The list of suppliers is for guidance only and does not represent an endorsement by the Royal Botanic Gardens, Kew. The manufacturer's instructions must be followed when using any of the equipment referred to in this Information Sheet.

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MILLENNIUM SEED BANK PROJECT Kew

Assessing a potential seed collection

Technical Information Sheet_02
Michael Way and Kate Gold, Seed Conservation Department

The most difficult moment for a seed collector is often deciding whether a population meets the minimum quality and quantity standards for seed sampling for a particular purpose or project. This information sheet provides guidelines and a tool – the pre-collection checklist - to help collectors carry out that assessment and ensure that seed collections arriving at the seed bank are of the highest possible quality and quantity for long-term conservation. Refer to Technical Information Sheet_03 in this series for further details on Seed Collecting Techniques.

Below: Plant identification in the field

Prospecting

Make a preliminary trip to locate populations of the target species, confirm the identification, and estimate fruiting period. If this is not possible, try to consult a local naturalist or other expert who can inform you of locations. Make use of information on herbarium sheets and in published floras and monographs.

Identification of the target species

It is critical to the value of the seed collections that the species is accurately identified. Seed collectors must be able to distinguish the target species from others in the same genus.

- What other similar species are present?
- Can you distinguish the target?
- Allow time prior to the trip to become familiar with the identification features of the species. Consult field guides or herbarium staff on key characters before the trip.
- Visit the potential collecting locations early in the season (ideally at flowering) to make herbarium specimens and to confirm identification with local specialists.
- Invite an appropriate taxonomist or specialist in the local flora to join the team if possible.
- Bring and use relevant identification guides, floras, or field guides where available. Colour photocopies of herbarium sheets of target taxa may be a useful reference.

Assessing the population

A seed collection will be most representative of the population if many individual plants, (ideally at least 50), are sampled randomly and evenly across the extent of the population.

- What is the extent of the population?
- How many individual plants are there?
- Is the population damaged in any way?
- Is the population at reproductive stage?
- Do sub-populations exist?

What is a population?

A useful working definition for out breeding species (most wild plants are out breeders) is:

a group of individuals, capable of interbreeding, that occupy a defined geographic area

- Consider any obvious geographic barriers to gene flow (e.g. wide rivers).
- What are the pollination and seed dispersal mechanisms? Some insect pollinators may have a home range of 5km.

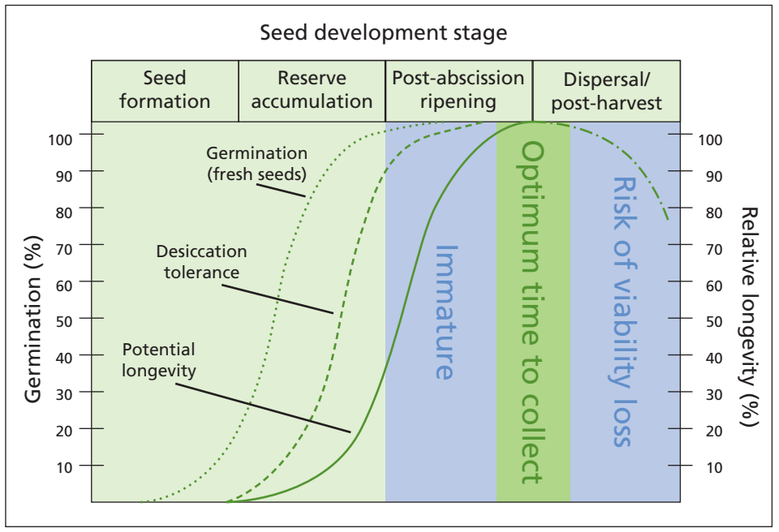
Detailed analysis of the partitioning of genetic diversity within the species would be necessary to confirm the actual extent of the population.

Above: Assessing the extent of a population

Timing of seed collections: challenges for collectors

- Individual plants may initiate flower and fruit development on different dates and ripen over an extended period
- In species with indeterminate inflorescences, several stages of development may be evident on a single individual.
- Seed may be shed over a long time period and may be easily lost from dehiscent seed heads.

Left: Collecting team assessing numbers of seeds per dispersal unit in a population



Above: Aquisition of seed quality traits during during development

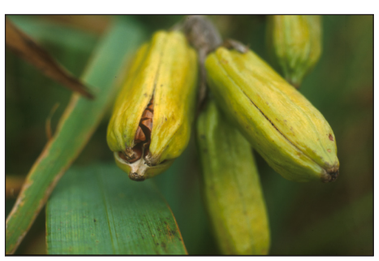
Assessing readiness for collecting

Seeds must be collected at the optimum stage of development to maximize longevity in long term storage (see graph above). Most seeds in the process of natural dispersal are suitable for collection. Seeds collected before or after this stage may not survive as long in storage.

Look for:

- Changes in fruit colour
- Changes in seed coat colour
- Fruits splitting or breaking open
- Seeds rattling
- Seeds that are hard and dry
- Some seeds already dispersed

Below and below right: *Iris* fruits splitting open at natural dispersal



Assessing the physical quality of seeds

Some plant families may have critically high levels of non viable seeds. Poaceae, Asteraceae, Cyperaceae and Combretaceae typically show high levels of 'empty' seeds. Leguminosae collections are often affected by insect damage. It is better to avoid collecting such seeds.

The 'cut test' (see box) is the only simple and reliable technique for providing accurate, quantitative seed-quality data in the field. Seek another population if the proportion of empty and infested seeds is greater than 30%; otherwise, increase the number of seeds collected in order to compensate for the non viable ones.

Assessing seed availability

An ideal seed collection for long-term conservation will contain at least 10,000 potentially viable seeds (see box overleaf).

First, estimate the number of plants at the stage of seed dispersal. Taking a representative sample, estimate the number of available seeds per fruit and fruits per plant.

- Is it possible to collect sufficient healthy seeds (sampled from at least 50 individual plants) without taking more than 20% of the mature seeds available on the day?
- If seed availability is less than 2,000 seeds, consider carefully whether other, more productive populations could be collected instead.

In the case of rare and threatened species, aim to collect a minimum of 500 seeds, always taking into account the 20% rule. Multi-year collecting and/or propagation may be necessary to achieve a good-sized seed collection for such species.

Above: Evaluation of Yucca seeds by cut-test

Cut-test to assess seed quality

- Cut 10-20 seeds, collected from several well-spaced individuals in the population.
- Use secateurs, scissors, nail clippers or similar sharp blades and cut along both axes if possible.
- Record the number of empty, infested and aborted seeds.
- Tiny seeds can be held on adhesive tape during sectioning.
- A hand lens of x10 or x20 magnification will help.
- Seeds that are known to be non-toxic can be crushed between fingernails or teeth if sectioning is difficult.

EXAMPLE OF A PRE-COLLECTION CHECKLIST
(developed for a conservation and restoration project)

IDENTIFICATION			
Family		Locality	
Genus		Date of Assessment	
Species			
POPULATION ASSESSMENT			
Taxon identified and apparently similar taxa distinguished		*YES / NO*	
Approximate area of population		*x*	*(m², km²)*
Approx. number of accessible individual plants		*1-10* *11-50* *51-100* *101-1000* *>1000*	
Evidence of disturbance/damage by herbicides, fire etc.		*YES / NO*	
ASSESSING READINESS OF POPULATION FOR SEED COLLECTION			
Most frequently occurring phenological stage (please tick or give percentage)			
Vegetative			
Reproductive	Flowering		
	Immature seeds		
	Around natural dispersal		
	Post dispersal		
Estimated number of individual plants at natural dispersal			
PHYSICAL QUALITY			
Cut-test 10-20 seeds: of the sample examined, indicate the most frequently occurring (please tick or give percentage)			
Full seeds			
Empty seeds			
Infested seeds			
Immature seeds			
AVAILABILITY OF SEEDS			
Average number of seeds per fruit/dispersal unit			
Average number of fruits/dispersal units per individual plant			
Is it possible to collect *5,000 - 10,000* healthy seeds around natural dispersal without taking more than *20%* of the available seeds?		*YES / NO*	
MONITORING			
For populations NOT yet at natural dispersal, estimate suitable date to return and collect seeds			