

The Millennium Seed Bank Partnership

Seed Conservation Standards for 'MSB Partnership Collections'

To be recognised as a global resource and satisfy the needs of anticipated users of collections and associated data, MSB Partnership seed collections must be of high quality. The proposed standards provide a framework to recognise **Millennium Seed Bank Partnership Collections** ('MSB Partnership Collections'), including material not duplicated at Kew's Millennium Seed Bank. The standards assure users of the utility of the collections and also provide a basis for technology transfer amongst partners and capacity development within the MSBP network as a whole.

Setting standards for seed conservation of wild plant species is particularly difficult. In comparison with most crop species, populations of wild plants tend to be heterogeneous, with widely spread flowering and fruiting times. This may affect initial seed viability and vigour and, consequently, seed longevity. Seed dormancy is frequently encountered, creating difficulties for germination testing. Many *ex-situ* conservation programmes focus on collecting seeds from small populations of rare and threatened species, meaning that desired seed numbers are difficult to obtain.

The proposed standards represent current best practice for long-term conservation of orthodox seeds. They draw on and reference various existing protocols and guidelines (see Annex). Such protocols may have been developed for a particular activity (e.g. seed testing), a particular set of species (e.g. sampling guidelines for rare and endangered plants), or to meet the needs of regional networks.

The standards cover all stages of the *ex-situ* conservation process and indicators are proposed for each with exception of those marked*.

1. COLLECTING

Seed, herbarium vouchers and data are collected to recognised protocols or guidelines:

- 1.1. Genetic materials, including traditional knowledge, are legally collected and conserved**
- 1.2. Collection names are verified (ideally by reference to herbarium voucher specimen)**
- 1.3. Genetic diversity of sampled population is adequately represented**
- 1.4. Essential field data is recorded**
- 1.5. Survival of source population is not compromised**

Indicator(s)

Copies of agreements and permits showing that genetic materials have been collected in accordance with all applicable laws, including consent from government and landowners
Herbarium voucher material collected from same population as seeds (or field verification made)

Agreement with appropriate herbarium to verify herbarium voucher

Data records for: verifier, date of verification, name and authority used

No more than 20% of the available, ripe, seeds are collected

Field data records

2. PROCESSING

Seed collections are accessioned, dried and processed according to recognised protocols or guidelines:

- 2.1. **Unique accession reference number is assigned to all incoming material**
- 2.2. **Collections are placed in a dry environment of 15% RH \pm 3%, 15°C \pm 3°C, within 4 weeks of collection (immature seeds are ripened before drying; short-lived and/or microscopic seeds (e.g. *Salix*, *Populus*, orchids) are dried within 1 week of collection)**
- 2.3. **Collections are cleaned to remove empty, poorly developed and insect-infested seeds and debris**
- 2.4. **Purity is assessed by X-ray and/or cut test**

Indicator(s)

Data records for seed maturity, drying, cleaning, X-ray/cut test

3. STORAGE AND DUPLICATION

Seed collections are stored and duplicated according to recognised protocols or guidelines:

- 3.1. **Seed collections are banked as soon as possible after drying to equilibrium with 15% RH \pm 3%, 15°C \pm 3°C, and within 6 months of collection (Short-lived and/or microscopic seeds (e.g. *Salix*, *Populus*, orchids) are banked within 2 weeks of drying)**
- 3.2. **Collections are held in air-tight (hermetic) containers**
- 3.3. **Collections are stored at -20°C \pm 3°C**
- 3.4. **Collection size is monitored to ensure that sufficient potentially viable seeds are available for effective management and distribution to users**
- 3.5. **Collections are duplicated at -20°C \pm 3°C after drying to equilibrium with 15% eRH \pm 3%, 15°C \pm 3°C at a second, geographically-separate, facility or reason for non-duplication recorded (reasons include: low seed number, accession being regenerated and/or on priority list for recollection)**

Indicator(s)

Records of container testing
Functioning cold storage facilities (freezers, cold room)
Agreement in place with second seed bank
Notification of Transfer (NOTs) records
List of non-duplicated materials, with justification
Collection size (i.e. seed number) data

4. VIABILITY MONITORING

Seed viability is monitored according to recognised protocols or guidelines:

- 4.1. Initial viability is tested, preferably by germination test, and monitored at least every 10 years**
- 4.2. Management decisions (including to regenerate or re-collect) are implemented if initial viability is below 85% and if/when collection quality drops to 85% of initial viability***

Indicator(s)

Data records for date of receipt and date of viability testing
Germination test results (including data on fresh un-germinated seeds and empty/incompetent seeds if applicable)
Re-generation/re-collection lists

5. DATA MANAGEMENT

- 5.1. A data management system, using recognised seed bank data standards, is in use and capable of export in standard format**

Indicator(s)

Database records with mandatory fields completed

6. DISTRIBUTION

- 6.1. Collections are available for use [under an appropriate Material Supply Agreement], at least in country where banked**
- 6.2. A distribution policy, with appropriate risk management for pests, diseases and potentially invasive species, is in place and applied**

Indicator(s)

Distribution policy available
Distribution data available

7. SEEDBANK MANAGEMENT

- 7.1. Risks to collections are accurately assessed and appropriate mitigation procedures are in place for significant risks.**

Indicator(s)

Risk assessment strategy in place against major threats e.g. power cut, fire, flooding, earthquake

Partners meeting the MSBP Seed Conservation Standards may share accession data via the MSBP Data Warehouse following the Instructions to Data Providers [document available at <http://brahmsonline.kew.org/msbp/Resources>].

Annex

Relevant protocols, guidelines, references

Barrios Roveri José, Solange C. (2010) Manual de Curadores de Germoplasma – Vegetal Conservação *ex situ* (Colbase – Sementes). Documentos 317; Embrapa Recursos Genéticos e Biotecnologia, Brasília, DF

<https://www.embrapa.br/documents/1355163/2005846/doc317.pdf/83d36007-b172-41e2-b74b-031108fb12d9>

ENSCONET (2009) ENSCONET Seed Collecting Manual for wild species. Eds. Royal Botanic Gardens, Kew (UK) & Universidad Politécnica de Madrid (Spain).

http://ensconet.maich.gr/PDF/Collecting_protocol_English.pdf

ENSCONET (2009) ENSCONET Curation Protocols & Recommendations. Ed Royal Botanic Gardens, Kew (UK). http://ensconet.maich.gr/PDF/Curation_protocol_English.pdf

FAO (2013) Genebank Standards for Plant Genetic Resources for Food and Agriculture. Rome <http://www.fao.org/docrep/019/i3704e/i3704e.pdf>

ISTA (2013) International Rules for Seed Testing, Edition 2013. ISTA, Switzerland.

Millennium Seed Bank Technical Information Sheets. <http://www.kew.org/science-conservation/research-data/resources/millennium-seed-bank-resources>

Nesbitt, M., et al. (2010) Linking biodiversity, food and nutrition: the importance of plant identification and nomenclature — a review. *Journal of Food Composition and Analysis*. [doi:10.1016/j.jfca.2009.03.001](https://doi.org/10.1016/j.jfca.2009.03.001).

Offord, C.A. and Meagher, P.F. (2009) Plant germplasm conservation in Australia: strategies and guidelines for developing, managing and utilising *ex situ* collections. Fully Revised Edition. Australian Network for Plant Conservation Inc., Canberra.

Rao, N.K.; Hanson, J.; Dulloo, M.E.; Ghosh, K.; Nowell, A. and Larinde, M. (2006) Manual of Seed Handling in Genebanks by. xiv+147 pp. Rome, Italy: Bioversity International.

<http://www.bioversityinternational.org/e-library/publications/detail/manual-of-seed-handling-in-genebanks/>

RBG Kew (2008) Seed Bank Data Exchange Schema Version 1.0.

http://brahmsonline.kew.org/Content/Projects/msbp/Resources/MSB_Data_schema.xsd

Seeds of Success (2012) Bureau of Land Management Technical Protocol for the collection, study, and conservation of seeds from native plant species for Seeds of Success.

http://www.blm.gov/wo/st/en/prog/more/fish_wildlife_and/plants/seeds_of_success/protocol.html