Global strategy for conservation and use of apple genetic resources: summary for ITPGRFA stakeholders

Photo: Michael Major

This document is a concise summary of the *Global Strategy for the Conservation and Use of Apple Genetic Resources* (Bramel and Volk, 2019). The development of the global conservation strategy involved an initial background study, a survey of the status of major collections, expert consultations, and site visits. Its aim is to support decision making by the stakeholders of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) by providing evidence-based information on this genepool in an accessible format.

Crops covered by the strategy
Malus x domestica Borkh.
This is not an Annex 1 crop as of the time of writing.

Global system for the conservation and use of apple genetic resources

Apple genetic resources are mostly conserved as field collections, in *in vitro* culture, and in cryopreservation. Wild species are also conserved in long-term storage as seed.

The *ex situ* conservation system for apple genetic resources includes public entities, universities, botanical gardens, nurseries, private breeding companies, and private collections. These conserve three types of apple genetic resources:

International cultivars, which are produced on a large scale, or used in breeding programs, or in genomics, physiology, and pathology research programs.

Local cultivars and landraces, which are genotypes with economic and cultural value in some specific localities or regions, adapted to local food-products, with potentially unique traits. These represent significant diversity.

Wild species, which are under-represented in collections. These can be conserved as accessions in grafted field plantings, as seed, and as pollen.

Table 1. Summary of key metrics for apple genetic resources.

Key metrics	Data source	Value
Estimated global number of accessions *ex situ*	Survey[1] (2014)	31,349
Estimated global number of accessions *ex situ*	FAO WIEWS (2025)	53,607
Number of accessions with DOI	GLIS portal (2025)	2,870
Number of accessions notified as available in the MLS	GLIS portal (2025)	2,055
Number of accessions notified as available in the MLS conserved in Article 15 genebanks	GLIS portal (2025)	0

[1]40 institutes answered the survey

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Composition and gaps in *ex situ* collections

The surveyed collections reported a total of 31,349 *Malus* accessions conserved *ex situ*. Of these 50% were international cultivars, 21% were local or historical cultivars, 24% were wild species, and 3% were breeding lines.

The largest apple collections included in the survey were:

- USDA-ARS Plant Genetic Resources, USA (5,291 accessions).
- N.I. Vavilov Research Institute of Plant Industry, Russia (3,821 accessions).
- University of Reading, United Kingdom (2,247 accessions).
- Research Institute of Horticulture and Seeds (IRHS), National Institute for Agricultural Research (INRA), France (2,090 accessions).
- Walloon Agricultural Research Centre (CRA-W), Belgium (1,773 accessions).
- RUE Institute for Fruit Growing, Belarus (1,545 accessions).
- Apple Research Division, Institute of Fruit Tree Science, National Agriculture and Food Research Organization (NARO), Japan (1,350 accessions).
- Institute for Breeding Research on Fruit Crop, Julius Kühn Institute (1,343 accessions)
- Agroscope, Switzerland (1,300 accessions).

Routine operations, regeneration, and safety duplication

Half of the surveyed collections reported having established protocols for acquisition, characterization, maintenance, pathogen/disease detection, and distribution. But only three collections reported to have developed and documented all the routine operations. Twenty percent reported to not having developed formal protocols for any of the routine operations. Only a few of the surveyed instituted have dedicated funds to cover the cost of routine operations. Similarly, only a few of the surveyed collections were completely safety duplicated, and 57% had only part of the collection safety duplicated.

Documentation and information systems

Among the surveyed collections, 68% had accession-level data for passport, 60% for phenotype, and 63% had all or part of their accessions genotyped. Three of the surveyed institutions had no accession-level data. Several descriptor lists have been developed and are used for apple genetic resources (Evans et al., 2012; FAO/IPGRI, 2001; Iezzoni et al., 2010; Kellerhals et al., 2012; Lateur and Populer, 1994; Mratinić and Akšić, 2011). A single standardized global descriptor set would facilitate comparisons of apple collections.

Distribution and obstacles to use

Among the surveyed collections 89% distribute material. USDA-ARS, Irish Seed Savers and the Belgian collection are the largest distributors. Thirty-one percent collections only distributed within their country, and 55% distributed both internationally and domestically. Generally, among the surveyed collections, the level of international exchange of the material is low. Constraints to distribution of apple genetic resources include institutional and national policies, phytosanitary regulations, and the shipping cost.

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Priority actions required

- Build a global apple conservation and use community that is composed of a wide range of public, private, non-governmental, and individual actors involved in the apple value chain.
- Ensure access to an information platform with an international registry and database of *ex situ* and in situ apple collections, including tree- and accession-level phenotype, passport and genotype information.
- Facilitate working groups that would be established to focus on key issues such as best practices for securing local cultivar conservation.
- Monitor the status and vulnerability of apple genetic resources *ex situ* and *in situ*.
- Coordinate a global genotyping effort to assess diversity within and among accessions in collections, verify accession identity, confirm redundancies, identify mislabeled accessions, and identify unique accessions.
- Collate information about key local cultivars and verify identity or uniqueness.
- Develop regional or global core collections, or trait-specific subsets.
- Put in place a global communication and advocacy strategy for conservation and use.
- Share news and information within the community.
- Facilitate training opportunities to improve collection management.

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