GLOBAL CROP CONSERVATION AND USE METRICS

STRAWBERRIES
(*Fragaria* L.)

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Global crop conservation and use metrics

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CROP TRUST

International Treaty on Plant Genetic Resources for Food and Agriculture

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Description

This report provides an up-to-date overview of the global status of *ex situ* conservation of genetic resources of strawberries and their wild relatives, including key metrics on:

- the identity and composition of genebank collections;
- the Multilateral System (MLS) status of accessions in these collections;
- storage, regeneration, and safety duplication status;
- documentation, information systems, and research resources;
- germplasm distribution; and
- varietal registrations and releases.

The report also includes global statistics on crop production, trade, and availability in food supplies, as well as information about crop networks and partnerships. It is meant to provide an update to some of the information presented in the Global Conservation Strategy for strawberry (Crop Trust, 2008), but is primarily based on publicly available datasets, rather than a new survey of genetic resource collections and expert consultations.

Introduction and background on strawberry

Strawberries (*Fragaria* L.) are members of the rose family that have been consumed since ancient times, with evidence of use of wild species in Roman literature and prehistoric European sites as well as in Indigenous Chilean cultures (Crop Trust, 2008; Chamorro *et al.*, 2025). While species such as *Fragaria vesca* L. and *Fragaria moschata* Weston have been in cultivation for over 500 years, the modern garden strawberry (*Fragaria x ananassa* Duchesne ex Rozier) emerged in 18th-century France as a hybrid between two American species: *Fragaria chiloensis* (L.) Mill. from western North America and western South America, and *Fragaria virginiana* Mill. from eastern and central North America (Crop Trust 2008; Hancock, 2020; Liston *et al.*, 2014). Today, strawberries are one of the world's most economically important berry crops (Crop Trust, 2008; Liston *et al.*, 2014). Beyond their popularity as fresh fruit, strawberries are valued for their high vitamin C content, antioxidants (particularly anthocyanins and ellagic acid), and versatility in culinary applications.

Based on the most recently available production statistics from FAOSTAT, reporting for the year 2023, strawberries are cultivated in at least 81 countries on 435,000 hectares worldwide, producing 10.5 million tonnes of fruit at a value of USD 25.8 billion (FAO, 2025a). The largest producers include China, USA, Egypt, Türkiye, Mexico, Spain, Russian Federation, Poland, Brazil, Republic of Korea, and Japan, each producing over 150,000 tonnes per annum.

There is considerable international trade in strawberries (over 3.5 million tonnes exported per annum), with Spain, Mexico, USA, Greece, Netherlands, Egypt, Türkiye, and Belgium reporting exporting over 35,000 tonnes each year (FAO, 2025a). Among the 166 countries reporting importing strawberries, the top recipients include USA, Germany, Canada, UK, France, Russian Federation, Netherlands, Poland, Belgium, and Mexico, all importing over 25,000 tonnes each year.

Global consumption statistics are imprecise, with FAOSTAT reporting the crop under its "Fruits, Other" category (Khoury *et al.*, 2023); estimates are provided in Table 1. Production, trade, and food supply metrics all indicate that strawberries are widely utilized outside of their regions of origin, implying significant international interdependence with regard to their genetic resources.

Table 1. Global status of strawberry production, trade, availability in food supplies, and public interest. Production, trade, and food supply statistics from FAOSTAT (2015 to 2018 average). Production and trade metrics are reported directly for the crop in FAOSTAT; for food supply, the crop is placed within "Fruits, Other" and the estimates presented here were derived by disaggregating that generalized food supply statistic using a weighted average based on crop production statistics (Khoury et al., 2023). Number of countries refers to the count of countries where the crop is reported as within the top 95 percent of crops in terms of contribution to production, trade, or food supply. The evenness metric quantifies evenness of production, trade, or availability in food supplies across world regions, where 0 equals highly uneven and 1 equals completely even. The international interdependence metric quantifies degree of production, trade, or availability in food supplies outside of the primary region of diversity of the crop, where 0 equals low estimated international interdependence and 1 equals high estimated international interdependence. Wikipedia metric is public pageviews over one year (2019) of the taxon name of the crop. All values from Khoury *et al.* (2023).

Metric	Global value	Number of countries where significant contributor	Evenness of contribution across world regions	Estimated international interdependence
Harvested area (ha)	377,319	2.00	0.25	0.95
Total production (tonnes)	8,267,342	9.00	0.23	0.89
Gross production value (current thousand USD)	17,656,403	41.75	0.18	0.87
Export quantity (tonnes)	893,436	11.50	0.23	0.85
Export value (current thousand USD)	2,419,141	19.25	0.21	0.82
Import quantity (tonnes)	903,887	14.00	0.20	0.73
Import value (current thousand USD)	2,695,626	44.00	0.19	0.68
Contribution to calories in food supplies (kcal/capita/day)	0.58	1.00	0.71	1.00
Contribution to protein in food supplies (g/capita/day)	0.01	0.00	0.70	1.00
Contribution to fat in food supplies (g/capita/day)	0.01	1.75	0.59	0.93
Contribution to food weight in food supplies (g/capita/day)	0.48	16.75	0.68	1.00
Number of public pageviews on Wikipedia over one year	2,201			

Identity and composition of *ex situ* collections

Based on the latest data in global genetic resource databases, germplasm collections of strawberries and wild relatives (i.e., genus *Fragaria* L.) are present in at least 63 institutions worldwide, collectively maintaining 8,227 accessions (Table 2, Table 3; Supplementary Table 1). This is slightly more than the number of accessions reported for the crop (8,177) in the major germplasm collections listed in *The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture* (FAO, 2025b).

There are no international centers with a mandate for the conservation and sustainable use of strawberries. Most of the largest collections are located in North America and Europe. The largest collections are in Canada, USA, Russian Federation, Japan, Switzerland, and Germany; these collectively maintain over three-quarters of documented accessions worldwide. Reported information on the status of accessions under the Multilateral System of Access and Benefit Sharing (MLS) of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty), as recorded in the Global Information System (GLIS) and in pertinent fields in Genesys and FAO WIEWS (Table 2; Table 4), likely underestimate the full degree to which

accessions are currently included in the MLS, as several of the strawberry collections without information on MLS status are in countries that are contracting parties to the Plant Treaty (such as USA, Japan, and Spain) and distribute samples using the Standard Material Transfer Agreement (SMTA).

Based on a genebank stakeholder survey and inventorying process, the 2008 Strategy identified more than 12,000 accessions of strawberries and wild relatives maintained in over 27 countries (Crop Trust, 2008). The identified major collections were located in many of the same countries as those with the largest collections in global genetic resource databases, and included USA, Canada, the European Cooperation in the Field of Scientific and Technical Research (COST 836) network, the Russian Federation, Germany, Spain, and Chile, although in some cases, such as Chile and Spain, the numbers of accessions appear to have decreased dramatically and the reporting institutions may be different (Crop Trust, 2008).

Fragaria L. (Rosaceae) contains around 60 taxa within around 24 species, native to temperate regions of the northern Hemisphere, as well as western South America (USDA, 2025). Along with the two species that were hybridized to derive the modern cultivated strawberry – *Fragaria chiloensis* (L.) Mill. (from western North America and western South America) and *Fragaria virginiana* Mill. (from eastern and central North America) – the primary genepool of the crop is considered to include two additional species – *Fragaria iinumae* Makino (from East Asia) and *Fragaria vesca* L. (from North America, Europe, and temperate Asia). The secondary genepool includes *Fragaria cascadensis* K. E. Hummer and *Fragaria iturupensis* Staudt, with 26 other taxa assigned to the tertiary genepool. The genera

Table 2. Major *ex situ* collections of strawberries genetic resources. Top 20 institutions listed in descending order by total number of accessions. Number of accessions and storage condition information from Genesys and FAO WIEWS (2024), with supplementary information as noted. Multilateral System (MLS) status from Plant Treaty GLIS (2025) and from Genesys and FAO WIEWS (2024).

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions conserved in vitro or in cryo storage	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
CAN025	Canadian Clonal Genebank, Harrow Research and Development Centre	2,013	24.5%	24.5%	1,915	0	2,013
USA026	National Clonal Germplasm Repository USDA, ARS	2,006	24.4%	48.6%	648	0	0
RUS001	N.I. Vavilov All-Russian Research Institute of Plant Industry (VIR)	726	8.8%	57.7%	0	0	0
JPN183	NARO Genebank	572	7.0%	64.6%	0	0	0
CHE063	ProSpecieRara	559	7.0%	71.4%	0	0	492
DEU451	Federal Research Centre for Cultivated Plants - Institute of Fruit Breeding	460	5.6%	77.0%	138	0	460
BLR017	Republican Unitary Enterprise 'Institute for Fruit Growing'	181	2.2%	79.2%	0	0	0

ITA380	CREA-Centro di Ricerca Olivicoltura, Frutticoltura e Agrumicoltura - Sede di Forlì	175	2.1%	81.3%	175	195	175
ESP138	Junta de Andalucía. Consejería de Agricultura y Pesca. Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica. Centro de Churriana	164	2.0%	83.3%	0	0	14
DEU610	Federal Plant Variety Office (Bundessortenamt), Station Wurzen	142	1.7%	85.1%	0	0	140
DNK020	Pometum	140	1.7%	86.8%	0	0	135
CAN004	Plant Gene Resources of Canada, Saskatoon Research and Development Centre	139	1.7%	88.5%	76	0	139
CHL028	Banco Base de Semillas INIA Intihuasi	118	1.4%	89.9%	0	0	0
SVK001	National Agricultural and Food Centre (NPPC), Research Institute of Plant Production (RIPP)	99	1.2%	91.1%	0	0	99
CZE031	Research and Breeding Institute of Pomology, Holovousy Ltd.	90	1.1%	92.2%	34	0	90
ROM009	Research and Development Institute for Fruit Tree Growing Pitesti - Maracineni	81	1.0%	93.2%	0	0	0
CHL099	Banco Base INIA Quilamapu	68	0.8%	94.0%	0	0	0
CHE001	Agroscope Changins	61	0.7%	94.7%	47	0	61
FIN016	Natural Resources Institute Finland Piikkiö	58	0.7%	95.4%	5	0	0
LVA015	Latvia State Institute of Fruit-Growing, Rural Department, Ministry of Agriculture	39	0.5%	95.9%	0	0	2
	Other institutions (n = 43)	336	4.1%	100%	68	1	158

Table 3. Composition of ex situ collections of strawberry genetic resources. Main ex situ collections data from Genesys and FAO WIEWS (2024). Primary and secondary regions information from Khoury et al. (2023) and subsequent research for this summary. Botanic gardens data from BGCI PlantSearch (2024).

Metric	Number	Percentage
Total number of accessions in genebank collections	8,227	
Number of institutions holding genebank collections	63	
Number of distinct taxonomic names in genebank collections	49	
Number of accessions of crop wild relatives (CWR) in genebank collections	2,630	32.0%
Number of accessions of weedy materials in genebank collections	3	0.04%
Number of accessions of landraces in genebank collections	125	1.5%
Number of accessions of breeding materials in genebank collections	969	11.8%
Number of accessions of improved varieties in genebank collections	1,974	24.0%
Number of accessions of other materials in genebank collections	35	0.4%
Number of accessions not marked with an improvement type in genebank collections	2,491	30.3%
Number of countries where germplasm has been collected for genebank collections	48	
Number of accessions in genebank collections from the primary region(s) of diversity	1,921	23.4%
Number of accessions in genebank collections from the primary and secondary region(s) of diversity	2,095	25.5%
Number of taxa in botanic garden collections	47	
Number of botanic gardens holding collections of crop or its wild relatives	249	

Duchesnea Sm. and *Potentilla* L. are closely related to *Fragaria* (Crop Trust, 2008).

Data compilation for this report on strawberries genetic resources included all taxa in *Fragaria*. Along with the crop, 46 taxa as well as hybrid crosses and accessions only recognized to the genus level are present in germplasm collections (Supplementary Table 2). These mainly include large collections of the crop species and subspecific taxa, as well as accessions in *F. chiloensis* and subspecies, *Fragaria virginiana* Mills subsp. *virginiana*, *F. vesca*, *Fragaria moschata* Weston, and accessions only determined to the genus level.

Wild relatives make up the largest proportion of collections (32%), followed by improved varieties (24%), and breeding materials (11.8%) (Table 3); these percentages are rough estimates based on available data, noting that 30.3% of accessions do not have biological status data. *Fragaria* germplasm has been collected from at least 48 countries, with approximately 23.4% of accessions originating from the primary region of diversity of strawberries (i.e. North America and temperate South America) and 25.5% from primary and secondary (i.e. Western Europe, Andean South America, tropical South America, and East Asia) regions; these statistics are also estimates, as 32% of strawberry landrace accessions and 4.9% of wild relative accessions do not contain information even of the country where the accession was collected. Information on botanic garden collections from BGCI PlantSearch indicate that 249 botanic gardens collectively conserve 47 *Fragaria* taxa; comparing these to genebank collections, 3 taxa are only conserved in botanic gardens.

Aside from the taxa that appear to be entirely missing from, or with very small representation in, germplasm collections, the global genetic resources databases do not offer insights on diversity gaps, but published research has indicated specific priority species and geographic regions for further collecting for conservation. The 2008 Strategy remarked that many of the surveyed institutes had identified gaps in their collections, including

at species and population levels (Crop Trust, 2008). Areas of Chile were specifically identified as significant geographic gaps, with several other taxa and regions also noted. A major gap identified by the Strategy was the need for a significant strawberry collection in Asia – specifically suggesting China – as well as additional efforts in Chile. China, unfortunately, does not appear to have been reporting to the global genetic resource databases in recent years, thus it is difficult to assess based on available data whether this gap has been filled. Japan, on the other hand, now holds one of the largest *Fragaria* collections in the world among those that are reported in the global germplasm databases. Regarding Chile, three collections are currently listed in the databases - Banco Base de Semillas INIA Intihuasi (118 accessions), Banco Base INIA Quilamapu (68 accessions), and Banco de Germoplasma de Papa - Universidad Austral de Chile (1 accession). Participants in the expert stakeholder workshop for the 2008 Strategy prioritized further collecting of: Asian diploid and higher ploidy species; northwest Alaskan octoploids; *F. virginiana* from northwest and northeast Canada and the midwestern and southwestern USA states south of Colorado; *F. moschata* and *F. viridis* from eastern Europe; and heirloom cultivars that possess unique genetics (Crop Trust, 2008). In a global *ex situ* conservation gap analysis of the wild relatives of major crops, Castañeda-Álvarez *et al.* (2016), assessing 17 strawberry wild relatives, listed 14 (82.4%) as of high priority for further collecting, and the remaining three species as of medium priority.

Multilateral System status of accessions in *ex situ* collections

The genus *Fragaria* is listed in Annex I of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty) and is thus included in its Multilateral System of Access and Benefit Sharing (MLS). Of the 8,227 accessions conserved globally, 207 accessions are formally included in the MLS according to the Plant Treaty's GLIS database, and 212 accessions have been assigned Digital Object Identifiers (DOIs) (Table 4). Per the relevant fields in the global genetic resources databases, 3,978 accessions (48.4% of world total) are listed as included in the MLS; this is likely an underestimate, noting that 39.4% of accessions do not have MLS status data. The discrepancies between the GLIS data and the global genetic resources data indicates that several institutions have not registered or recently updated their registrations in the GLIS portal.

Storage conditions, regeneration status, and safety duplication

Strawberry germplasm collections are mainly maintained in the field (50.9% of accessions), with 35.3% of accessions listed as conserved in in vitro conditions (Table 5). Seed collections comprise 37.3% of accessions, the great majority (at least 79%) of which are conserved in long-term conditions. Only 2.5% of accessions are conserved in cryopreservation. Information on storage type is not available for 3.7% of accessions.

Table 4. Representation of strawberry accessions in international and national institutions, number of accessions with DOIs, and representation of accessions in the Multilateral System of Access and Benefit Sharing of the International Treaty on Plant Genetic Resources for Food and Agriculture. Main ex situ collections data from Genesys and FAO WIEWS (2024). DOI and MLS data from Plant Treaty GLIS (2025).

Metric	Number	Percentage
Number of accessions in genebank collections in international institutions	0	0%
Number of accessions in genebank collections in national or other institutions	8,227	100%
Number of accessions in genebank collections in Annex I	8,227	100%
Number of accessions with DOI (Plant Treaty GLIS 2025)	212	
Number of accessions included in the Multilateral System (MLS) (Plant Treaty GLIS 2025)	207	
Number of accessions included in the Multilateral System (MLS) (genebank collections databases)	3,978	48.4%
Number of accessions included in the Multilateral System (MLS) that are in international collections (genebank collections databases)	0	0%
Number of accessions not included in the Multilateral System (MLS) (genebank collections databases)	1,008	12.3%
Number of accessions without information regarding inclusion in the Multilateral System (MLS) (genebank collections databases)	3,241	39.4%

Current regeneration status and needs cannot be directly derived from the global germplasm databases. The 2008 Strategy did not specifically document regeneration status or priorities for strawberry collections (Crop Trust, 2008). FAO WIEWS reporting for the Third State of the World's Plant Genetic Resources for Food and Agriculture (FAO, 2025b) for the years 2014 to 2019, documented 856 strawberry accessions regenerated during this time by reporting institutions, with 227 accessions identified as needing regeneration and none of these lacking funds to conduct the regeneration.

Analysis of the location of safety duplication sites of strawberry germplasm, as listed in Genesys, indicates that none of the accessions listed are safety duplicated in an active collection (i.e., apart from potentially being duplicated at the Svalbard Global Seed Vault [SGSV]) outside of the country of the main collection (Table 5). The actual extent of safety duplication of strawberry accessions worldwide, when also considering safety duplication within the same country, may be significant, given that a number of national genebanks (such as the USA and Russian Federation) typically safety backup their collections in a different location within the country. Information from the SGSV database from 2024 indicated that approximately 1.5% of total accessions worldwide were duplicated in Svalbard.

The 2008 Strategy noted that, at that time, about half of accessions in European institutions were backed up through inter-country cooperation, and that the Russian Federation, the Czech Republic, and the USA all had some degree of back-up at different facilities within country borders (Crop Trust, 2008). The Strategy further mentioned that the Canadian and Chilean collections were not officially backed-up, although the USA genebank had some representation from both countries in its collection. The stakeholder workshop identified improving the level of safety duplication of strawberry germplasm through alternative storage techniques such as in vitro or seed as a priority.

Table 5. Storage conditions of strawberry *ex situ* collections, regeneration status, and safety duplication status. Main *ex situ* collections data from Genesys and FAO WIEWS (2024). Regeneration status information from FAO WIEWS (2024); data from 2014 to 2019. Safety duplication out of the country data based only on Genesys (2024) data. Svalbard Global Seed Vault data from SGSV portal (2024).

Metric	Number	Percentage
Number of accessions held in seed storage in genebank collections	3,066	37.3%
Number of accessions held in short-term seed storage in genebank collections	0	0%
Number of accessions held in medium-term seed storage in genebank collections	178	5.8%
Number of accessions held in long-term seed storage in genebank collections	2,422	79%
Number of accessions held in seed storage of undefined type in genebank collections	466	15.2%
Number of accessions held in field storage in genebank collections	4,191	50.9%
Number of accessions held in in-vitro storage in genebank collections	2,905	35.3%
Number of accessions held in cryo storage in genebank collections	205	2.5%
Number of accessions held as DNA in genebank collections	4	0.05%
Number of accessions held in other storage in genebank collections	0	0%
Number of accessions not marked with a storage type in genebank collections	301	3.7%
Number of accessions in genebank collections regenerated 2014–2019	856	85.6%
Number of accessions in genebank collections in need of regeneration 2014–2019	227	22.7%
Number of accessions in genebank collections in need of regeneration without budget for regeneration 2014–2019	0	0%
Number of accessions safety duplicated out of the country in genebank collections	0	0%
Number of accessions in genebank collections safety duplicated in Svalbard	120	1.5%

Documentation, information systems, and research resources

A descriptor list for strawberry was published in 1986 and is available online (IBPGR and CEC, 1986). The estimated completeness of passport information for strawberry accessions listed in Genesys was 6.5 on a scale of 0 (no data) to 10 (complete data), which indicates that much data is available, but also that there are gaps that it would be valuable to fill. Four metrics of the current degree of digital sequence information (DSI) for strawberry (from the National Center for Biotechnology Information USA database), two metrics of published literature on the crop (Google Scholar and PubMed Central), and one metric of the degree of research resources such as herbarium specimens (from the Global Biodiversity Information Facility - GBIF), are listed in Table 6.

The 2008 Strategy identified the following major needs regarding documentation and information systems at that time:

- A global online database of strawberry collections should be established, through linking present on-line databases. More generally, further prioritization of maintaining electronic inventories was important.
- Standardized descriptors should be adopted for all collections, with the current published descriptors to be used by all major collections. More generally, ontology for phenotypic and genotypic characterization of collections should be standardized across institutions.

- The expert stakeholders "expressed their interest to form a global information network to coordinate the global conservation of strawberry genetic resources." (Crop Trust, 2008).

Information management for crop genetic resources has evolved substantially since the 2008 Strategy. The current Genesys and FAO WIEWS databases offer some essential taxonomic, institutional, and passport data, and Genesys has the potential to hold characterization data for the crop. This said, it is apparent that for strawberry, a dedicated online information system including complete accession-level characterization and evaluation data remains a gap.

Table 6. Documentation, information systems, and research resources for strawberry. Passport data completeness index (PDCI) from Genesys (2024), based on the methods outlined in van Hintum et al. (2011). Global Biodiversity Information Facility data from GBIF (2025). All other metrics data from Khoury et al. (2023).

Metric	Number
Passport data completeness index (range 0-10) as a median value across accessions in genebank collections	6.5
Number of genes as recorded in NCBI's Entrez database as of 2022	64,434
Number of genomes as recorded in NCBI's Entrez database as of 2022	8
Number of nucleotides as recorded in NCBI's Entrez database as of 2022	85,551
Number of proteins as recorded in NCBI's Entrez database as of 2022	5,917
Number of publications listed in Google Scholar with taxon name in title published between 2009 and 2019	14
Number of publications listed in PubMed Central with taxon name in text as of 2022	3,884
Number of research materials as recorded in GBIF (2025)	963,534

Germplasm distributions and varietal registrations and releases

Germplasm distribution and varietal development statistics for strawberry are listed in Table 7. Germplasm distribution data from FAO WIEWS and the Plant Treaty Data Store reflect different reporting scopes: FAO WIEWS primarily reports distributions from national genebanks, while the Plant Treaty Data Store includes all transfers made under the SMTA, encompassing distributions made by genebanks as well as by breeding programs and other organizational types (Khoury *et al.*, 2025). Strawberries are among the top half of fruit crops in terms of varietal registrations and releases (Khoury *et al.*, 2023) (Table 7).

Table 7. Strawberry germplasm distributions and varietal registrations and releases. FAO WIEWS distributions data is annual average over years 2014 to 2019. Plant Treaty Data Store distributions data is annual average over years 2015 to 2021. Evenness metric quantifies evenness of germplasm distributions across world regions, where 0 equals highly uneven and 1 equals completely even. International Union for the Protection of New Varieties of Plants (UPOV) PLUTO data is annual average over years 2014 to 2018. FAO WIEWS varietal releases data is annual average over years 2015 to 2019. All metrics data from Khoury et al. (2023), with Plant Treaty Data Store additions for more recent years (2019 to 2021).

Metric	Number
Average annual number of accessions distributed worldwide as recorded in FAO WIEWS	69.8
Average annual number of samples distributed worldwide as recorded in FAO WIEWS	134.5
Average annual number of samples distributed worldwide as recorded in the Plant Treaty Data Store	8.3
Number of countries receiving germplasm as recorded in the Plant Treaty Data Store	2.7
Evenness of distributions across world regions as recorded in the Plant Treaty Data Store	0.4
Average annual number of varietal registrations worldwide as recorded in UPOV's PLUTO	104.0
Average annual number of varietal releases worldwide as recorded in FAO WIEWS	14.4

Networks and partnerships

- The 2008 Strategy identified only one international network relevant to strawberry genetic resources – the European Cooperation in the Field of Scientific and Technical Research (COST 836) in Europe. By the time of the Strategy, around 31 countries were members of COST and 52 locations had representatives. Around 1,056 unique genotypes and 418 wild species accessions were conserved, and a core collection of 106 cultivars had been selected. A new project starting in 2007 focused on "rationalization and conservation of *ex situ* collections; definition and selection of primary and secondary descriptors; characterization of the genetic diversity using molecular markers; characterization for health nutritional compounds and for disease resistances; dissemination of the results to the public and elaboration of a European small berries database." (Crop Trust, 2008). At the time of writing of this report, the website link for COST 836 was no longer functioning, and no website results more recent than around 2005 were available online.
- Current active crop networks relevant to strawberry include:
  - The European Cooperative Programme for Plant Genetic Resources (ECPGR) Berries Working Group
  - The USDA ARS Small Fruits Crop Germplasm Committee (also here)
- Information on other networks active in strawberry conservation or use is not readily available online.

Conclusions

Strawberry continues to be an extremely important fruit crop worldwide and it is possible that it will continue to grow in popularity in future food systems. In the absence of international institutions with a mandate for the conservation and sustainable use of the crop, its genetic resources are bolstered by the activities taking place at national and other research organizations mainly in North America and Europe. In recent decades, there appears to have been some progress made in conserving collections in vitro and as seed, and there are considerable amounts of associated research resources and significant activity in germplasm distribution and varietal development. This said, it is very likely that further and increased efforts are needed to strengthen existing collections, comprehensively include all unique strawberry germplasm collections under the MLS of the Plant Treaty, fill gaps in collections, make the information accompanying accessions more complete and/or more accessible in online databases, and address safety duplication backlogs.

Methods and materials

Primary data sources for the metrics reported in this summary include: Genesys; World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture of the Food and Agriculture Organization of the United Nations (FAO WIEWS); Botanic Gardens Conservation International PlantSearch database (BGCI PlantSearch); Global Information System of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty GLIS); Data Store of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty Data Store); Svalbard Global Seed Vault portal (SGSV portal); International Union for the Protection of New Varieties of Plants (UPOV) PLUTO database; FAOSTAT; National Center for Biotechnology Information's Entrez database (NCBI Entrez); Google Scholar; PubMed Central; Wikipedia; and the Global Biodiversity Information Facility (GBIF). Some of these data were acquired from literature/databases including Khoury et al. (2023) and Khoury et al. (2025). Data processing, metric calculation, and table generation were conducted in R, with code available on this GitLab repository. Extended methods are available here

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Supplementary information

Supplementary Table 1: Full list of *ex situ* collections of strawberry genetic resources, in descending order by total number of accessions. Number of accessions and storage condition information from Genesys and FAO WIEWS (2024), with supplementary information as noted. Multilateral System (MLS) status from Plant Treaty GLIS (2025) and from Genesys and FAO WIEWS (2024).

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions conserved in vitro or in cryo storage	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
CAN025	Canadian Clonal Genebank, Harrow Research and Development Centre	2,013	24.5%	24.5%	1,915	0	2,013
USA026	National Clonal Germplasm Repository USDA, ARS	2,006	24.4%	48.9%	648	0	0
RUS001	N.I. Vavilov All-Russian Research Institute of Plant Industry	726	8.8%	57.7%	0	0	0
JPN183	NARO Genebank	572	7.0%	64.6%	0	0	0
CHE063	ProSpecieRara	559	6.8%	71.4%	0	0	492
DEU451	Federal Research Centre for Cultivated Plants - Institute of Fruit Breeding	460	5.6%	77.0%	138	0	460
BLR017	Republican Unitary Enterprise 'Institute for Fruit Growing'	181	2.2%	79.2%	0	0	0
ITA380	CREA-Centro di Ricerca Olivicoltura, Frutticoltura e Agrumicoltura - Sede di Forlì	175	2.1%	81.3%	175	195	175
ESP138	Junta de Andalucía. Consejería de Agricultura y Pesca. Instituto Andaluz de Investigación y Formación Agraria, Pesquera, Alimentaria y de la Producción Ecológica. Centro de Churriana	164	2.0%	83.3%	0	0	14
DEU610	Federal Plant Variety Office (Bundessortenamt), Station Wurzen	142	1.7%	85.1%	0	0	140
DNK020	Pometum	140	1.7%	86.8%	0	0	135
CAN004	Plant Gene Resources of Canada, Saskatoon Research and Development Centre	139	1.7%	88.5%	76	0	139
CHL028	Banco Base de Semillas INIA Intihuasi	118	1.4%	89.9%	0	0	0

SVK001	National Agricultural and Food Centre (NPPC), Research Institute of Plant Production (RIPP)	99	1.2%	91.1%	0	0	99
CZE031	Research and Breeding Institute of Pomology, Holovousy Ltd.	90	1.1%	92.2%	34	0	90
ROM009	Research and Development Institute for Fruit Tree Growing Pitesti - Maracineni	81	1.0%	93.2%	0	0	0
CHL099	Banco Base INIA Quilamapu	68	0.8%	94.0%	0	0	0
CHE001	Agroscope Changins	61	0.7%	94.7%	47	0	61
FIN016	Natural Resources Institute Finland Piikkiö	58	0.7%	95.4%	5	0	0
LVA015		39	0.5%	95.9%	0	0	2
VNM132	Potato, Vegetable and Flower Research Center	37	0.4%	96.4%	0	0	37
EST019	Estonian Crop Research Institute	35	0.4%	96.8%	35	0	35
GBR004	Millennium Seed Bank - Royal Botanic Gardens Kew	30	0.4%	97.2%	5	0	0
UKR028	Institute of Horticulture	26	0.3%	97.5%	0	0	0
BRA020	Embrapa Clima Temperado	25	0.3%	97.8%	0	0	0
NOR035	Sagaplant, Laboratory and Plant Hospital	23	0.3%	98.1%	23	0	23
SWE089	Department of Landscape Architecture, Planning and Management/National Genebank Alnarp	22	0.3%	98.3%	0	0	0
DEU502	Botanical Garden of the University of Osnabrück	18	0.2%	98.5%	0	0	18
MKD001	Faculty of Agriculture, University Ss. Cyril and Methodius	17	0.2%	98.7%	0	0	0
CUB003	Instituto de Investigaciones en Fruticultura Tropical	10	0.1%	98.9%	0	0	0
LTU006	Lithuanian Institute of Horticulture	9	0.1%	99.0%	0	0	0
DEU515	Botanischer Versuchs- und Lehrgarten der Universitaet Regensburg	8	0.1%	99.1%	0	0	8
DEU626	Pädagogische Hochschule Karlsruhe	8	0.1%	99.2%	0	0	8
ESP198	Comunidad de Madrid. Consejería de Medio Ambiente, Vivienda y Ordenación del Territorio. Instituto Madrileño de Investigación y Desarrollo Rural. Banco de Variedades Locales de Madrid	5	0.1%	99.2%	0	0	4

USA995	National Center for Genetic Resources Preservation	5	0.1%	99.3%	0	0	0
CUB005	Instituto Nacional de Ciencias Agrícolas	4	0.0%	99.3%	4	0	0
NOR053	Njoes fruit and berry centre	4	0.0%	99.4%	0	0	4
ROM021	Research and Development Station for Plant Culture on Sands Dabuleni	4	0.0%	99.4%	0	0	0
DEU022	Botanical Garden Berlin-Dahlem	3	0.0%	99.5%	0	0	3
ECU023	Departamento Nacional de Recursos Fitogenéticos	3	0.0%	99.5%	0	0	2
EST012	Polli Horticultural Research Centre (Estonian University of Life Sciences)	3	0.0%	99.6%	0	0	3
HRV041	Faculty of Agriculture, University of Zagreb	3	0.0%	99.6%	0	0	0
IND001	National Bureau of Plant Genetic Resources	3	0.0%	99.6%	1	0	0
LBN020	Lebanese Agricultural Research Institute	3	0.0%	99.7%	0	0	3
USA022	Western Regional Plant Introduction Station, USDA-ARS, Washington State University	3	0.0%	99.7%	0	0	0
AUT001	Austrian Agency for Health and Food Safety	2	0.0%	99.7%	0	0	2
AZE004	Institute of Botany	2	0.0%	99.7%	0	0	0
BEL002	Gembloux agro-biotech, Université de Liège, département des Sciences agronomiques, Phytotechnie tropicale et Horticulture	2	0.0%	99.8%	0	0	2
BLR014	State research institution 'Institute of Experimental Botany of the National Academy of Sciences of Belarus'	2	0.0%	99.8%	0	0	0
GRC044	Balkan Botanic Garden of Kroussia, Institute of Plant Breeding and Genetic Resources	2	0.0%	99.8%	0	0	0
NOR059	University of Agder, Natural History Museum and Botanical Garden	2	0.0%	99.8%	0	0	2
UKR019	Research Station of Medicinal Crops	2	0.0%	99.9%	0	0	0
BGD014	Bangladesh Forest Research Institute (BFRI)	1	0.0%	99.9%	0	0	0
BGD016	Bangladesh Agricultural University (BAU)	1	0.0%	99.9%	0	0	0
CHL071	Banco de Germoplasma de Papa, Universidad Austral de Chile	1	0.0%	99.9%	0	0	0

ESP172	Cabildo Insular de Tenerife. Centro de Conservación de la Biodiversidad Agrícola de Tenerife	1	0.0%	99.9%	0	0	0
KGZ034	Botanical Garden named after E.Z.Gareev	1	0.0%	99.9%	0	0	1
MLT001	Argotti Botanic Gardens & Resource Centre, University of Malta	1	0.0%	99.9%	0	0	0
PAK001	Plant Genetic Resources Program	1	0.0%	100.0%	0	0	1
PHL024	Bureau of Plant Industry-Davao National Crop Research and Development Center	1	0.0%	100.0%	0	0	1
SWE054	Nordic Genetic Resource Center	1	0.0%	100.0%	0	2	1
UKR018	Institute of Volatile Oil Bearing and Medicine Crops	1	0.0%	100.0%	0	0	0
USA151	National Arboretum-Germplasm Unit, USDA/ARS	1	0.0%	100.0%	0	0	0

Supplementary Table 2: Full list of taxonomic names in ex situ genetic resource collections, in descending order by number of accessions conserved. Germplasm data from Genesys and FAO WIEWS (2024).

Taxon	Number of accessions (from genebank collections databases)
Fragaria x ananassa Duchesne ex Rozier	4,079
Fragaria chiloensis subsp. *pacifica* Staudt	926
Fragaria x ananassa nothosubsp. cuneifolia (Nutt. ex Howell) Staudt	721
Fragaria virginiana subsp. *virginiana*	454
Fragaria sp.	381
Fragaria chiloensis f. *patagonica* Staudt	280
Fragaria chiloensis (L.) Mill.	250
Fragaria vesca L.	229
Fragaria moschata Weston	116
Fragaria vesca f. bracteata (A. Heller) Staudt	75
Fragaria virginiana subsp. glauca (S. Watson) Staudt	63
Fragaria virginiana Mill.	57
Fragaria cascadensis K. E. Hummer	53
Fragaria virginiana subsp. grayana (Vilm. ex J. Gay) Staudt	51
Fragaria vesca subsp. vesca	44
Fragaria viridis Weston	44
Fragaria virginiana subsp. platypetala (Rydb.) Staudt	41
Fragaria vesca f. semperflorens (Duchesne) Staudt	37
Fragaria chiloensis f. chiloensis	33
Fragaria hybr.	30
Fragaria iinumae Makino	30
Fragaria chiloensis subsp. *lucida* (E. Vilm. ex Gay) Staudt	27
Fragaria orientalis Losinsk.	23
Fragaria vesca f. *alba* (Ehrh.) Staudt	20
Fragaria x vescana Rud. Bauer & A. Bauer	20
Fragaria nilgerrensis Schltdl. ex J. Gay	19
Fragaria vesca subsp. *americana* (Porter) Staudt	19
Fragaria x bringhurstii Staudt	18
Fragaria nipponica Makino	17
Fragaria vesca subsp. *californica* (Cham. & Schltdl.) Staudt	11
Fragaria chiloensis subsp. *sandwicensis* (Decne.) Staudt	10
Fragaria nubicola (Hook. f.) Lindl. ex Lacaita	6
Fragaria x ananassa nothosubsp. ananassa	6
Fragaria bucharica Losinsk.	5
Fragaria corymbosa Losinsk.	4
Fragaria chinensis Losinsk.	3
Fragaria daltoniana J. Gay	3
Fragaria gracilis Losinsk.	3
Fragaria pentaphylla Losinsk.	3
Fragaria iturupensis Staudt	2
Fragaria mandshurica Staudt	2
Fragaria moupinensis (Franch.) Cardot	2
Fragaria nilgerrensis var. *nilgerrensis*	2
Fragaria vesca subsp. *bracteata* (A. Heller) Staudt	2
Fragaria x bifera Duchesne	2
Fragaria nipponica subsp. *nipponica*	1
Fragaria tibetica Staudt & Dickoré	1
Fragaria vesca f. helleri (Holz.) Staudt	1
Fragaria vesca f. vesca	1

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