GLOBAL CROP CONSERVATION AND USE METRICS

COTTON
(*Gossypium* L.)

CROP TRUST

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Global crop conservation and use metrics

COTTON
(*Gossypium* L.)

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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 cotton and its wild relatives, including key metrics on:

- global statistics on crop production, trade, and availability in food supplies;
- 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;
- varietal registrations and releases; and
- crop networks and partnerships

Introduction and background on cotton

Cultivated cottons (*Gossypium* L.) originated in multiple regions independently, with species domesticated in Mesoamerica (*Gossypium hirsutum* L.), tropical South America (*Gossypium barbadense* L.), South Asia (*Gossypium arboreum* L.), and West Asia or potentially Africa (*Gossypium herbaceum* L.) (Yuan *et al.,* 2021). Today, *G. hirsutum* is the source of over 90% of world production, with *G. barbadense* representing around 5% and the remaining two species less than 2% each (Yuan *et al.,* 2021). The soft, fibrous seed hairs have become the foundation of the global textile industry, as cotton fabric offers breathability, durability, and comfort suitable for clothing, home furnishings, and industrial applications (Campbell *et al.*, 2010). Beyond textiles, cottonseed oil is used in food products and cosmetics, while the remaining meal serves as livestock feed and the cellulose fibers are used in paper production and medical supplies (Wu *et al.*, 2022). Cotton is one of the world's most economically significant crops and is the most important textile crop, accounting for approximately one-quarter of global textile fiber production, cultivated across tropical and subtropical regions worldwide, and supporting millions of livelihoods in farming and manufacturing (Campell *et al.*, 2010). Its cultural impact is equally profound, having shaped trade routes, influenced colonial expansion and labor systems, including slavery, and driven the Industrial Revolution through mechanized cotton textile production (Robins, 2024; Yuan *et al.,* 2021).

Based on the most recently available production statistics from FAOSTAT, reporting for the year 2023, cotton is cultivated in at least 82 countries on 32.2 million hectares worldwide, producing 74.3 million tonnes at a value of USD 78.6 billion (FAO, 2025a). The largest producers include China, India, USA, Brazil, Pakistan, Uzbekistan, Australia, and Türkiye, each producing over 2 million tonnes per annum.

There is considerable international trade in cotton in various forms, including ginned lint, seed, carded or combed cotton, linters, oil, and waste products, amounting to over 10.5 million tonnes exported per annum, with the USA, Australia, Brazil, India, Türkiye, Greece, Benin, Mali, Sudan, Burkina Faso, Kazakhstan, Tajikistan, and Pakistan reporting exports of over 100,000 tonnes each year (FAO, 2025a). Among the 170 countries reporting importing cotton, the top recipients include China, Vietnam, Bangladesh, Türkiye, Pakistan, Indonesia, India, Republic of Korea, Egypt, Mexico, Malaysia, and Saudi Arabia, all importing over 100,000 tonnes each year.

Cottonseed oil is a major contributor to calories in the food supplies of at least 32 countries and to fat in at least 56 countries (Table 1). Production, trade, and food supply metrics all indicate that cotton is widely utilized outside of its regions of origin, implying significant international interdependence with regard to its genetic resources.

Table 1. Global status of cotton production, trade, availability in food supplies, and public interest. Production, trade, and food supply statistics from FAOSTAT (2015 to 2018 average). 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)	32,195,377	47.25	0.27	0.93
Total production (tonnes)	69,546,624	34.75	0.25	0.93
Gross production value (current thousand USD)	55,043,617	28.00	0.17	0.94
Export quantity (tonnes)	10,130,431	43.50	0.33	0.87
Export value (current thousand USD)	14,263,288	47.50	0.30	0.87
Import quantity (tonnes)	9,852,405	54.75	0.28	0.94
Import value (current thousand USD)	14,874,540	68.00	0.25	0.96
Contribution to calories in food supplies (kcal/capita/day)	13.00	32.75	0.39	1.00
Contribution to protein in food supplies (g/capita/day)	0.00	0.00	0.10	0.96
Contribution to fat in food supplies (g/capita/day)	1.42	56.50	0.39	1.00
Contribution to food weight in food supplies (g/capita/day)	0.44	15.50	0.36	1.00
Number of public pageviews on Wikipedia over one year	52,523			

Identity and composition of *ex situ* collections

Based on the latest data in global genetic resource databases, germplasm collections of cultivated cottons and their wild relatives (i.e., genus *Gossypium* L.) are present in at least 73 institutions worldwide, collectively maintaining 75,608 accessions (Table 2, Table 3; Supplementary Table 1). This is somewhat more than the number of accessions reported for the crop (71,767) 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). The institutions include large collections in Europe, the Americas, Asia (mainly Central and South Asia), Australia, and Africa. The largest collections are in Uzbekistan (at least 38% of total accessions worldwide, spread across several institutes), USA (14%), and India (13%), as well as the Russian Federation, Brazil, Pakistan, Azerbaijan, and Australia; these collectively maintain over 90% of documented accessions worldwide.

Table 2. Major *ex situ* collections of cotton 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 (2025), with supplementary information as noted. Multilateral System (MLS) status from Plant Treaty GLIS (2025) and from Genesys and FAO WIEWS (2025).

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions in long term storage (-18-20 C)	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
UZB036	Uzbek Research Institute of Cotton Breeding and Seed Production	12,288	16.3%	16.3%	Not listed	0	0
USA049	Crop Germplasm Research Unit USDA, ARS	10,535	14.0%	30.3%	Not listed*	0	0
UZB001	Institute of Genetics and Plant Experimental Biology	9,953	13.2%	43.5%	Not listed	0	0
IND001	National Bureau of Plant Genetic Resources	9,768	13.0%	56.5%	9,768	0	0
UZB006	Uzbek Research Institute of Plant Industry	6,404	8.5%	65.0%	Not listed	0	0
RUS001	N.I. Vavilov All-Russian Research Institute of Plant Industry	6,334	8.4%	73.4%	Not listed	0	0
BRA007	Embrapa Algodão	4,714	6.3%	79.7%	Not listed	0	0
BRA003	Embrapa Recursos Genéticos e Biotecnologia	3,265	4.3%	84.0%	Not listed	0	0
PAK001	Plant Genetic Resources Program	2,056	2.7%	86.7%	2,054	0	0
AZE015	Genetic Resources Institute	1,518	2.0%	88.7%	Not listed	0	0
AUS165	Australian Grains Genebank, Agriculture Victoria	1,082	1.4%	90.2%	1,078	1,059	1,060
COL017	Corporación Colombiana de Investigación Agropecuaria, AGROSAVIA	913	1.2%	91.4%	694	0	0
MEX208	INIFAP, Centro Nacional de Recursos Genéticos (CNRG)	558	0.7%	92.1%	558	0	0
BGD044	Cotton Development Board (CDB)	512	0.7%	92.8%	512	0	132
ARG1343	Banco Activo Regional del Nordeste	488	0.6%	93.5%	Not listed	0	0

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions in long term storage (-18-20 C)	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
USA995	National Center for Genetic Resources Preservation	413	0.6%	94.0%	Not listed	0	0
THA300	Genebank	404	0.5%	94.6%	72	0	0
ECU023	Departamento Nacional de Recursos Fitogenéticos	330	0.4%	95.0%	328	0	0
KEN212	Genetic Resources Research Institute	329	0.4%	95.4%	329	0	0
GRC005	Greek Genebank, Institute of Plant Breeding and Genetic Resources	307	0.4%	95.8%	Not listed	0	0
	Other institutions (n = 53)	3,137	4.1%	100.0%	1,104	44	195

* but known to conserve accessions in long-term storage conditions

The International Board for Plant Genetic Resources (IBPGR)/International Plant Genetic Resources Institute (IPGRI) Register of Base Collections, which included collections that had formed (or had been proposed for) agreements with the international institutions based on long-term conservation of crop genepools on global or regional bases during the 1970s through 1990s (IBPGR/IPGRI, 1993; Thormann *et al.*, 2019), listed, for cotton:

- Department des cultures annuelles (CIRAD-CA) (France) – global collection (agreement date not listed). This genebank is not listed in current germplasm databases (Table 2, Supplementary Table 1) and the status of the collection is not clear, although CIRAD continues to conduct cotton research (CIRAD, 2025).
- Greek Gene Bank (Greece) – regional collection for South Europe and the Mediterranean (agreement dated 1984). This genebank is within the top 20 cotton collections worldwide in terms of total numbers of accessions, based on current germplasm databases (Table 2).

Gossypium L. (Malvaceae) contains around 50 species native to arid and semiarid regions of the tropics and subtropics of the Americas, Africa, Asia (especially the Middle East), and Australia (USDA, 2025; WFO, 2025). A published genepool concept is available for upland cotton (*Gossypium hirsutum* L.) (USDA, 2025).

The primary genepool contains:
Gossypium barbadense L.
Gossypium darwinii G. Watt
Gossypium ekmanianum Wittm.
Gossypium hirsutum L. (wild type)
Gossypium stephensii J. Gallagher et al.

The secondary genepool contains:
Gossypium mustelinum Miers ex G. Watt
Gossypium tomentosum Nutt. ex Seem.

The remaining (ca. 45) species and their taxa are assigned to the tertiary genepool.

Data compilation for this report on cotton genetic resources included all taxa in *Gossypium*. Around 109 taxonomic names are

present in germplasm collections, including the crop species, wild relative taxa, many distinct hybrids, and accessions only determined at the genus level (Supplementary Table 2). The largest collections are of the crop species, accessions classified at the genus level, and hybrids.

Improved varieties make up the largest proportion of collections (16.1%), followed by breeding materials (15.9%), landraces (9.8%), and wild relatives (4.2%) (Table 3); these percentages are estimates based on available data, noting that 41.2% of accessions do not have biological status data and another 12.7% are marked as "other" materials. *Gossypium* germplasm has been collected from at least 145 countries, with approximately 9.6% of accessions originating from the primary region of diversity of the crops (i.e. Mesoamerica, tropical South America, and the Caribbean; East and Southern Africa; and South Asia); these statistics are also estimates, as 5.7% of cotton landrace accessions and 7.4% 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 180 botanic gardens collectively conserve 47 *Gossypium* taxa. All of these taxa are also conserved in genebank 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. In a global *ex situ* conservation gap analysis of the wild relatives of major crops, Castañeda-Álvarez *et al.* (2016), assessing 24 cotton wild relatives, listed 12 (50%) as of high priority for further collecting, and seven other species as of medium priority.

Table 3. Composition of *ex situ* collections of cotton genetic resources. Main *ex situ* collections data from Genesys and FAO WIEWS (2025). Primary and secondary regions information from Khoury *et al*. (2023) and subsequent research for this summary. Botanic gardens data from BGCI PlantSearch (2025).

Metric	Number	Percentage
Total number of accessions in genebank collections	75,308	
Number of institutions holding genebank collections	73	
Number of distinct taxonomic names in genebank collections	109	
Number of accessions of crop wild relatives (CWR) in genebank collections	3,181	4.2%
Number of accessions of weedy materials in genebank collections	0	0.0%
Number of accessions of landraces in genebank collections	7,395	9.8%
Number of accessions of breeding materials in genebank collections	12,013	15.9%
Number of accessions of improved varieties in genebank collections	12,112	16.1%
Number of accessions of other materials in genebank collections	9,568	12.7%
Number of accessions not marked with an improvement type in genebank collections	31,039	41.2%
Number of countries where germplasm has been collected for genebank collections	145	
Number of accessions in genebank collections from the primary region(s) of diversity	7,227	9.6%
Number of taxa in botanic garden collections	47	
Number of botanic gardens holding collections of crop or its wild relatives	180	

Multilateral System status of accessions in *ex situ* collections

The genus *Gossypium* is not listed in Annex I of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty) and is thus not included in its Multilateral System of Access and Benefit Sharing (MLS). This said, institutions can voluntarily place their collections under the MLS. As of 2025, 1,103 accessions are formally included in the MLS according to the Plant Treaty's GLIS database, and 2,674 accessions have been assigned Digital Object Identifiers (DOIs) Table 4). Per the relevant fields in the global genetic resources databases, 1,387 accessions (1.8% of world total) are listed as included in the MLS; this may be an underestimate, noting that 86.5% of accessions do not have MLS status data.

Table 4. Representation of cotton 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 (2025). DOI and MLS data from Plant Treaty GLIS (2025).

Metric	Number	Percentage
Number of accessions in genebank collections in international institutions	8	0%
Number of accessions in genebank collections in national or other institutions	75,300	100%
Number of accessions in genebank collections in Annex I	0	0%
Number of accessions with DOI (Plant Treaty GLIS 2025)	2,674	
Number of accessions included in the Multilateral System (MLS) (Plant Treaty GLIS 2025)	1,103	
Number of accessions included in the Multilateral System (MLS) (genebank collections databases)	1,387	1.8%
Number of accessions included in the Multilateral System (MLS) that are in international collections (genebank collections databases)	5	0%
Number of accessions not included in the Multilateral System (MLS) (genebank collections databases)	8,777	11.7%
Number of accessions without information regarding inclusion in the Multilateral System (MLS) (genebank collections databases)	65,144	86.5%

Storage conditions, regeneration status, and safety duplication

As expected for an orthodox seed crop, the great majority (at least 88%) of *Gossypium* accessions are conserved as seed, with 24.9% of these accessions listed as conserved under long-term cold-storage conditions and almost half held in medium-term conditions (Table 5). Information on storage in general is missing for 11.7% of all accessions, and information on seed storage type (i.e., long, medium, or short term) is missing for 26.6% of seed accessions.

Current regeneration status and needs cannot be directly derived from the global germplasm databases. 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 14,410 *Gossypium* accessions regenerated during this time by reporting institutions, with 22,717 accessions identified as needing regeneration and 4,450 of these lacking funds to conduct regeneration.

Analysis of the location of safety duplication sites of cotton germplasm, as listed in Genesys, indicates that none of the accessions listed in that database 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 cotton accessions worldwide, when also considering safety duplication within the same country, may be higher than this estimate, given that some national genebanks, such as the USA, typically provide safety backup for their collections in a different location within the country. Information from the SGSV database from 2025 indicates that only 0.1% of total accessions worldwide are duplicated in Svalbard.

Table 5. Storage conditions of cotton *ex situ* collections, regeneration status, and safety duplication status. Main *ex situ* collections data from Genesys and FAO WIEWS (2025). Regeneration status information from FAO WIEWS (2025); data from 2014 to 2019. Safety duplication out of the country data based only on Genesys (2025) data. Svalbard Global Seed Vault data from SGSV portal (2025).

Metric	Number	Percentage
Number of accessions held in seed storage in genebank collections	66,258	88.0%
Number of accessions held in short-term seed storage in genebank collections	0	0.0%
Number of accessions held in medium-term seed storage in genebank collections	32,148	48.5%
Number of accessions held in long-term seed storage in genebank collections	16,497	24.9%
Number of accessions held in seed storage of undefined type in genebank collections	17,613	26.6%
Number of accessions held in field storage in genebank collections	361	0.5%
Number of accessions held in in-vitro storage in genebank collections	0	0.0%
Number of accessions held in cryo storage in genebank collections	3	0.0%
Number of accessions held as DNA in genebank collections	0	0.0%
Number of accessions held in other storage in genebank collections	0	0.0%
Number of accessions not marked with a storage type in genebank collections	8,800	11.7%
Number of accessions in genebank collections regenerated 2014-2019	14,410	38.3%
Number of accessions in genebank collections in need of regeneration 2014-2019	22,717	60.4%
Number of accessions in genebank collections in need of regeneration without budget for regeneration 2014-2019	4,450	11.8%
Number of accessions safety duplicated out of the country in genebank collections	0	0.0%
Number of accessions in genebank collections safety duplicated in Svalbard	50	0.1%

Documentation, information systems, and research resources

A revised descriptor list for cotton was published in 1985 and is available online (IBPGR, 1985).

The estimated completeness of passport information for cotton accessions listed in Genesys is 5.2 on a scale of 0 (no data) to 10 (complete data), which indicates that there are gaps that it would be valuable to fill. Four metrics of the current degree of digital sequence information (DSI) for cotton (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.

Table 6. Documentation, information systems, and research resources for cotton. Passport data completeness index (PDCI) from Genesys (2025), 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	5.2
Number of genes as recorded in NCBI's Entrez database as of 2022	108,133
Number of genomes as recorded in NCBI's Entrez database as of 2022	1
Number of nucleotides as recorded in NCBI's Entrez database as of 2022	888,397
Number of proteins as recorded in NCBI's Entrez database as of 2022	441,714
Number of publications listed in Google Scholar with taxon name in title published between 2009 and 2019	3,560
Number of publications listed in PubMed Central with taxon name in text as of 2022	15,251
Number of research materials as recorded in GBIF (2025)	78,967

Germplasm distributions and varietal registrations and releases

Germplasm distributions and varietal development statistics for cotton 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 programmes and other organizational types (Khoury *et al.*, 2025). Distributions as reported in the FAO WIEWS dataset were made from institutions in 17 countries, with the largest numbers of samples distributed from institutions in China, India, Uzbekistan, Australia, and Uganda, and were primarily to within-country national agricultural research centers and to other (unspecified) users (Khoury *et al.*, 2025). In the Plant Treaty dataset, the sole provider - and recipient - of cotton germplasm was located in Spain. The differences in numbers of samples distributed as recorded by FAO WIEWS versus the Plant Treaty Data Store is likely a reflection of the lack of inclusion of the crop in Annex 1 of the Plant Treaty (Khoury *et al*., 2023).

Table 7. Cotton 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	3,232.4
Average annual number of samples distributed worldwide as recorded in FAO WIEWS	3,241.8
Average annual number of samples distributed worldwide as recorded in the Plant Treaty Data Store	1.0
Number of countries receiving germplasm as recorded in the Plant Treaty Data Store	1.0
Evenness of distributions across world regions as recorded in the Plant Treaty Data Store	0.0
Average annual number of varietal registrations worldwide as recorded in UPOV's PLUTO	63.2
Average annual number of varietal releases worldwide as recorded in FAO WIEWS	29.6

Networks and partnerships

Currently active networks include:

- The USDA ARS Cotton Crop Germplasm Committee (also here)
- Communities related to cotton genetics, e.g. https://www.cottongen.org/, Dai *et al.* (2022), and Zhang *et al.* (2022).

Conclusions

Cotton continues to be a critically important fiber crop, and its oil also contributes significantly to food supplies worldwide. Its genetic resources are bolstered by the activities taking place in collections in national and subnational agricultural research organizations; there are no major international collections for the crop. Available data indicates that these collections, in combination, are diverse and extensive, although they do not represent the full range of crop varieties as well as species and populations of wild relatives that could be conserved *ex situ* and made available for use. Lack of inclusion of the crop in Annex 1 of the Plant Treaty constrains international access to germplasm, with only around 1.8% of total accessions worldwide currently included in the MLS. There are considerable amounts of associated research resources, and there has been significant activity in germplasm distributions (by national institutions) and in varietal development for the crop. Further efforts are required to: identify/determine taxa within current *ex situ* accessions; regenerate accessions in need; fully secure these accessions in long-term seed storage conditions and safety backup all unique accessions, including at the SGSV; and provide more complete accession-level passport information as well as generate further characterization and evaluation datasets.

GOSSYPIUM HERBACEUM – CALIMO/WIKIMEDIA COMMONS

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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UZBEKISTAN – BERNARD GAGNON/WIKIMEDIA COMMONS

References

Castañeda-Álvarez NP, Khoury CK, Achicanoy HA, Bernau V, Dempewolf H, Eastwood RJ, Guarino L, Harker RH, Jarvis A, Maxted N, Mueller JV, Ramírez-Villegas J, Sosa CC, Struik PC, Vincent H, and Toll J (2016) Global conservation priorities for crop wild relatives. *Nature Plants* 2(4): 16022. https://doi.org/10.1038/nplants.2016.22

Campbell BT, Saha S, Percy R, Frelichowski J, Jenkins JN, Park W, *et al*. (2010) Status of the Global Cotton Germplasm Resources. *Crop Sci.* 50(4): 1161–1179. https://doi.org/10.2135/cropsci2009.09.0551

Centre de coopération internationale en recherche agronomique pour le développement (CIRAD) (2025) Cotton. https://www.cirad.fr/en/our-activities-our-impact/tropical-value-chains/cotton/what-cirad-is-doing (accessed December 2025)

Dai F, Chen J, Zhang Z, Liu F, Li J, Zhao T, *et al.* (2022) COTTONOMICS: a comprehensive cotton multi-omics database. *Database* 2022: baac080. https://doi.org/10.1093/database/baac080

FAO (2009) *The International Treaty on Plant Genetic Resources for Food and Agriculture*. Food and Agriculture Organization of the United Nations (FAO), Rome, Italy. https://openknowledge.fao.org/server/api/core/bitstreams/a9d0de2a-8e98-4f75-98a8-673078841030/content

FAO (2025a) FAOSTAT. https://www.fao.org/faostat/en/#data (accessed September 2025)

FAO (2025b) *The Third Report on The State of the World's Plant Genetic Resources for Food and Agriculture*. FAO: Rome. https://doi.org/10.4060/cd4711en

International Board for Plant Genetic Resources (IBPGR)/International Plant Genetic Resources Institute (IPGRI) (1993) *Register of Base Collections*. https://www.researchgate.net/profile/Johannes-Engels-2/publication/329175759_Registry_of_Base_Collections_Engels_and_Thormannpdf/data/5bfa7fcfa6fdcc538819a20e/Registry-of-Base-Collections-Engels-and-Thormann.pdf?origin=publication_list

International Board for Plant Genetic Resources (IBPGR) (1985) Cotton descriptors (Revised). International Board for Plant Genetic Resources 17 pp. https://hdl.handle.net/10568/72870

Khoury CK, Sotelo S, Amariles D, and Hawtin G (2023) *The Plants That Feed the World: baseline data and metrics to inform strategies for the conservation and use of plant genetic resources for food and agriculture*. International Treaty on Plant Genetic Resources for Food and Agriculture Rome: Food and Agricultural Organization of the United Nations. doi: 10.4060/cc6876en. https://www.fao.org/documents/card/en/c/cc6876en

Khoury CK, Sotelo S, Hawtin G, Halewood M, Lopez Noriega I, and Lusty C (2025) Germplasm exchange: Thematic Study for *The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture*. Rome: Food and Agricultural Organization of the United Nations. doi: 10.4060/cd4850en. https://doi.org/10.4060/cd4850en

Robins J (2024) Cotton. In: Whayne J, editor. *The Oxford Handbook of Agricultural History. 1st ed.* Oxford University Press; pp. 394–410. https://doi.org/10.1093/oxfordhb/9780190924164.013.21

Thormann I, Engels JMM, and Halewood M (2019) Are the old International Board for Plant Genetic Resources (IBPGR) base collections available through the Plant Treaty's multilateral system of access and benefit sharing? A review. *Genet Resour Crop Evol.* 66(2): 291–310. https://doi.org/10.1007/s10722-018-0715-5

USDA (2025) Global Global Taxonomy. https://npgsweb.ars-grin.gov/gringlobal/taxon/taxonomysearch (accessed September 2025)

Van Hintum T, Menting F, and Van Strien E (2011) Quality indicators for passport data in *ex situ* genebanks. *Plant Genetic Resources* 9(3): 478–485. https://doi.org/10.1017/S1479262111000682

World Flora Online (WFO) (2025) *Gossypium* L. https://www.worldfloraonline.org/taxon/wfo-4000016081 (accessed October 2025)

Wu M, Pei W, Wedegaertner T, Zhang J, and Yu J (2022) Genetics, Breeding and Genetic Engineering to Improve Cottonseed Oil and Protein: A Review. *Front Plant Sci.* 13: 864850. https://doi.org/10.3389/fpls.2022.864850

Yuan D, Grover CE, Hu G, Pan M, Miller ER, Conover JL, *et al*. (2021) Parallel and Intertwining Threads of Domestication in Allopolyploid Cotton. *Advanced Science* 8(10). https://doi.org/10.1002/advs.202003634

Zhang Z, Chai M, Yang Z, Yang Z, and Fan L (2022) GRAND: An Integrated Genome, Transcriptome Resources, and Gene Network Database for *Gossypium*. *Front Plant Sci.* 13: 773107. https://doi.org/10.3389/fpls.2022.773107

Supplementary information

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

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions in long term storage (-18-20 C)	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
UZB036	Uzbek Research Institute of Cotton Breeding and Seed Production	12,288	16.3%	16.3%	Not listed	0	0
USA049	Crop Germplasm Research Unit USDA, ARS	10,535	14.0%	30.3%	Not listed	0	0
UZB001	Institute of Genetics and Plant Experimental Biology	9,953	13.2%	43.5%	Not listed	0	0
IND001	National Bureau of Plant Genetic Resources	9,768	13.0%	56.5%	9,768	0	0
UZB006	Uzbek Research Institute of Plant Industry	6,404	8.5%	65.0%	Not listed	0	0
RUS001	N.I. Vavilov All-Russian Research Institute of Plant Industry	6,334	8.4%	73.4%	Not listed	0	0
BRA007	Embrapa Algodão	4,714	6.3%	79.7%	Not listed	0	0
BRA003	Embrapa Recursos Genéticos e Biotecnologia	3,265	4.3%	84.0%	Not listed	0	0
PAK001	Plant Genetic Resources Program	2,056	2.7%	86.7%	2,054	0	0
AZE015	Genetic Resources Institute	1,518	2.0%	88.7%	Not listed	0	0
AUS165	Australian Grains Genebank, Agriculture Victoria	1,082	1.4%	90.2%	1,078	1,059	1,060
COL017	Corporación Colombiana de Investigación Agropecuaria, AGROSAVIA	913	1.2%	91.4%	694	0	0
MEX208	INIFAP, Centro Nacional de Recursos Genéticos (CNRG)	558	0.7%	92.1%	558	0	0
BGD044	Cotton Development Board (CDB)	512	0.7%	92.8%	512	0	132
ARG1343	Banco Activo Regional del Nordeste	488	0.6%	93.5%	Not listed	0	0
USA995	National Center for Genetic Resources Preservation	413	0.6%	94.0%	Not listed	0	0
THA300	Genebank	404	0.5%	94.6%	72	0	0
ECU023	Departamento Nacional de Recursos Fitogenéticos	330	0.4%	95.0%	328	0	0

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions in long term storage (-18-20 C)	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
KEN212	Genetic Resources Research Institute	329	0.4%	95.4%	329	0	0
GRC005	Greek Genebank, Institute of Plant Breeding and Genetic Resources	307	0.4%	95.8%	Not listed	0	0
UKR006	Institute of Agriculture of the Southern Region	281	0.4%	96.2%	281	0	0
MAR088	Centre Régional de la Recherche Agronomique de Settat	259	0.3%	96.6%	Not listed	0	0
TJK027	National Center for Genetic Resources	210	0.3%	96.8%	210	0	0
ROM007	Suceava Genebank	190	0.2%	97.1%	Not listed	20	20
MEX201	UACh, Centro Regional Universitario Sur (CRUS)	186	0.2%	97.3%	Not listed	0	0
ESP004	Centro Nacional de Recursos Fitogenéticos	178	0.2%	97.6%	166	0	0
MEX287	Banco de Germoplasma de Especies Nativas de Oaxaca (BAGENO)	163	0.2%	97.8%	Not listed	0	0
MEX131	UDG, Centro Universitario de Ciencias Biológicas y Agropecuarias (UDG-CUCBA)	137	0.2%	98.0%	Not listed	0	0
BEL002	Gembloux agro-biotech, Université de Liège, département des Sciences agronomiques, Phytotechnie tropicale et Horticulture	131	0.2%	98.1%	Not listed	0	131
MEX014	INIFAP, Campo Experimental Iguala (CEIGUA)	127	0.2%	98.3%	Not listed	0	0
PER031	Estación Experimental Agraria Vista Florida	109	0.1%	98.5%	Not listed	0	0
JPN183	NARO Genebank	104	0.1%	98.6%	44	0	0
UGA132	Plant Genetic Resource Centre	99	0.1%	98.7%	99	0	0
UGA528	Uganda National Genebank	99	0.1%	98.9%	Not listed	0	0
SDN002	Agricultural Plant Genetic Resources Conservation and Research Centre	98	0.1%	99.0%	98	0	0

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions in long term storage (-18-20 C)	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
PER017	Estación Experimental Agraria El Porvenir	91	0.1%	99.1%	Not listed	0	0
MEX263	SNICS, Depositario Nacional de Referencia de Semillas (DNRS)	85	0.1%	99.2%	Not listed	0	0
MEX194	Instituto de Investigación y Capacitación Agropecuaria, Acuícola y Forestal del Estado de México (ICAMEX)	82	0.1%	99.3%	Not listed	0	0
CUB042	Instituto de Investigaciones Hortícolas Liliana Dimitrova	58	0.1%	99.4%	Not listed	0	0
MEX069	UAAAN, Centro de Conservación de Semillas Ortodoxas, Región Norte (CC-SO)	52	0.1%	99.5%	Not listed	0	0
ETH085	Ethiopian Biodiversity Institute	45	0.1%	99.5%	Not listed	0	0
GBR004	Millennium Seed Bank - Royal Botanic Gardens Kew	37	0.0%	99.6%	Not listed	0	0
KGZ040	Bank-Laboratory of Plant Genetic Resources of the KR	37	0.0%	99.6%	37	0	0
BGR001	Institute for Plant Genetic Resources 'K.Malkov'	35	0.0%	99.7%	Not listed	0	0
ZMB048	National Plant Genetic Resources Centre	28	0.0%	99.7%	28	0	0
ALB026	Plant Genetic Resources Center	25	0.0%	99.7%	25	0	0
DEU146	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research	18	0.0%	99.8%	18	0	0
UGA394	National Semi Arid Agricultural Research Institute	18	0.0%	99.8%	Not listed	0	0
GRC009	Cotton Department, Institute of Plant Breeding and Genetic Resources	16	0.0%	99.8%	16	0	0
SWZ015	National Plant Genetic Resources Centre	16	0.0%	99.8%	16	0	0
NGA010	National Centre for Genetic Resources and Biotechnology	15	0.0%	99.9%	15	15	15
ECU313	Pontificia Universidad Católica del Ecuador sede Ibarra	14	0.0%	99.9%	14	0	14

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions in long term storage (-18-20 C)	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
EGY087	National Gene Bank	14	0.0%	99.9%		0	0
ERI003	National Agricultural Research Institute	11	0.0%	99.9%	11	0	0
HUN003	Centre for Plant Diversity	10	0.0%	99.9%	Not listed	0	0
GHA091	Plant Genetic Resources Research Institute	8	0.0%	99.9%	Not listed	0	0
MLT003	Plant Protection Directorate, Veterinary and Phytosanitary Regulation Department	7	0.0%	99.9%	Not listed	0	0
TUR034	Field Crop Central Research Institute	7	0.0%	100.0%	7	0	0
CRI001	Centro Agronómico Tropical de Investigación y Enseñanza	6	0.0%	100.0%	5	5	5
AUS167	Australian Pastures Genebank	4	0.0%	100.0%	4	4	4
MEX367	Facultad de Ciencias Naturales, Universidad Autónoma de Querétaro	4	0.0%	100.0%	Not listed	0	0
SAU015	Plant Genetic Resources Bank	4	0.0%	100.0%	Not listed	0	4
MEX006	UACh, Banco Nacional de Germoplasma Vegetal (BANGEV)	3	0.0%	100.0%	2	0	0
SLV050	CENTA - Banco de Germoplasma	3	0.0%	100.0%	3	0	0
ESP172	Cabildo Insular de Tenerife. Centro de Conservación de la Biodiversidad Agrícola de Tenerife	2	0.0%	100.0%	Not listed	0	0
PRT102	Banco de Germoplasma - Universidade da Madeira	2	0.0%	100.0%		0	2
URY003	INIA La Estanzuela	2	0.0%	100.0%	2	0	0
ZMB030	SADC Plant Genetic Resources Centre	2	0.0%	100.0%	2	0	0
CUB014	Instituto de Investigaciones Fundamentales en Agricultura Tropical	1	0.0%	100.0%	Not listed	0	0
ECU308	Estación Experimental Central de la Amazonia	1	0.0%	100.0%	Not listed	0	0

Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions in long term storage (-18-20 C)	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
LKA036	Plant Genetic Resources Centre	1	0.0%	100.0%	Not listed	0	0
TZA016	National Plant Genetic Resources Centre	1	0.0%	100.0%	1	0	0
USA151	National Arboretum-Germplasm Unit, USDA/ARS	1	0.0%	100.0%	Not listed	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 (2025).

Taxon	Number of accessions (from genebank collections databases)
Gossypium hirsutum L.	46,167
Gossypium barbadense L.	9,044
Gossypium L.	6,678
Gossypium arboreum L.	6,375
Gossypium hirsutum var. *hirsutum*	2,884
Gossypium herbaceum L.	2,160
Gossypium hybr.	199
Gossypium darwinii G. Watt	156
Gossypium mustelinum Miers ex G. Watt	153
Gossypium somalense (Gürke) J. B. Hutch., Silow & S. G. Stephens	153
Gossypium thurberi Tod.	145
Gossypium aridum (Rose & Standl.) Skovsted	81
Gossypium klotzschianum subsp. *davidsonii* (Kellogg) Roberty	81
Gossypium raimondii Ulbr.	78
Gossypium klotzschianum Andersson	74
Gossypium morrilli O. F. Cook & J. W. Hubb.	66
Gossypium gossypioides (Ulbr.) Standl.	60
Gossypium australe F. Muell.	59
Gossypium trilobum (Sessé & Moc. ex DC.) Skovst.	58
Gossypium harknessii Brandegee	49
Gossypium sturtianum J. H. Willis	49
Gossypium anomalum Wawra & Peyr.	47
Gossypium herbaceum var. *herbaceum*	37
Gossypium harknessii subsp. *armourianum* (Kearney) Roberty	35
Gossypium tomentosum Nutt. ex Seem.	30
Gossypium bickii Prokh.	28
Gossypium nelsonii Fryxell	27
Gossypium lobatum Gentry	24
Gossypium longicalyx J. B. Hutch. & B. J. S. Lee	23
Gossypium stocksii Mast.	23
Gossypium robinsonii F. Muell.	22
Gossypium populifolium Tod.	20
Gossypium herbaceum subsp. *africanum* (G. Watt) Vollesen	19
Gossypium sturtianum var. *nandewarense* (Derera) Fryxell	19

Taxon	Number of accessions (from genebank collections databases)
Gossypium laxum L. Ll. Phillips	18
Gossypium anomalum subsp. *senarense* (Wawra & Peyr.) Vollesen	13
Gossypium incanum (O. Schwartz) Hillc.	12
Gossypium triphyllum (Harv.) Hochr.	11
Gossypium hirsutum x *barbadense*	10
Gossypium turneri Fryxell	10
Gossypium schwendimanii Fryxell & S. D. Koch	7
Gossypium areysianum Deflers	6
Gossypium cunninghamii Tod.	6
Gossypium ekmanianum Wittm.	5
Gossypium costulatum Tod.	4
Gossypium hirsutum x *anomalum*	4
Gossypium nobile Fryxell, Craven & J. M. Stewart	4
Gossypium sturtianum var. *sturtianum*	4
Gossypium barbadense x *hirsutum*	3
Gossypium hirsutum x *longicalyx*	3
Gossypium anomalum x *australe*	2
Gossypium anomalum x *klotzchianum*	2
Gossypium arboreum x *thurberi*	2
Gossypium davidsonii x *australe*	2
Gossypium hirsutum x *lobatum*	2
Gossypium hirsutum x *stocksii*	2
Gossypium hirsutum x *sturtianum* x *lobatu*	2
Gossypium marchantii Fryxell, Craven & J. M. Stewart	2
Gossypium pilosum Fryxell	2
Gossypium sturtianum x *lobatum*	2
Gossypium thurberi x *anomalum*	2
Gossypium thurberi x *sturtianum*	2
Gossypium aboreum x *sturtianum*	1
Gossypium anomalum x *aridum*	1
Gossypium arboreum x *armourianum*	1
Gossypium arboreum x *hirsutum*	1
Gossypium arboreum x *stocksii*	1
Gossypium barbadense var. *barbadense*	1
Gossypium barbadense var. *peruvianum*	1
Gossypium barbadense x *harknessii*	1
Gossypium barbadense x *tomentosum*	1
Gossypium contextum O. F. Cook & J. W. Hubb.	1
Gossypium davidsonii x *anomalum*	1
Gossypium davidsonii x *armourianum*	1
Gossypium exiguum Fryxell, Craven & J. M. Stewart	1
Gossypium harknessii x *armourianum*	1
Gossypium harknessii x *barbadense*	1
Gossypium harknessii x *laxum*	1
Gossypium herbaceum x *thurberi*	1
Gossypium herbaceum x *anomalum*	1
Gossypium hirsutum var. *punctatum*	1
Gossypium hirsutum x *anomalum* x *harknessii*	1
Gossypium hirsutum x *anomalumi*	1
Gossypium hirsutum x *arboreum*	1
Gossypium hirsutum x *areysianum*	1

Taxon	Number of accessions (from genebank collections databases)
Gossypium hirsutum x *aridum*	1
Gossypium hirsutum x *armourianum*	1
Gossypium hirsutum x *australe*	1
Gossypium hirsutum x *barbosanum*	1
Gossypium hirsutum x *herbaceum*	1
Gossypium hirsutum x *longicaly*	1
Gossypium hirsutum x *raimondii*	1
Gossypium hirsutum x *raimondii* x *sturtianum*	1
Gossypium hirsutum x *robinsonii*	1
Gossypium hirsutum x *sturtii*	1
Gossypium hirsutum x *thurberi*	1
Gossypium hirsutum x *thurberi* x *sturtianum*	1
Gossypium hirsutum x *tomentosum*	1
Gossypium hirsutum x *triphyllum*	1
Gossypium pulchellum (C. A. Gardner) Fryxell	1
Gossypium raimondii x *sturtianum*	1
Gossypium rotundifolium Fryxell, Craven & J. M. Stewart	1
Gossypium somalense x *stocksii*	1
Gossypium sturtianum x *aridum*	1
Gossypium sturtianum x *armourianum*	1
Gossypium sturtianum x *triphyllum*	1
Gossypium thurberi x *australe*	1
Gossypium thurberi x *sturtianum* x *hirsutum*	1
Gossypium trilobum x *harknessii*	1

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