GLOBAL CROP CONSERVATION AND USE METRICS

LENTIL
(*Lens* Miller)

CROP TRUST

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Global crop conservation and use metrics

LENTIL
(*Lens* Miller)

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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 lentil and its 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 lentil (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 lentil

Lentil (*Lens culinaris* Medik., Fabaceae) is one of the earliest domesticated crops, with archaeological evidence tracing its cultivation back nearly 10,000 years in the Fertile Crescent of the Near East (Sonnante *et al*., 2009). A cool-season legume, lentils are well-adapted to semi-arid environments and are now grown across a diversity of agroecological zones mainly in North America, South Asia, Australia, and the Mediterranean and West Asia. The grain is a rich source of protein, complex carbohydrates including dietary fiber, and micronutrients including iron, phosphorus, magnesium, thiamine, and folate. It is a staple in traditional diets in the Mediterranean and in West and South Asia, as well as in plant-based diets worldwide. Lentils are among the major grain legumes with the shortest cooking time requirements. Several varietal types exist and are preferred in different regions; flour from the grain is also used in bakery, extruded, meat, and dairy products (Shaikh *et al.,* 2024). This legume crop is additionally important as an animal fodder for small ruminants and for maintaining soil fertility.

Based on the most recently available production statistics from FAOSTAT (for 2023), lentils are cultivated in at least 44 countries – mainly outside its regions of origin – on a total of over 5.5 million hectares worldwide, producing over 7 million tonnes of dry grain, for a value of over USD 4 billion (FAO, 2025a). The largest producers include Australia, Canada, India, Türkiye, USA, Nepal, Bangladesh, Kazakhstan, China, the Russian Federation, and Ethiopia - each producing over 100,000 tonnes per annum. These global production statistics place lentils after soybeans, common beans (*Phaseolus*), peas, chickpeas, and cowpeas (Khoury *et al.*, 2023). Recent production statistics for lentils have risen compared to equivalent data for the years 2015 to 2018 (Table 1) and are more than triple those reported in the 2008 Strategy, which itself mentioned that lentil production had been rising steadily over previous decades and had tripled since 1980 (Crop Trust, 2008). Global average yield (per hectare) of the crop is considerably lower than that of common beans, faba beans, and soybeans, is roughly equivalent to that of chickpeas, and is higher than that of pigeonpeas (FAO, 2025a).

Table 1. Global status of lentil 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 "Pulses, 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)	5,412,472	14.25	0.22	0.56
Total production (tonnes)	6,413,867	4.25	0.22	0.64
Gross production value (current thousand USD)	3,852,687	7.75	0.22	0.63
Export quantity (tonnes)	3,356,386	7.50	0.16	0.82
Export value (current thousand USD)	2,405,653	8.25	0.17	0.77
Import quantity (tonnes)	3,285,469	39.75	0.25	0.31
Import value (current thousand USD)	2,658,574	49.25	0.28	0.34
Contribution to calories in food supplies (kcal/capita/day)	5.20	39.00	0.50	0.55
Contribution to protein in food supplies (g/capita/day)	0.32	77.25	0.51	0.59
Contribution to fat in food supplies (g/capita/day)	0.04	9.00	0.47	0.41
Contribution to food weight in food supplies (g/capita/day)	0.55	29.00	0.50	0.56
Number of public pageviews on Wikipedia over one year	3,933			

Well over half of the global production is traded internationally, with 12 countries reporting exporting over 10,000 tonnes annually. The vast majority is exported from Canada and Australia, which together export two-thirds of worldwide export quantity (FAO, 2025a). Among the 191 countries reporting importing lentils, the major recipients include India, Bangladesh, Türkiye, United Arab Emirates (as a re-export hub), Sri Lanka, Iraq, and Algeria (FAO, 2025a; Shaikh *et al.,* 2024).

Global consumption statistics are imprecise, with FAOSTAT reporting the crop under its "Pulses, Other" category (Khoury *et al.*, 2023). Estimates derived from these data for the years 2015–2018 indicate that the global per capita dietary contribution of lentils – as measured in terms of both calories and protein – is considerable, but lower than that of common beans, soybeans, chickpeas, peas, and cowpeas. The crop is a significant contributor to protein in the food supplies of 75 countries.

Identity and composition of *ex situ* collections

Based on the latest data in global genetic resource databases, lentil germplasm collections are present in at least 83 institutions worldwide, collectively maintaining 44,085 accessions (Table 2, Table 3; Supplementary Table 1). This is slightly more than the number of accessions reported for the crop (43,942) 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 are well distributed globally, including large collections in Asia, Australia, the Americas, Europe, and Africa. The International Centre for Agricultural Research in Dry Areas (ICARDA) and the Australian Grain Genebank together maintain nearly half of documented accessions, and these are included in the Multilateral System of Access and Benefit Sharing (MLS) of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty). Reported information on the MLS status of accessions for several other institutions, as recorded in the Global Information System (GLIS) as well as in pertinent fields in Genesys and FAO WIEWS (Table 2; Table 4), likely underestimate the degree to which accessions are currently included in the MLS, as many of the major lentil collections without information on MLS status are in countries that are contracting parties to the Plant Treaty (such as USA, Chile, and Hungary) and distribute samples using the Standard Material Transfer Agreement (SMTA).

Based on a genebank stakeholder survey process, the 2008 Strategy identified 43,214 lentil accessions maintained worldwide (Crop Trust, 2008). The major lentil collections were largely the same as those currently listed in Genesys and FAO WIEWS, although several other collections listed in the 2008 Strategy are not currently reported in the global genetic resource databases, including the Seed and Plant Improvement Institute (Iran, 3,000 accessions based on 2008 survey), the General Commission for Scientific Agricultural Research (Syria, 1,072 accessions), the Institute of Crop Germplasm Resources (CAAS) (China, 855 accessions), and the Central Plant Breeding and Biotechnology (Nepal, 489 accessions), among others. Further, the total number of accessions of lentils in several collections appear to have declined significantly compared to the 2008 survey, including those in the National Genebank (Egypt, 875 accessions in the survey; 36 in current online databases) and the Agricultural Research Organisation - The Volcani Center (Israel, 500 accessions in the survey; 188 in current online databases).

During the 2008 Strategy stakeholder meeting, participants categorized ICARDA, VIR, NBPGR, and the USDA collections in the "A" group due to the quantity of accessions and uniqueness of their lentil collections, high maintenance standards, and significant germplasm distributions. Other collections were grouped in "B" or "C" categories, with recommendations for further support to improve their standards, or for further safety duplication to ensure against loss.

The genepool of lentils, including all taxa in the genus *Lens* Miller, comprises seven taxa within four to five species (Crop Trust, 2008; USDA, 2025):

Lens culinaris Medik. subsp. *culinaris* (the cultivated crop),
Lens culinaris Medik. subsp. *orientalis* (Boiss.) Ponert,
Lens culinaris Medik. subsp. *tomentosus* (Ladiz.) M. E. Ferguson et al., and
Lens culinaris Medik. subsp. *odemensis* (Ladiz.) M. E. Ferguson et al. (syn. *Lens odemensis* Ladiz.), all in the primary genepool.

Table 2. Major *ex situ* collections of lentil 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 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)
LBN002	International Centre for Agricultural Research in Dry Areas	14,377	32.6%	32.6%	Not listed*	14,342	14,342
AUS165	Australian Grains Genebank, Agriculture Victoria	6,217	14.1%	46.7%	5,652	7,826	6,023
USA022	Western Regional Plant Introduction Station, USDA-ARS, Washington State University	3,179	7.2%	53.9%	31,73	0	0
IND001	National Bureau of Plant Genetic Resources (NBPGR)	2,609	5.9%	59.8%	2,609	0	0
RUS001	N.I. Vavilov All-Russian Research Institute of Plant Industry (VIR)	2,598	5.9%	65.7%	2,598	0	0
CHL150	Banco Activo INIA Carillanca	1,834	4.2%	69.9%	Not listed	0	0
CAN004	Plant Gene Resources of Canada, Saskatoon Research and Development Centre	1,194	2.7%	72.6%	1,194	0	1,194
UKR001	Institute of Plant Production n.a. V.Y. Yurjev of UAAS	1,100	2.5%	75.1%	970	0	0
HUN003	Centre for Plant Diversity	1,080	2.5%	77.6%	91	0	6
TUR001	Plant Genetic Resources Department	926	2.1%	79.7%	926	0	0
PAK001	Plant Genetic Resources Program	882	2.0%	81.7%	757	0	819
ETH085	Ethiopian Biodiversity Institute	724	1.6%	83.3%	652	0	695
MAR088	Centre Régional de la Recherche Agronomique de Settat	711	1.6%	84.9%	Not listed	0	0
ESP124	Junta de Comunidades de Castilla-La Mancha. Consejería de Agricultura. Centro de Investigación Agraria de Albaladejito.	612	1.4%	86.3%	530	0	354

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)
BGR001	Institute for Plant Genetic Resources 'K.Malkov'	514	1.2%	87.5%	373	0	0
DEU146	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research	462	1.1%	88.5%	462	465	462
PRT001	Banco Português de Germoplasma Vegetal	456	1.0%	89.5%	447	0	456
TUR034	Field Crop Central Research Institute	430	0.98%	90.5%	430	0	0
BGD003	Bangladesh Agricultural Research Institute	356	0.81%	91.3%	356	0	0
BGD028	Bangladesh Institute of Nuclear Agriculture (BINA)	348	0.79%	92.1%	Not listed	0	0
	Other institutions (n = 63)	3,476	7.9%	100%	1,586	326	1,709

*But documented in the 2008 Strategy as maintaining collections in long-term conditions (Crop Trust, 2008)

There are also three species in the secondary or tertiary genepool:

Lens ervoides (Brign.) Grande,
Lens lamottei Czefr., and
Lens nigricans (M. Bieb.) Webb & Berthel in the secondary or tertiary genepools.

All species are diploid (2n=14), annual, and self pollinating with a low outcrossing frequency (Crop Trust, 2008).

The entire *Lens* genus is represented within the 44,085 accessions conserved *ex situ* in genebanks (Supplementary Table 2), although the wild relatives represent only 3.3% of accessions as measured by pertinent (biological status) fields in the online databases, or 3.7% if calculated by taxonomic names in these databases (Table 3). Landraces make up the largest proportion of collections (43.6%), followed by breeding materials (11.4%), and improved varieties (3.6%); these percentages are estimates based on available data, noting that over 38% of accessions do not have biological status data.

Lentil germplasm has been collected from at least 84 countries, with approximately 28.8% of accessions originating from the primary region of diversity (i.e. West and South Asia and the Mediterranean) and 33.4% from primary and secondary (East Africa, South-eastern Europe, and Australia and New Zealand) regions; these statistics are also estimates, as 9.9% of lentil landrace accessions and 1% of wild relative accessions do not contain information even of the country where the accession was collected. Comparing the total number of lentil accessions worldwide to that of other grain legumes, lentil is in the middle, with many more accessions of common beans, soybeans, and chickpeas in *ex situ* conservation, but fewer of cowpeas, pigeonpeas, and other pulses. Information on botanic garden collections from BGCI PlantSearch indicate that 46 botanic gardens collectively conserve all of the taxa except for *L. culinaris* subsp. *tomentosus*.

Table 3. Composition of *ex situ* collections of lentil 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	44,085	
Number of institutions holding genebank collections	83	
Number of distinct taxonomic names in genebank collections	8	
Number of accessions of crop wild relatives (CWR) in genebank collections	1,466	3.3%
Number of accessions of weedy materials in genebank collections	1	0%
Number of accessions of landraces in genebank collections	19,199	43.6%
Number of accessions of breeding materials in genebank collections	5,038	11.4%
Number of accessions of improved varieties in genebank collections	1,596	3.6%
Number of accessions of other materials in genebank collections	0	0%
Number of accessions not marked with an improvement type in genebank collections	16,785	38.1%
Number of countries where germplasm has been collected for genebank collections	84	
Number of accessions in genebank collections from the primary region(s) of diversity	12,699	28.8%
Number of accessions in genebank collections from the primary and secondary region(s) of diversity	14,729	33.4%
Number of taxa in botanic garden collections	7	
Number of botanic gardens holding collections of crop or its wild relatives	46	

The genetic resources databases do not provide specific insights on lentil diversity gaps, but published research has indicated specific taxa and geographic regions where lentil wild relatives and landraces have been prioritized for further collecting for conservation. Gaps for lentil wild relatives were noted in the 2008 Strategy, drawing from stakeholder meetings and citing several previous studies, and identifying geographic gaps in southwest Turkey as the highest priority, followed by several North African and Central and West Asian countries (Crop Trust, 2008). In a global *ex situ* conservation gap analysis of wild relatives of major crops, Castañeda-Álvarez *et al.* (2016) listed three lentil wild relatives – *L. culinaris* subsp. *orientalis*, *L. ervoides*, and *L. nigricans* – out of the five assessed taxa as of high priority, and one additional taxon as of medium priority, for further collecting. Some progress has been made recently in filling these gaps, including via the Adapting Agriculture to Climate Change: Collecting, Protecting and Preparing Crop Wild Relatives Project (Crop Trust, 2025), which resulted in the collecting of 60 seed samples of five lentil wild relative taxa from six countries (including 16 samples of wild *L. culinaris*, 20 of *L. ervoides*, 11 of *L. lamottei*, and 13 of *L. nigricans*) as well as the development of new varieties with introgressions from wild germplasm (Eastwood *et al.*, 2022).

Regarding landraces, the 2008 Strategy stakeholder meeting identified farmer varieties in Morocco and in China as potentially undersampled (Crop Trust, 2008). Ramirez-Villegas *et al.* (2022) identified geographic gaps for lentil landrace groups in specific regions in the Near East, West, Central, and South Asia, Ethiopia, and Southern Europe and Morocco. Piergiovanni (2022) noted that lack of passport information for lentil germplasm accessions limits the ability to comprehensively assess geographic coverage and identify gaps; in the current global genetic resources databases, 9.9% of landrace accessions do not contain information even of the country where the accession was collected.

Multilateral System status of accessions in *ex situ* collections

The genus *Lens* is listed in Annex I of the Plant Treaty. Of the 44,085 accessions conserved globally, approximately 32.7% are held in international institutions (i.e., ICARDA and the World Vegetable Center), and included in the MLS under Article 15 of the Plant Treaty or similar arrangements, with the remainder maintained in national and other collections (Table 4).

As of 2025, 23,501 accessions are formally included in the MLS according to the Plant Treaty's GLIS database, and 23,978 accessions have been assigned Digital Object Identifiers (DOIs). Per the relevant fields in the global genetic resources databases, 26,060 accessions (59.1% of world total) are listed as included in the MLS; this is likely an underestimate, noting that 36.1% of accessions do not have MLS status data.

Table 4. Representation of lentil 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	14,421	32.7%
Number of accessions in genebank collections in national or other institutions	29,664	67.3%
Number of accessions in genebank collections in Annex I	44,085	100%
Number of accessions with DOI (Plant Treaty GLIS 2025)	23,978	
Number of accessions included in the Multilateral System (MLS) (Plant Treaty GLIS 2025)	23,501	
Number of accessions included in the Multilateral System (MLS) (genebank collections databases)	26,060	59.1%
Number of accessions included in the Multilateral System (MLS) that are in international collections (genebank collections databases)	14,370	32.6%
Number of accessions not included in the Multilateral System (MLS) (genebank collections databases)	2,114	4.8%
Number of accessions without information regarding inclusion in the Multilateral System (MLS) (genebank collections databases)	15,911	36.1%

Storage conditions, regeneration status, and safety duplication

As expected for an orthodox seed crop, almost the entirety (at least 98%) of lentil accessions are conserved as seed, with over half (52.8%) of these accessions listed as conserved under long-term cold-storage conditions (Table 5). Information on storage in general is missing for 2% of all accessions, and information on seed storage type (i.e., long, medium, or short term) is missing for 33.3% of seed accessions.

Current regeneration status and needs cannot be directly derived from the global germplasm databases. The 2008 Strategy listed proportions of collections in need of regeneration per institute, recognizing a need for further efforts on regeneration of lentil germplasm. Regeneration status varied substantially across institutions, but for the majority, at least 20% of accessions were in need of regeneration at that time (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 1,949 accessions regenerated during this time by reporting institutions, with 1,180 accessions identified as needing regeneration and 528 of these lacking funds to conduct the regeneration.

Analysis of the location of safety duplication sites of lentil germplasm, as listed in Genesys, indicates that at least 42.4% of 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 lentil accessions worldwide, when also considering safety duplication within the same country, may be higher than this estimate, given that ICARDA's collections conserved in the Lebanon site and duplicated at the site in Morocco are not included in this estimate (because they have the same INSTCODE), and a number of national genebanks (such as the USA and Russian Federation) typically provide safety backup their collections in a different location within the country. Information from the SGSV database from 2024 indicated that approximately 42.1% of total accessions worldwide were duplicated in Svalbard.

The 2008 Strategy listed proportions of collections safety duplicated per institute for some of the surveyed institutes, as well as the total number of lentil accessions duplicated by that time at the recently opened SGSV. The data indicated that many important collections were inadequately duplicated, particularly collections in India, Pakistan, Turkey, Ukraine, Portugal, Ethiopia, Spain, and Ecuador. The stakeholder meeting process included further planning for safety duplication of unique accessions both in other institutions outside of the country as well as in the SGSV. This included aiming to fully duplicate ICARDA's lentil collection in Svalbard and at NBPGR, India. The total number of lentil accessions in SGSV has increased from 3,352 in 2008 to 18,577 in 2024; this represents very significant progress, and turned out to be important for ICARDA due to the evacuation of their Aleppo site in 2014 (Simon, 2020).

Table 5. Storage conditions of lentil *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	43,210	98.0%
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	6,024	13.9%
Number of accessions held in long-term seed storage in genebank collections	22,806	52.8%
Number of accessions held in seed storage of undefined type in genebank collections	14,380	33.3%
Number of accessions held in field storage in genebank collections	2	0%
Number of accessions held in in-vitro storage in genebank collections	0	0%
Number of accessions held in cryo storage in genebank collections	1	0%
Number of accessions held as DNA in genebank collections	8	0.02%
Number of accessions held in other storage in genebank collections	0	0%
Number of accessions not marked with a storage type in genebank collections	873	2.0%
Number of accessions in genebank collections regenerated 2014–2019	1,949	49.1%
Number of accessions in genebank collections in need of regeneration 2014–2019	1,180	29.7%
Number of accessions in genebank collections in need of regeneration without budget for regeneration 2014–2019	528	13.3%
Number of accessions safety duplicated out of the country in genebank collections*	8,805	42.4%
Number of accessions in genebank collections safety duplicated in Svalbard	18,577	42.1%

*ICARDA passport data list accessions under one institute code (LBN002) even though it has two main sites (in Lebanon and in Morocco) which enable safety duplication outside of the country of the main collection; thus this metric may underreport the proportion of accessions duplicated outside of country.

Documentation, information systems, and research resources

A descriptor list for lentil was published in 1985 and is available online (IBPGR and ICARDA, 1985), and a prioritized list of characterization and evaluation descriptors was published in 2010 (Bioversity International, ICARDA, and NBPGR, 2010). The estimated completeness of passport information for lentil accessions listed in Genesys was 6.10 on a scale of 0 (no data) to 10 (complete data), which indicates that some data is available, but also that there are gaps that it would be valuable to fill. Thirty-two lentil characterization and evaluation datasets are available via Genesys, covering a total of 14,636 accessions. Four metrics of the current degree of digital sequence information (DSI) for lentil (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. Lentils stand out compared to other grain legumes in terms of research publications in PubMed Central, second only to soybeans.

The stakeholder meeting for the 2008 Strategy identified several priorities for lentil documentation and information systems (Crop Trust, 2008). To build on the 1985 descriptors, the group recognized the need for a minimum list of (prioritized) descriptors. This may have been adequately accomplished through the 2010 publication focused on lentil germplasm documentation (Bioversity International, ICARDA, and NBPGR, 2010). The meeting also recognized the need for an integrated online information system for lentil genetic resources, noting the efforts of both the International Lentil Information System (ILIS) (now defunct), which combined the databases of ICARDA, USDA and ATFCC Australia, as well as the EURISCO/ECPGR database. The current Genesys and FAO WIEWS databases offer some essential taxonomic, institutional, and passport data, and Genesys now holds some characterization data for the crop, but a dedicated online information system including accession-level characterization and evaluation data for lentil germplasm collections remains a gap.

Table 6. Documentation, information systems, and research resources for lentils. 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	6.1
Number of genes as recorded in NCBI's Entrez database as of 2022	7,345
Number of genomes as recorded in NCBI's Entrez database as of 2022	0
Number of nucleotides as recorded in NCBI's Entrez database as of 2022	46,598
Number of proteins as recorded in NCBI's Entrez database as of 2022	14,975
Number of publications listed in Google Scholar with taxon name in title published between 2009 and 2019	1,450
Number of publications listed in PubMed Central with taxon name in text as of 2022	28,832
Number of research materials as recorded in GBIF (2025)	418,606

Germplasm distributions and varietal registrations and releases

Germplasm distribution and varietal development statistics for lentils 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). Lentils stand out compared to other grain legumes in terms of samples distributed with the SMTA, second only to chickpeas (Khoury *et al*., 2023) (Table 7). Information on varietal registrations and releases indicate that lentil is average in terms of varietal development, compared to other pulses.

Table 7. Lentil 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	1,689.6
Average annual number of samples distributed worldwide as recorded in FAO WIEWS	2,083.6
Average annual number of samples distributed worldwide as recorded in the Plant Treaty Data Store	10,041.4
Number of countries receiving germplasm as recorded in the Plant Treaty Data Store	35.4
Evenness of distributions across world regions as recorded in the Plant Treaty Data Store	0.7
Average annual number of varietal registrations worldwide as recorded in UPOV's PLUTO	14.0
Average annual number of varietal releases worldwide as recorded in FAO WIEWS	8.0

Networks and partnerships

- ICARDA continues to play a critical role in lentil germplasm conservation and varietal development, maintaining active partnerships with national agricultural research organizations, other international centers, and several academic and industry institutions.
- The European Cooperative Programme for Plant Genetic Resources (ECPGR) Grain Legumes Working Group was initiated in 1991 and remains active, particularly in lentil germplasm characterization and evaluation through competitive calls.
- The BEANS Meta Network (Better pulses for Environment, Agriculture, Nutrition and Societies) was launched in 2025 to transform Mediterranean food systems through the power of legumes. This initiative builds upon the MEDIET project, which highlighted the nutritional, health, and environmental benefits of faba beans, lentils, chickpeas, and dry beans.
- The Global Bean Project is a network that aims to increase the cultivation and consumption of legumes around the world.
- The African Orphan Crops Consortium focuses on the crop for Africa.
- The USDA ARS has a pertinent Crop Germplasm Committee on food legumes (also here)
- Although not primarily focused on genetic resources, there are several networks

promoting lentil growers and other food system actors. Examples include the USA Dry Pea and Lentil Council in the United States and Protein Industries Canada.

- The 2008 Strategy recognized the importance of crop genetic resource networks, and mentioned that West Asia and North Africa, Central Asia and the Caucasus, and South Asia, East Asia and Southeast Asia all had existing networks that recognize the conservation of lentil germplasm as being important to their region, and, further, that these networks were generally underfunded and thus are unable to contribute to the extent desirable (Crop Trust, 2008). Very little information is currently available online that might indicate the persistence and level of activity of these networks over the past two decades.

Conclusions

Lentil continues to be an important grain legume worldwide and it is likely that it will continue to grow in importance in future food systems for both human health and environmental sustainability aims. Lentil genetic resources are bolstered by the activities of ICARDA as well as several major collections in national agricultural research organizations. Available information indicates that the overall number of accessions maintained worldwide has been relatively stable over the past two decades, and that the proportion of those accessions included in the MLS is now close to 60%. There has been evident progress made in safety duplication and in information systems, there are considerable associated research resources, and there has been significant activity in germplasm distribution and varietal development for the crop. But the data also indicates that additional efforts are needed to fill persisting gaps in existing collections through further collecting of wild relatives and landraces, and to make the information accompanying accessions more complete and/or more accessible in online databases. Further efforts are also needed to address regeneration and safety duplication backlogs.

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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 GitHub repository. Extended methods are available here.

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Supplementary information

Supplementary Table 1: Full list of *ex situ* collections of lentil 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 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)
LBN002	International Centre for Agricultural Research in Dry Areas	14,377	32.6%	32.6%	Not listed*	14,342	14,342
AUS165	Australian Grains Genebank, Agriculture Victoria	6,217	14.1%	46.7%	5,652	7,826	6,023
USA022	Western Regional Plant Introduction Station, USDA-ARS, Washington State University	3,179	7.2%	53.9%	3,173	0	0
IND001	National Bureau of Plant Genetic Resources	2,609	5.9%	59.8%	2,609	0	0
RUS001	N.I. Vavilov All-Russian Research Institute of Plant Industry	2,598	5.9%	65.7%	2,598	0	0
CHL150	Banco Activo INIA Carillanca	1,834	4.2%	69.9%	Not listed	0	0
CAN004	Plant Gene Resources of Canada, Saskatoon Research and Development Centre	1,194	2.7%	72.6%	1,194	0	1,194
UKR001	Institute of Plant Production n.a. V.Y. Yurjev of UAAS	1,100	2.5%	75.1%	970	0	0
HUN003	Centre for Plant Diversity	1,080	2.4%	77.6%	91	0	6
TUR001	Plant Genetic Resources Department	926	2.1%	79.7%	926	0	0
PAK001	Plant Genetic Resources Program	882	2.0%	81.7%	757	0	819
ETH085	Ethiopian Biodiversity Institute	724	1.6%	83.3%	652	0	695

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)
MAR088	Centre Régional de la Recherche Agronomique de Settat	711	1.6%	84.9%	Not listed	0	0
ESP124	Junta de Comunidades de Castilla-La Mancha. Consejería de Agricultura. Centro de Investigación Agraria de Albaladejito.	612	1.4%	86.3%	530	0	354
BGR001	Institute for Plant Genetic Resources 'K.Malkov'	514	1.2%	87.5%	373	0	0
DEU146	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research	462	1.0%	88.5%	462	465	462
PRT001	Banco Português de Germoplasma Vegetal	456	1.0%	89.5%	447	0	456
TUR034	Field Crop Central Research Institute	430	1.0%	90.5%	430	0	0
BGD003	Bangladesh Agricultural Research Institute	356	0.8%	91.3%	356	0	0
BGD028	Bangladesh Institute of Nuclear Agriculture (BINA)	348	0.8%	92.1%	Not listed	0	0
AZE015	Genetic Resources Institute	329	0.8%	92.9%	Not listed	0	329
SVK001	National Agricultural and Food Centre (NPPC), Research Institute of Plant Production (RIPP)	285	0.6%	93.5%	Not listed	0	285
ECU023	Departamento Nacional de Recursos Fitogenéticos	253	0.6%	94.1%	252	0	252
POL003	Plant Breeding and Acclimatization Institute	248	0.6%	94.6%	247	117	137
ITA436	Istituto di Bioscienze e Biorisorse, Consiglio Nazionale delle Ricerche	204	0.5%	95.1%	191	0	0
ISR002	Israel Gene Bank for Agricultural Crops, Agricultural Research Organisation, Volcani Center	188	0.4%	95.5%	12	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)
GBR004	Millennium Seed Bank - Royal Botanic Gardens Kew	173	0.4%	95.9%	Not listed	0	51
NPL069	National Agriculture Genetic Resources Centre-Genebank	148	0.3%	96.3%	148	0	0
TJK027	National Center for Genetic Resources	135	0.3%	96.6%	115	0	135
CUB005	Instituto Nacional de Ciencias Agrícolas	121	0.3%	96.8%	Not listed	0	0
LSO015	Lesotho National Plant Genetic Resources Centre	116	0.3%	97.1%	Not listed	0	0
JPN183	NARO Genebank	114	0.3%	97.4%	8	0	0
BRA003	Embrapa Recursos Genéticos e Biotecnologia	109	0.2%	97.6%	109	0	0
BRA012	Embrapa Hortaliças	109	0.2%	97.9%	Not listed	0	109
JOR105	National Agricultural Research Center	98	0.2%	98.1%	Not listed	98	98
CZE122	Gene bank	92	0.2%	98.3%	92	9	92
ITA363	Dipartimento di Chimica, Biologia e Biotecnologie, Universitá degli Studi Perugia	88	0.2%	98.5%	88	0	0
MEX006	UACh, Banco Nacional de Germoplasma Vegetal (BANGEV)	78	0.2%	98.7%	78	0	0
ARM059	Agrobiotechnology Scientific Center	43	0.1%	98.8%	32	0	0
LKA036	Plant Genetic Resources Centre	38	0.1%	98.8%	Not listed	0	0
MNG030	Institute of Plant and Agricultural Science	38	0.1%	98.9%	3	0	3
CYP004	National (CYPARI) Genebank, Agricultural Research Institute, Ministry of Agriculture, Rural Development and Environment	36	0.1%	99.0%	14	0	19

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	36	0.1%	99.1%	Not listed	1	36
LBN020	Lebanese Agricultural Research Institute	34	0.1%	99.2%	34	34	3
ESP109	Junta de Castilla y León. Instituto Tecnológico Agrario de Castilla y León. Centro de Investigación de Zamadueñas	31	0.1%	99.2%	Not listed	0	29
TWN001	World Vegetable Center	28	0.1%	99.3%	28	28	28
ROM007	Suceava Genebank	26	0.1%	99.4%	21	25	25
GRC005	Greek Genebank, Institute of Plant Breeding and Genetic Resources	25	0.1%	99.4%	Not listed	0	0
ERI003	National Agricultural Research Institute	23	0.0%	99.5%	23	0	19
LBY006	National Bank for Plant Genetic Resources	23	0.0%	99.5%	Not listed	0	0
ESP004	Centro Nacional de Recursos Fitogenéticos	21	0.0%	99.6%	2	0	0
NZL001	Margot Forde Genebank, AgResearch Ltd	19	0.0%	99.6%	Not listed	0	0
ARM005	Institute of Botany	18	0.0%	99.7%	16	0	18
BLR011	Republican Unitary Enterprise 'Research and Practical Centre of the National Academy of Sciences of Belarus for Arable Farming'	17	0.0%	99.7%	4	0	0
ZMB030	SADC Plant Genetic Resources Centre	16	0.0%	99.7%	16	0	0
ESP172	Cabildo Insular de Tenerife. Centro de Conservación de la Biodiversidad Agrícola de Tenerife	14	0.0%	99.8%	Not listed	0	14
GRC100	CIHEAM Mediterranean Agronomic Institute of Chania	13	0.0%	99.8%	13	0	0

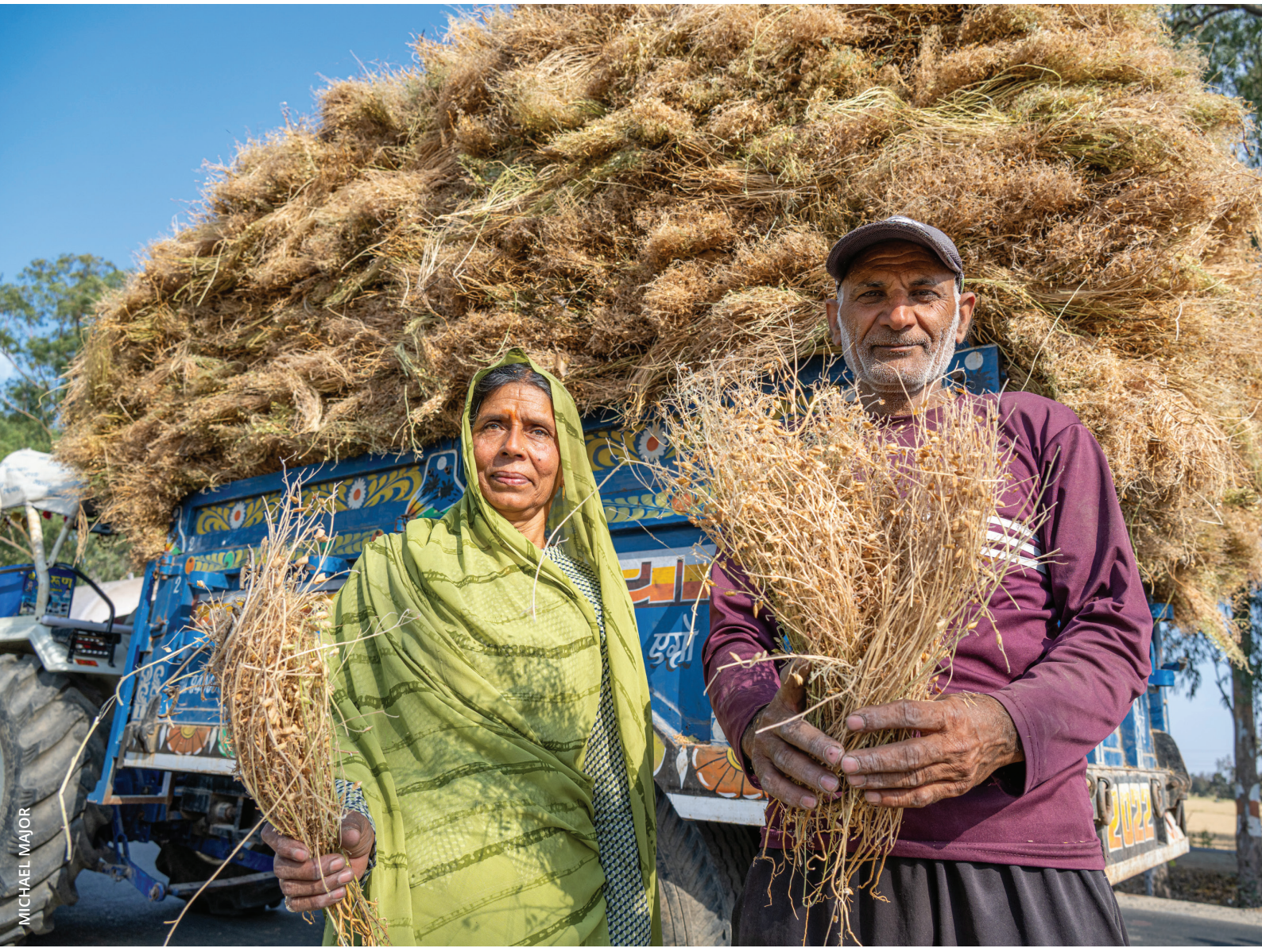
Institution Code	Institution name	Number of accessions	Percent of total	Cumulative percent	Number of accessions in long term storage (-18-20 C)	Number of accessions included in MLS (from Plant Treaty GLIS)	Number of accessions included in MLS (from genebank collections databases)
ROM055	Research and Development Station for Vegetables - Bacau	12	0.0%	99.8%	Not listed	0	0
MEX208	INIFAP, Centro Nacional de Recursos Genéticos (CNRG)	10	0.0%	99.8%	10	0	0
PRT102	Banco de Germoplasma - Universidade da Madeira	10	0.0%	99.9%	10	0	10
BEN098	Groupe de Recherche, Innovation agricole, Gestion de la Biodiversité et Action pour un Développement durable et Équitable à la Base	9	0.0%	99.9%	Not listed	0	0
GRC006	Plant Production Department, Institute of industrial and forage crops	6	0.0%	99.9%	6	0	0
ARG1350	Banco Activo de Germoplasma de La Consulta	4	0.0%	99.9%	Not listed	0	0
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	4	0.0%	99.9%	Not listed	0	4
CUB014	Instituto de Investigaciones Fundamentales en Agricultura Tropical	3	0.0%	99.9%	Not listed	0	0
ESP027	Gobierno de Aragón. Centro de Investigación y Tecnología Agroalimentaria. Banco de Germoplasma de Hortícolas	3	0.0%	99.9%	Not listed	0	2
MKD007	Fabia CSB Bogdanci	3	0.0%	99.9%	Not listed	0	0
USA974	Seed Savers Exchange	3	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)
ALB026	Plant Genetic Resources Center	2	0.0%	100.0%	2	0	2
ITA391	CREA-Centro di Ricerca Orticoltura e Florovivaismo - Sede di Pontecagnano	2	0.0%	100.0%	Not listed	12	2
MLT003	Plant Protection Directorate, Veterinary and Phytosanitary Regulation Department	2	0.0%	100.0%	Not listed	0	0
SWE054	Nordic Genetic Resource Center	2	0.0%	100.0%	2	2	2
TUN029	Banque Nationale de Gènes de Tunisie	2	0.0%	100.0%	2	0	2
USA995	National Center for Genetic Resources Preservation	2	0.0%	100.0%	2	0	0
ZAF062	RSA National Plant Genetic Resources Centre	2	0.0%	100.0%	2	0	0
AUT001	Austrian Agency for Health and Food Safety	1	0.0%	100.0%	1	0	1
AZE003	Research Institute of Crop Husbandry	1	0.0%	100.0%	Not listed	0	0
BEL002	Gembloux agro-biotech, Université de Liège, département des Sciences agronomiques, Phytotechnie tropicale et Horticulture	1	0.0%	100.0%	Not listed	0	1
GBR006	Warwick Genetic Resources Unit	1	0.0%	100.0%	1	0	0
GEO013	Niko Ketskhoveli Institute of Botany	1	0.0%	100.0%	Not listed	0	0
KEN212	Genetic Resources Research Institute	1	0.0%	100.0%	1	0	0
ROM023	University of Agricultural Sciences and Veterinary Medicine Timisoara	1	0.0%	100.0%	Not listed	0	0
SDN002	Agricultural Plant Genetic Resources Conservation and Research Centre	1	0.0%	100.0%	1	0	1

*But documented in the 2008 Strategy as maintaining collections in long-term conditions (Crop Trust, 2008)

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)
Lens culinaris subsp. *culinaris*	42,164
Lens culinaris Medik. subsp. *orientalis* (Boiss.) Ponert	607
Lens ervoides (Brign.) Grande	465
Lens nigricans (M. Bieb.) Webb & Berthel.	320
Lens sp.	279
Lens culinaris Medik. subsp. *odemensis* (Ladiz.) M. E. Ferguson et al.	172
Lens lamottei Czefr.	48
Lens culinaris Medik. subsp. *tomentosus* (Ladiz.) M. E. Ferguson et al.	30



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