GLOBAL CROP CONSERVATION AND USE METRICS

BARLEY
(*Hordeum* L.)

CROP TRUST

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Global crop conservation and use metrics

BARLEY
(*Hordeum* 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 barley 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 barley (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 barley

Barley (*Hordeum vulgare* L.) is one of the oldest domesticated crops, with archaeological evidence indicating its cultivation began more than 10,000 years ago in the Fertile Crescent of the Near East (Badr et al., 2000), and with additional independent domestication regions likely in West or Central Asia (Morrell and Clegg, 2007). This versatile cereal is now primarily used for animal feed and for malting for beer and whiskey production, although it remains important as a food grain to make bread, porridge, soups, and other dishes, particularly in parts of Asia and North Africa where wheat is less suitable (Baik and Ullrich, 2008). The grain provides dietary fiber, vitamins, minerals, and beta-glucans that have been associated with cholesterol reduction and improved cardiovascular health, making it a promising cereal for improved human nutrition (Baik and Ullrich, 2008). Barley's agricultural importance stems from its adaptability to diverse environmental conditions, including marginal lands in arid and semi-arid regions with poor soil quality, drought stress, and salinity, making it more resilient than many other cereal crops (Newton *et al.*, 2011).

Based on the most recently available production statistics from FAOSTAT, reporting for the year 2023, barley is cultivated in at least 103 countries on 46.3 million hectares worldwide, producing 145.8 million tonnes of grain at a value of USD 31.3 billion (FAO, 2025a). The largest producers include the Russian Federation, Australia, France, Germany, Türkiye, Canada, UK, Ukraine, Argentina, USA, Spain, and Iran, each producing over 3 million tonnes per annum.

There is considerable international trade in barley (around 40 million tonnes per annum), with Australia, France, Germany, Russian Federation, Argentina, Canada, Romania, Ukraine, Kazakhstan, and Hungary reporting exporting over one million tonnes each year (FAO, 2025a). Among the 140 countries reporting importing barley, the top recipients include China, Spain, Netherlands, Saudi Arabia, Belgium, Germany, Türkiye, Tunisia, Japan, and Morocco, all importing over one million tonnes each year.

Barley is a major contributor to calories in the food supplies of 60 countries and to protein in 69 countries (Table 1). Production, trade, and food supply metrics all indicate that barley is widely utilized outside of its regions of origin, implying significant international interdependence with regard to its genetic resources.

Table 1. Global status of barley 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)	48,529,581	84.00	0.34	0.61
Total production (tonnes)	145,454,426	75.75	0.33	0.74
Gross production value (current thousand USD)	25,150,732	63.75	0.37	0.74
Export quantity (tonnes)	53,590,986	87.75	0.26	0.90
Export value (current thousand USD)	21,249,791	84.00	0.27	0.95
Import quantity (tonnes)	51,351,133	156.75	0.27	0.71
Import value (current thousand USD)	22,415,895	161.75	0.31	0.85
Contribution to calories in food supplies (kcal/capita/day)	8.00	60.00	0.34	0.78
Contribution to protein in food supplies (g/capita/day)	0.21	69.25	0.34	0.78
Contribution to fat in food supplies (g/capita/day)	0.03	20.50	0.35	0.74
Contribution to food weight in food supplies (g/capita/day)	1.06	48.50	0.32	0.78
Number of public pageviews on Wikipedia over one year	4,981			

Identity and composition of *ex situ* collections

Based on the latest data in global genetic resource databases, germplasm collections of barley and wild relatives (i.e., genus *Hordeum* L.) are present in at least 129 institutions worldwide, collectively maintaining 397,206 accessions (Table 2, Table 3; Supplementary Table 1). This is slightly more than the number of accessions reported for the crop (396,962) 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 the Americas, Asia, Australia, Europe, and Africa. The International Centre for Agricultural Research in Dry Areas (ICARDA) and International Maize and Wheat Improvement Center (CIMMYT) maintain international collections for the crop, while the largest national collections are in Canada, Australia, USA, Germany, Brazil, Russian Federation, Ethiopia, the Scandinavian countries, Japan, the UK, India, and Morocco; these international and national collections 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

Table 2. Major *ex situ* collections of barley 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)
CAN004	Plant Gene Resources of Canada, Saskatoon Research and Development Centre (PGRC)	42,948	10.8%	10.8%	42,948	0	42,948
AUS165	Australian Grains Genebank, Agriculture Victoria	39,221	9.9%	20.7%	Not listed	21,457	23,137
USA029	National Small Grains Collection, USDA-ARS	36,597	9.2%	29.9%	36,597	0	0
LBN002	International Centre for Agricultural Research in Dry Areas (ICARDA)	32,487	8.2%	38.1%	Not listed*	31,851	31,851
DEU146	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research (IPK)	24,084	6.1%	44.1%	23,052	23,991	24,084
BRA003	Embrapa Recursos Genéticos e Biotecnologia	18,578	4.7%	48.8%	18,577	0	0
RUS001	N.I. Vavilov All-Russian Research Institute of Plant Industry (VIR)	17,788	4.5%	53.3%	17,788	0	0
SWE054	Nordic Genetic Resource Center	16,784	4.2%	57.5%	16,784	16,497	16,765
ETH085	Ethiopian Biodiversity Institute	16,614	4.2%	61.7%	16,509	0	16,377
JPN183	NARO Genebank	15,820	4.0%	65.7%	6,710	4,891	4,891
MEX002	International Maize and Wheat Improvement Center (CIMMYT)	15,441	3.9%	69.6%	Not listed*	15,385	0#
GBR247	Germplasm Resources Unit, John Innes Centre, Norwich Research Park (JIC)	10,441	2.6%	72.2%	10,441	0	0
IND001	National Bureau of Plant Genetic Resources (NBPGR)	8,685	2.2%	74.4%	8,685	0	0
MAR088	Centre Régional de la Recherche Agronomique de Settat	8,620	2.2%	76.6%	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)
POL003	Plant Breeding and Acclimatization Institute	7,432	1.9%	78.4%	7,422	0	6,079
BGR001	Institute for Plant Genetic Resources 'K.Malkov'	6,415	1.6%	80.1%	5,042	0	0
CZE122	Gene bank	5,364	1.4%	81.4%	5,364	198	5,364
ARE003	International Center for Biosaline Agriculture	5,020	1.3%	82.7%	Not listed	3,483	5,020
UKR001	Institute of Plant Production n.a. V.Y. Yurjev of UAAS	4,819	1.2%	83.9%	1,130	0	0
ISR003	Lieberman Germplasm Bank, Institute for Cereal Crops Improvement, Tel-Aviv University	4,610	1.2%	85.4%	Not listed	0	0
	Other institutions (n = 109)	59,438	14.9%	100%	30,539	5,853	26,715

*But known to maintain barley collections in long-term conditions.
#Reporting of MLS status in Genesys by CIMMYT for its barley collection is clearly underreported or out of date; the estimated correct number would be around 15,218.

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 barley collections without information on MLS status are in countries that are contracting parties to the Plant Treaty (such as USA, Brazil, and the UK) and distribute samples using the Standard Material Transfer Agreement (SMTA).

Based on a genebank stakeholder survey and inventorying process, the 2008 Strategy identified 405,000 barley and wild relative accessions maintained worldwide (Crop Trust, 2008). The major barley collections were largely the same as those currently listed in Genesys and FAO WIEWS, although several collections listed in the 2008 Strategy are not currently reported in the global genetic resource databases. These include the Institute of Crop Germplasm Resources (CAAS) (China, 18,818 accessions); the National Institute of Agricultural Biotechnology, Suwon (Republic of Korea, 18,764 accessions); the National Genebank of Iran, Genetic Resources Division, Karaj (7,600 accessions, the Station d'Amélioration des Plantes, INRA, Clermont-Ferrand (France, 5,517 accessions); and the Research Institute of Agriculture and Plant Science, Darkhan (Mongolia, 5,255 accessions), among others.

The 2008 Strategy mentioned that the largest barley landrace collections were held in ICARDA, CAAS China, IBC Ethiopia, PGRC Canada, USDA, IPK Germany, and RIB Japan (Crop Trust, 2008). For wild relatives, JIC UK, Institute for Cereal Crops Improvement Israel, PGRC Canada, Institute of Evolution – University of Haifa Israel, Israel Plant Genebank, ICARDA, USDA, IPK, and CAAS China held the largest collections. For breeding materials, CIMMYT, PGRC Canada, ICARDA, USDA, NIAR

Japan and INRA France held the largest collections, and for genetic materials the largest collections were at NordGen, PGRC Canada, USDA and NIAR Japan. The largest cultivar collections were maintained at VIR Russia, IPK Germany, PGRC Canada, and USDA. The 2008 Strategy also mentioned that considerable duplication existed between the four largest collections worldwide (PGRC, USDA, EMBRAPA and ICARDA).

During the 2008 Strategy stakeholder meeting, participants categorized PGRC Canada, USDA, ICARDA, IPSR UK, IPK Germany, and 16 other collections in the "A" group due to the quantity of accessions and uniqueness of their barley collections, high maintenance standards, and general availability for distribution. Other collections were grouped in B or C categories with recommendations for further support to improve their standards, or for further safety backup to ensure against loss.

Hordeum L. (Poaceae) contains around 32 species and 45 total taxa, native to temperate regions of Africa, Eurasia, and the Americas. The wild progenitor, *Hordeum vulgare* L. subsp. *Spontaneum* (K. Koch) Thell., is native to West, Central and East Asia, and the Mediterranean (USDA, 2025). One secondary genepool wild relative is known – *Hordeum bulbosum* L., while around 60 taxa have been categorized as tertiary relatives, including not only the remaining taxa in *Hordeum*, but also five species in *Elymus* L. and one in *Leymus* Hochst.

Data compilation for this report on barley genetic resources included all taxa in *Hordeum*. Along with the crop, 54 taxa as well as hybrids and accessions only recognized to the genus level are present in germplasm collections (Supplementary Table 2). These include large collections of the progenitor and secondary genepool wild relatives. Breeding materials make up the largest proportion of collections (31.2%), followed by landraces (27.2%), improved varieties (14.9%), and wild relatives (5.3%) (Table 3); these percentages are estimates based on available data, noting that 21.3% of accessions do not have biological status data.

Hordeum germplasm has been collected from

Table 3. Composition of *ex situ* collections of barley 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	397,206	
Number of institutions holding genebank collections	129	
Number of distinct taxonomic names in genebank collections	57	
Number of accessions of crop wild relatives (CWR) in genebank collections	21,124	5.3%
Number of accessions of weedy materials in genebank collections	353	0.09%
Number of accessions of landraces in genebank collections	107,953	27.2%
Number of accessions of breeding materials in genebank collections	123,982	31.2%
Number of accessions of improved varieties in genebank collections	59,015	14.9%
Number of accessions of other materials in genebank collections	1	0%
Number of accessions not marked with an improvement type in genebank collections	84,771	21.3%
Number of countries where germplasm has been collected for genebank collections	118	
Number of accessions in genebank collections from the primary region(s) of diversity	46,411	11.7%
Number of accessions in genebank collections from the primary and secondary region(s) of diversity	87,435	22%
Number of taxa in botanic garden collections	47	
Number of botanic gardens holding collections of crop or its wild relatives	123	

at least 118 countries, with approximately 11.7% of accessions originating from the primary regions of diversity (i.e. West and Central Asia and the Mediterranean) and 22% from primary and secondary (i.e. East Africa and South Asia) regions; these statistics are also estimates, as 5.2% of barley landrace accessions and 4.8% 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 123 botanic gardens collectively conserve 47 *Hordeum* taxa. All of these taxa are also conserved in genebank collections.

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. Regarding landrances, Ramirez-Villegas *et al.* (2022) identified geographic gaps for barley landrace groups in the Fertile Crescent, West Asia, and the Mediterranean.

In a global *ex situ* conservation gap analysis of the wild relatives of major crops, Castañeda-Álvarez *et al.* (2016), assessing four barley wild relatives, listed one (*Hordeum brevisubulatum* (Trin.) Link) as of high priority for further collecting, and two other species (*H. bulbosum* and *Hordeum chilense* Roem. & Schult.) as of medium priority. Some progress has been made recently in filling barley wild relative 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 346 seed samples of 21 barley wild relative taxa from 11 countries (including 13 samples of *H. brevisubulatum*, 49 of *H. bulbosum*, and 22 of *H. chilense*) as well as the development of new varieties with introgressions from this wild germplasm (Eastwood *et al.*, 2022).

Multilateral System status of accessions in *ex situ* collections

The genus *Hordeum* 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 397,206 accessions conserved globally, approximately 13.3% are held in international institutions (i.e., ICARDA and CIMMYT), and are included in the MLS under Article 15 of the Plant Treaty, with the remainder maintained in national and other collections (Table 4).

As of 2025, 126,613 accessions are formally included in the MLS according to the Plant Treaty's GLIS database, and 138,047 accessions have been assigned Digital Object Identifiers (DOIs). Per the relevant fields in the global genetic resources databases, 203,231 accessions (51.2% of world total) are listed as included in the MLS; this is likely an underestimate, noting that 31% of accessions do not have MLS status data and that CIMMYT was underreporting at the time of data compilation. The discrepancies between the data in GLIS and in the global genetic resources databases indicates that several institutions have not registered or recently updated their registrations in the GLIS portal.

Table 4. Representation of barley 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	53,037	13.3%
Number of accessions in genebank collections in national or other institutions	344,169	86.7%
Number of accessions in genebank collections in Annex I	397,206	100%
Number of accessions with DOI (Plant Treaty GLIS 2025)	138,047	
Number of accessions included in the Multilateral System (MLS) (Plant Treaty GLIS 2025)	126,613	
Number of accessions included in the Multilateral System (MLS) (genebank collections databases)	203,231 (218,449)*	51.2% (55%)*
Number of accessions included in the Multilateral System (MLS) that are in international collections (genebank collections databases)	36,907 (52,125)*	9.3% (13.1%)*
Number of accessions not included in the Multilateral System (MLS) (genebank collections databases)	70,906	17.9%
Number of accessions without information regarding inclusion in the Multilateral System (MLS) (genebank collections databases)	123,069	31.0%

*Reporting of MLS status in Genesys by CIMMYT for its barley collection is clearly underreported or out of date; the estimated number would be around 15,218. Updated estimates provided here

Storage conditions, regeneration status, and safety duplication

As expected for an orthodox seed crop, the great majority (at least 84.5%) of *Hordeum* accessions are conserved as seed, with 73.7% of these accessions listed as conserved under long-term cold-storage conditions (Table 5). Information on storage in general is missing for 14.9% of all accessions, and on seed storage type (i.e., long, medium, or short term) it is missing for 9.7% 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 major barley collection and per biological status type. Regeneration status varied substantially across institutions. While many institutions had urgent regeneration needs, the largest collections, including PGRC, USDA, ICARDA, and IPK, were assessed as in relatively good shape at that time. The 2008 Strategy stakeholder meeting identified wild species and genetic stocks as first priorities for regeneration, noted those collections with more urgent regeneration needs, and considered partnerships as a means by which to regenerate the more difficult species. 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 8,207 barley accessions regenerated during this time by reporting institutions, with 9,277 accessions identified as needing regeneration and 3,899 of these lacking funds to conduct the regeneration.

Analysis of the location of safety duplication sites of barley germplasm, as listed in Genesys, indicates that at least one-quarter 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 barley 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 29.1% of total accessions worldwide were duplicated in Svalbard. Further, it is not straightforward to assess from the available online data how many of the total accessions conserved globally are *unique*, but given the high degree of duplication of accessions among major collections (Crop Trust, 2008), it is likely that the proportion of unique accessions safety duplicated in other institutions or locations, or at SGSV, is considerably higher than these percentages.

The 2009 Strategy listed proportions of collections safety duplicated per institute for some of the surveyed institutes, and determined the overall degree of safety backup of barley accessions globally to be inadequate. Participants of the stakeholder meeting agreed that all unique accessions should be safety-duplicated, giving first priority to wild relatives, landraces, and genetic stocks, second priority to cultivars, and third priority to breeding material. They identified ICARDA as a central organization for receiving safety duplicates, and noted the value of additional (secondary) duplication, including in the SGSV. Given the evacuation of ICARDA's Aleppo site in 2014 (Simon, 2020), recommending this additional duplication turned out to be prudent.

Table 5. Storage conditions of barley *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	335,788	84.5%
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	55,641	16.6%
Number of accessions held in long-term seed storage in genebank collections	247,588	73.7%
Number of accessions held in seed storage of undefined type in genebank collections	32,559	9.7%
Number of accessions held in field storage in genebank collections	2,210	0.6%
Number of accessions held in in-vitro storage in genebank collections	0	0%
Number of accessions held in cryo storage in genebank collections	22	0.01%
Number of accessions held as DNA in genebank collections	26	0.01%
Number of accessions held in other storage in genebank collections	0	0%
Number of accessions not marked with a storage type in genebank collections	59,211	14.9%
Number of accessions in genebank collections regenerated 2014–2019	8,207	19.4%
Number of accessions in genebank collections in need of regeneration 2014–2019	9,277	21.9%
Number of accessions in genebank collections in need of regeneration without budget for regeneration 2014–2019	3,899	9.2%
Number of accessions safety duplicated out of the country in genebank collections*	25,513	28.5%
Number of accessions in genebank collections safety duplicated in Svalbard	115,500	29.1%

*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 for this institute.

Documentation, information systems, and research resources

A descriptor list for barley was first published in 1982, with a revised version published in 1994 (IPGRI, 1994) following suggestions for improvement by participants of the International Workshop on Barley Genetic Resources held in 1991 as well as published critiques (Cross, 1992). A prioritized list of characterization and evaluation descriptors was published in 2009 (Bioversity International and ICARDA, 2009).

The estimated completeness of passport information for barley accessions listed in Genesys was 5.5 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. At least 89 barley characterization and evaluation datasets are available via Genesys, covering a total of 36,557 accessions. Four metrics of the current degree of digital sequence information (DSI) for barley (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. Barley, along with wheat, maize, and rice, stands out compared to many other cereals in terms of the degree of DSI resources, published literature, and research resources in GBIF (Khoury *et al.*, 2023).

At the time of the 2008 Strategy, many collections had simple information management systems, often offline (Crop Trust, 2008). Efforts were being made to combine information, for example to produce a Global Inventory of Barley Genetic Resources (GIBGR), which was useful for determining the extent of representation of barley genetic resources in *ex situ* collections and to identify duplications and gaps. A European Barley Database (EBDB) and Database on Barley Genes and Genetic Stocks (BGS) were also active.

Participants of the Strategy stakeholder meeting recognized the need for an integrated online information system for barley genetic resources, and to fill gaps in germplasm databases, for example regarding passport data (e.g., though geo-referencing) and evaluation data. Information management for crop genetic resources has evolved substantially since the 2008 Strategy. The current Genesys and FAO WIEWS databases likely 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 complete accession-level characterization and evaluation data for barley germplasm collections remains a gap.

Table 6. Documentation, information systems, and research resources for barley. 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	5.5
Number of genes as recorded in NCBI's Entrez database as of 2022	59,268
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	5,045,522
Number of proteins as recorded in NCBI's Entrez database as of 2022	324,941
Number of publications listed in Google Scholar with taxon name in title published between 2009 and 2019	3,790
Number of publications listed in PubMed Central with taxon name in text as of 2022	21,943
Number of research materials as recorded in GBIF (2025)	960,027

Germplasm distributions and varietal registrations and releases

Germplasm distribution and varietal development statistics for barley 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). Barley is among the most distributed cereal crops in both these datasets (Khoury *et al.*, 2023) (Table 7). Information on varietal registrations and releases indicate that barley is also among the cereals with the largest numbers of varieties in development.

Table 7. Barley 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	66,562.0
Average annual number of samples distributed worldwide as recorded in FAO WIEWS	92,849.0
Average annual number of samples distributed worldwide as recorded in the Plant Treaty Data Store	25,250.7
Number of countries receiving germplasm as recorded in the Plant Treaty Data Store	55.9
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	991.2
Average annual number of varietal releases worldwide as recorded in FAO WIEWS	97.6

Networks and partnerships

- ICARDA continues to play a critical role in barley germplasm conservation and varietal development, maintaining active partnerships with national agricultural research organizations, other international centers, and several academic and industry institutions.
- Crop networks relevant to barley have changed substantially since the 2008 Strategy. Currently active networks include:
  - The European Cooperative Programme for Plant Genetic Resources (ECPGR) Barley Working Group
  - The European Union-funded Crop Wild Relatives Utilization and Conservation for Sustainable Agriculture (COUSIN) project unites 12 European countries to conduct *in situ* and *ex situ* conservation for wild relatives of barley.
  - The USDA ARS Barley Crop Germplasm Committee (also here)
  - Communities related to barley genetics, e.g. https://scabusa.org/node/723

Conclusions

Barley continues to be an extremely important cereal crop worldwide and it is likely that it will grow in importance in future food systems for both human health and environmental sustainability aims. Barley genetic resources are bolstered by the activities taking place in several major collections in national agricultural research organizations as well as at ICARDA. The available data indicates that there has been some significant progress made in placing accessions under the MLS of the Plant Treaty, safety duplication, and information systems over the past two decades, there are considerable amounts of associated research resources, and there has been significant activity in germplasm distribution and varietal development for the crop. The data also indicate that further efforts are needed to fill gaps in existing collections through collecting of wild relatives and landraces, to comprehensively include all unique barley germplasm collections under the MLS of the Plant Treaty, to make the information accompanying accessions more complete and/or more accessible in online databases, and 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 GitLab repository. Extended methods are available here.

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Supplementary information

Supplementary Table 1: Full list of *ex situ* collections of barley 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)
CAN004	Plant Gene Resources of Canada, Saskatoon Research and Development Centre	42,948	10.8%	10.8%	42,948	0	42,948
AUS165	Australian Grains Genebank, Agriculture Victoria	39,221	9.9%	20.7%	Not listed	21,457	23,137
USA029	National Small Grains Collection, USDA-ARS	36,597	9.2%	29.9%	36,597	0	0
LBN002	International Centre for Agricultural Research in Dry Areas	32,487	8.2%	38.1%	Not listed*	31,851	31,851
DEU146	Genebank, Leibniz Institute of Plant Genetics and Crop Plant Research	24,084	6.1%	44.1%	23,052	23,991	24,084
BRA003	Embrapa Recursos Genéticos e Biotecnologia	18,578	4.7%	48.8%	18,577	0	0
RUS001	N.I. Vavilov All-Russian Research Institute of Plant Industry	17,788	4.5%	53.3%	17,788	0	0
SWE054	Nordic Genetic Resource Center	16,784	4.2%	57.5%	16,784	16,497	16,765
ETH085	Ethiopian Biodiversity Institute	16,614	4.2%	61.7%	16,509	0	16,377
JPN183	NARO Genebank	15,820	4.0%	65.7%	6,710	4,891	4,891
MEX002	Centro Internacional de Mejoramiento de Maíz y Trigo	15,441	3.9%	69.6%	Not listed*	15,385	0
GBR247	Germplasm Resources Unit, John Innes Centre, Norwich Research Park	10,441	2.6%	72.2%	10,441	0	0
IND001	National Bureau of Plant Genetic Resources	8,685	2.2%	74.4%	8,685	0	0
MAR088	Centre Régional de la Recherche Agronomique de Settat	8,620	2.2%	76.6%	Not listed	0	0
POL003	Plant Breeding and Acclimatization Institute	7,432	1.9%	78.4%	7,422	0	6,079
BGR001	Institute for Plant Genetic Resources 'K.Malkov'	6,415	1.6%	80.0%	5,042	0	0
CZE122	Gene bank	5,364	1.4%	81.4%	5,364	198	5,364
ARE003	International Center for Biosaline Agriculture	5,020	1.3%	82.7%	Not listed	3,483	5,020
UKR001	Institute of Plant Production n.a. V.Y. Yurjev of UAAS	4,819	1.2%	83.9%	1,130	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)
ISR003	Lieberman Germplasm Bank, Institute for Cereal Crops Improvement, Tel-Aviv University	4,610	1.2%	85.0%	Not listed	0	0
MNG030	Institute of Plant and Agricultural Science	4,513	1.1%	86.2%	261	0	156
HUN003	Centre for Plant Diversity	4,429	1.1%	87.3%	223	0	87
TUN029	Banque Nationale de Gènes de Tunisie	4,283	1.1%	88.4%	4,283	0	4,282
TUR034	Field Crop Central Research Institute	3,261	0.8%	89.2%	3,261	0	0
UZB006	Uzbek Research Institute of Plant Industry	2,775	0.7%	89.9%	Not listed	0	0
ESP004	Centro Nacional de Recursos Fitogenéticos	2,694	0.7%	90.6%	2,341	0	2,085
NLD037	Centre for Genetic Resources, the Netherlands	2,664	0.7%	91.2%	2,664	2,672	2,664
ROM002	National Agricultural Research and Development Institute - Fundulea	2,510	0.6%	91.9%	Not listed	0	0
URY003	INIA La Estanzuela	2,438	0.6%	92.5%	2,438	469	0
BRA015	Embrapa Trigo	2,360	0.6%	93.1%	2	0	2,345
EGY087	National Gene Bank	1,933	0.5%	93.6%	674	156	1,933
SVK001	National Agricultural and Food Centre (NPPC), Research Institute of Plant Production (RIPP)	1,724	0.4%	94.0%	50	0	1,724
ECU023	Departamento Nacional de Recursos Fitogenéticos	1,631	0.4%	94.4%	1,629	0	544
PAK001	Plant Genetic Resources Program	1,481	0.4%	94.8%	1,273	0	1,277
ITA382	CREA-Centro di Ricerca Genomica e Bioinformatica - Sede di Fiorenzuola d'Arda	1,450	0.4%	95.1%	Not listed	1,194	1,194
BLR011	Republican Unitary Enterprise 'Research and Practical Centre of the National Academy of Sciences of Belarus for Arable Farming'	1,067	0.3%	95.4%	779	0	0
TUR001	Plant Genetic Resources Department	998	0.2%	95.7%	998	0	0
NPL069	National Agriculture Genetic Resources Centre-Genebank	929	0.2%	95.9%	929	0	0
AUT001	Austrian Agency for Health and Food Safety	923	0.2%	96.1%	884	0	923
TJK027	National Center for Genetic Resources	877	0.2%	96.4%	807	0	877
CHE001	Agroscope Changins	842	0.2%	96.6%	841	0	842
JOR105	National Agricultural Research Center	774	0.2%	96.8%	Not listed	773	768

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	764	0.2%	96.9%	764	0	0
UKR002	Institute of Breeding and Genetics	674	0.2%	97.1%	44	0	0
ERI003	National Agricultural Research Institute	644	0.2%	97.3%	644	0	216
UKR003	Myronivka Institute of Wheat (n.a. V.M.Remeslo)	640	0.2%	97.4%	142	0	0
UKR008	Ustymivka Experimental Station of Plant Production	605	0.1%	97.6%	138	0	0
FRA040	Génétique Diversité et Ecophysiologie des Céréales, Plant Biology and Breeding, INRAE Clermont-Ferrand	585	0.1%	97.7%	585	0	570
PRT001	Banco Português de Germoplasma Vegetal	562	0.1%	97.9%	486	0	562
LVA009	Latvian State Forest Research Institute 'Silava'	544	0.1%	98.0%	93	0	544
ROM007	Suceava Genebank	534	0.1%	98.2%	276	380	388
ITA436	Istituto di Bioscienze e Biorisorse, Consiglio Nazionale delle Ricerche	504	0.1%	98.3%	501	0	0
GBR004	Millennium Seed Bank - Royal Botanic Gardens Kew	425	0.1%	98.4%	Not listed	0	349
COL017	Corporación Colombiana de Investigación Agropecuaria, AGROSAVIA	418	0.1%	98.5%	412	0	0
AZE015	Genetic Resources Institute	414	0.1%	98.6%	40	0	396
CHL171	Banco de Semillas SAG Magallanes	408	0.1%	98.7%	408	0	0
NZL001	Margot Forde Genebank, AgResearch Ltd	397	0.1%	98.8%	Not listed	0	0
CHE100	Sortengarten Erschmatt	345	0.1%	98.9%	Not listed	0	345
LBY006	National Bank for Plant Genetic Resources	333	0.1%	99.0%	Not listed	0	0
ISR002	Israel Gene Bank for Agricultural Crops, Agricultural Research Organisation, Volcani Center	303	0.1%	99.0%	34	0	0
ROM028	Agricultural Research and Development Station Suceava	281	0.1%	99.1%	Not listed	0	0
ARM059	Agrobiotechnology Scientific Center	276	0.1%	99.2%	90	0	12
AUT005	Genebank Tirol	270	0.1%	99.3%	13	0	270
KGZ040	Bank-Laboratory of Plant Genetic Resources of the KR	210	0.0%	99.3%	183	0	210

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)
ESP007	Consejo Superior de Investigaciones Científicas. Estación Experimental de Aula Dei	203	0.0%	99.4%	Not listed	0	185
GRC001	Cereal Department, Institute of Plant Breeding and Genetic Resources	193	0.0%	99.4%	162	0	0
LTU001	Lithuanian Institute of Agriculture	185	0.0%	99.5%	114	0	179
BEL001	CRA-W, Centre wallon de Recherches agronomiques, Département de la Lutte Biologique et Ressources Phytogénétiques - Sélection céréalière	147	0.0%	99.5%	Not listed	0	147
LBN020	Lebanese Agricultural Research Institute	133	0.0%	99.5%	133	141	88
AZE003	Research Institute of Crop Husbandry	129	0.0%	99.6%		0	0
EST019	Estonian Crop Research Institute	127	0.0%	99.6%	127	0	127
LSO015	Lesotho National Plant Genetic Resources Centre	101	0.0%	99.6%	Not listed	0	0
ITA363	Dipartimento di Chimica, Biologia e Biotecnologie, Universitá degli Studi Perugia	99	0.0%	99.6%	99	0	0
IRL029	Department of Agriculture, Fisheries and Food, National Crop Variety Testing Centre	97	0.0%	99.7%	97	0	95
GRC005	Greek Genebank, Institute of Plant Breeding and Genetic Resources	95	0.0%	99.7%	Not listed	0	0
GBR016	Genetic Resources Unit, Institute of Biological, Environmental & Rural Sciences, Aberystwyth University	82	0.0%	99.7%	Not listed	0	2
CYP004	National (CYPARI) Genebank, Agricultural Research Institute, Ministry of Agriculture, Rural Development and Environment	80	0.0%	99.7%	22	0	30
ALB026	Plant Genetic Resources Center	76	0.0%	99.7%	76	0	75
HRV053	Center for Seed and Seedlings	73	0.0%	99.8%	73	0	66
CHL150	Banco Activo INIA Carillanca	69	0.0%	99.8%	Not listed	0	0
LTU010	Botanical Garden, Vilnius University	62	0.0%	99.8%	Not listed	0	0
GBR165	Science and Advice for Scottish Agriculture, Scottish Government	58	0.0%	99.8%	58	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)
GRC100	CIHEAM Mediterranean Agronomic Institute of Chania	55	0.0%	99.8%	55	0	0
ZMB030	SADC Plant Genetic Resources Centre	53	0.0%	99.8%	53	0	0
MEX208	INIFAP, Centro Nacional de Recursos Genéticos (CNRG)	48	0.0%	99.9%	48	0	0
MKD001	Faculty of Agriculture, University Ss. Cyril and Methodius	45	0.0%	99.9%	45	0	0
PRT102	Banco de Germoplasma - Universidade da Madeira	37	0.0%	99.9%	37	0	37
ETH013	International Livestock Research Institute	36	0.0%	99.9%	Not listed	36	36
HRV021	Agricultural Institute Osijek	35	0.0%	99.9%	5	0	0
USA022	Western Regional Plant Introduction Station, USDA-ARS, Washington State University	34	0.0%	99.9%	34	0	0
USA1004	Wheat Genetics Resource Center	34	0.0%	99.9%	Not listed	0	0
BGD003	Bangladesh Agricultural Research Institute	28	0.0%	99.9%	28	0	0
BIH039	Institute of Genetic Resources, University of Banja Luka	28	0.0%	99.9%	6	0	0
GHA091	Plant Genetic Resources Research Institute	28	0.0%	99.9%	Not listed	28	28
ROM008	Agricultural Research and Development Station Simnic	25	0.0%	99.9%	Not listed	0	0
ARM005	Institute of Botany	24	0.0%	99.9%	20	0	18
ESP172	Cabildo Insular de Tenerife. Centro de Conservación de la Biodiversidad Agrícola de Tenerife	23	0.0%	99.9%	Not listed	0	23
ISR001	Department of Field and Vegetable Crops, Hebrew University of Jerusalem	23	0.0%	100.0%	Not listed	0	0
ARM010	Armenian Botanical Society	21	0.0%	100.0%	Not listed	0	0
SVN019	Crops and Seed Production Department, Agricultural Institute of Slovenia	15	0.0%	100.0%	Not listed	0	0
MEX006	UACh, Banco Nacional de Germoplasma Vegetal (BANGEV)	13	0.0%	100.0%	12	0	0
MRT002	Centre National de Recherche Agronomique et de Développement Agricole	13	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)
MWI041	Malawi Plant Genetic Resources Centre	13	0.0%	100.0%	13	0	0
BIH036	Faculty of Agriculture and Food Sciences, University of Sarajevo	12	0.0%	100.0%	Not listed	0	0
GEO013	Niko Ketskhoveli Institute of Botany	12	0.0%	100.0%	Not listed	0	0
MNE001	Institute of Agriculture	10	0.0%	100.0%	10	0	0
ROM023	University of Agricultural Sciences and Veterinary Medicine Timisoara	8	0.0%	100.0%	Not listed	0	0
SDN002	Agricultural Plant Genetic Resources Conservation and Research Centre	8	0.0%	100.0%	8	0	8
KEN212	Genetic Resources Research Institute	7	0.0%	100.0%	7	0	0
LTU008	Department of Botany and Genetics, Vilnius University	7	0.0%	100.0%	Not listed	0	0
GEO001	I.Lomouri Institute of Crop Science	5	0.0%	100.0%	Not listed	0	0
GRC102	Hellenic Mediterranean University	4	0.0%	100.0%	Not listed	0	0
PAK034	Pakistan Agricultural Research Council	4	0.0%	100.0%	Not listed	0	0
VNM049	Plant Resources Center	4	0.0%	100.0%	Not listed	0	4
ARG1351	Banco Activo de Germoplasma de Anguil	3	0.0%	100.0%	Not listed	0	0
ARG1221	Estación Experimental Agropecuaria Chubut	2	0.0%	100.0%	Not listed	0	0
BLR014	State research institution 'Institute of Experimental Botany of the National Academy of Sciences of Belarus'	2	0.0%	100.0%	2	0	0
BRA144	Embrapa Pecuária Sul	2	0.0%	100.0%	Not listed	0	0
GTM001	Instituto de Ciencia y Tecnología Agrícolas	2	0.0%	100.0%	Not listed	0	0
ITA435	Banca del Germoplasma Vegetale	2	0.0%	100.0%	Not listed	0	2
MEX263	SNICS, Depositario Nacional de Referencia de Semillas (DNRS)	2	0.0%	100.0%	Not listed	0	0
QAT004	Biotechnology Center, Ministry of Environment	2	0.0%	100.0%	2	4	2
THA300	Genebank	2	0.0%	100.0%	2	0	0
CHL018	Inst. de Investig. Agropecuarias	1	0.0%	100.0%	Not listed	0	0
HRV015	Bc Institute for Breeding and Production of Field Crops	1	0.0%	100.0%	Not listed	0	0
ITA034	Institute of Plant Breeding and Agricultural Research 'Nazzareno Strampelli'	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)
ITA368	Banca del germoplasma autoctono vegetale regionale	1	0.0%	100.0%	1	0	0
MLT003	Plant Protection Directorate, Veterinary and Phytosanitary Regulation Department	1	0.0%	100.0%	Not listed	0	0
USA151	National Arboretum-Germplasm Unit, USDA/ARS	1	0.0%	100.0%	Not listed	0	0

*But known to maintain barley collections in long-term conditions.

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)
Hordeum vulgare subsp. *vulgare*	344,904
Hordeum vulgare subsp. *vulgare* (2-rows)	25,113
Hordeum vulgare subsp. *spontaneum* (K. Koch) Thell.	15,961
Hordeum vulgare subsp. *vulgare* (6-rows)	2,889
Hordeum L.	2,252
Hordeum bulbosum L.	1,415
Hordeum murinum subsp. glaucum (Steud.) Tzvelev	821
Hordeum murinum L.	809
Hordeum marinum Huds.	298
Hordeum jubatum L.	218
Hordeum chilense Roem. & Schult.	180
Hordeum marinum subsp. gussoneanum (Parl.) Thell.	169
Hordeum stenostachys Godr.	153
Hordeum comosum J. Presl	135
Hordeum lechleri (Steud.) Schenck	134
Hordeum pubiflorum Hook. f.	125
Hordeum parodii Covas	119
Hordeum murinum subsp. *leporinum* (Link) Arcang.	118
Hordeum agriocrithon A. E. Åberg	115
Hordeum brevisubulatum (Trin.) Link	104
Hordeum bogdanii Wilensky	101
Hordeum brachyantherum Nevski	101
Hordeum hybr.	82
Hordeum brachyantherum subsp. *brachyantherum*	64
Hordeum marinum subsp. *marinum*	61
Hordeum brevisubulatum subsp. *violaceum* (Boiss. & Hohen.) Tzvelev	59
Hordeum patagonicum (Hauman) Covas	58
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Taxon	Number of accessions (from genebank collections databases)
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Hordeum patagonicum subsp. *magellanicum* (Parodi & Nicora) Bothmer, Giles & N. Jacobsen	33
Hordeum intercedens Nevski	32
Hordeum roshevitzii Bowden	32
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Hordeum euclaston Steud.	27
Hordeum patagonicum subsp. *santacrucense* (Parodi & Nicora) Bothmer et al.	26
Hordeum flexuosum Nees	23
Hordeum patagonicum subsp. *setifolium* (Parodi & Nicora) Bothmer et al.	23
Hordeum fuegianum Bothmer et al.	22
Hordeum pubiflorum subsp. *halophilum* (Griseb.) Baden & Bothmer	20
Hordeum arizonicum Covas	18
Hordeum cordobense Bothmer et al.	18
Hordeum capense Thunb.	15
Hordeum murinum subsp. *murinum*	12
Hordeum patagonicum subsp. *patagonicum*	11
Hordeum brevisubulatum subsp. *turkestanicum* Tzvelev	10
Hordeum jubatum subsp. *jubatum*	6

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