

# Global strategy for the *ex situ* conservation of temperate forages: summary for ITPGRFA stakeholders

This document is a concise summary of the [Global strategy for the \*ex situ\* conservation of temperate forages \(Dodd, 2021\)](#) with some additional key metrics (Table 1) updated in 2024. This summary supports decision making by the stakeholders of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) by providing evidence-based information in an accessible format.

**Scope:** herbaceous plant species used for grazing livestock forages for, or used within, the temperate zone.

**Annex I crops:** *Agropyron cristatum*, *Agropyron desertorum*, *Agrostis stolonifera*, *Agrostis tenuis*, *Bromus* spp., *Dactylis glomerata*, *Festuca arundinacea*, *Festuca gigantea*, *Festuca heterophylla*, *Festuca ovina*, *Festuca pratensis*, *Festuca rubra*, *Lolium hybridum*, *Lolium multiflorum*, *Lolium perenne*, *Lolium rigidum*, *Lolium temulentum*, *Phleum pratense*, *Poa alpina*, *Poa annua*, *Poa pratensis*, *Elymus* spp., *Phalaris aquatica*, *Phalaris arundinacea*, *Hedysarum coronarium*, *Lotus corniculatus*, *Lotus subbiflorus*, *Lotus uliginosus*, *Lupinus albus*, *Lupinus angustifolius*, *Lupinus luteus*, *Melilotus albus*, *Melilotus officinalis*, *Onobrychis viciifolia*, *Ornithopus sativus*, *Vicia* spp., *Medicago arborea*, *Medicago falcata*, *Medicago sativa*, *Medicago scutellata*, *Medicago rigidula*, *Medicago truncatula*, *Trifolium alexandrinum*, *Trifolium alpestre*, *Trifolium ambiguum*, *Trifolium angustifolium*, *Trifolium arvense*, *Trifolium agrocicerum*, *Trifolium hybridum*, *Trifolium incarnatum*, *Trifolium pratense*, *Trifolium repens*, *Trifolium resupinatum*, *Trifolium rueppellianum*, *Trifolium semipilosum*, *Trifolium subterraneum*, *Trifolium vesiculosum*.

**International collections:** International Livestock Research Institute (ILRI), ICBA International Center for Biosaline Agriculture (ICBA), CIAT (Centro Internacional de Agricultura Tropical).

## Composition and gaps in *ex situ* collections

The Global Strategy considers 19 genera including temperate forages and reports that globally more than 400,000 accessions of temperate forage germplasm are conserved in more than 219 collections across more than 80 countries worldwide. Twenty one genebanks hold 80% of all the accessions in the 19 genera considered. In terms of species composition, 50% of the accessions are from 16 species<sup>1</sup>: *Vicia faba*, *Lolium perenne*, *Dactylis glomerata*, *Trifolium pratense*, *Lathyrus sativus*, *Medicago sativa*, *T. repens*, *M. truncatula*, *Festuca pratensis*, *Phleum pratense*, *Medicago polymorpha*, *F. arundinacea*, *Poa pratensis*, *T. subterraneum*, *L. albus* and *Vicia sativa*.

<sup>1</sup>This estimate was updated using WIEWS data available in 2024.

Among the temperate forages considered, the genera *Trifolium* and *Medicago* are the most represented in genebanks in terms of number of accessions.

## Routine operations, quality management system and safety duplication

Seventy percent of the surveyed genebanks have a management system with written procedures for storage, 65% for regeneration, 47% for characterization and 29% for germplasm health. All the genebanks that answered the 2021 survey question on storage reported having storage facilities to conserve seeds at temperatures compliant with [FAO Genebank Standards](#) and 71% reported having at least part of their collection dupli-

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cated in another genebank or/and at the Svalbard Global Seed Vault. For the 19 genera considered the estimated percentage of accessions conserved *ex situ* safety duplicated at Svalbard is about 20%.<sup>2</sup> The percentage by genus duplicated at Svalbard ranges from less than 1% for *Biserrula* to 35% for *Medicago*. An estimated 25% of the global temperate forage accessions are duplicated in another genebank, but more than 50% of these duplications are only in a genebank in the same country where the original accession is stored. This may limit the effectiveness of safety duplication as insurance policy against risks at the country level.

During the expert workshops, participants consistently highlighted that their low capacity for regeneration was a limiting factor.<sup>3</sup> This was generally attributed to budgetary constraints and insufficient land area and technical difficulties. Curators believe that identifying redundant duplication in collections is a cost-effective way of reducing the regeneration burden.

## Documentation and information systems

Seventy-one percent of the surveyed genebanks have fully electronic information systems to manage accessions, with Grin-Global being the most frequent infor-

<sup>2</sup>18% when estimated using data from SGSV and WIEWS, and 20% using data from Genesys

<sup>3</sup>Online consultation workshops with genebanks curators were conducted in 2020.

mation system used. Incomplete passport data was identified as an issue during the genebank curators' workshops. In the Genesys database, for the 334,082 accessions in the 19 genera considered here, the median value of the Passport Data Completeness Index<sup>4</sup> is 6.2. Curators also pointed out that having better availability of accession passport data would help them to identify unnecessary duplication, develop core collections and identify germplasm with desirable traits.

## Crop descriptors

Curators and users consulted in the 2020 workshops pointed out the lack of globally consistent standard descriptor lists for temperate forages. A key issue is agreeing on a minimum descriptor set for any given species.

## Accessions in the Multilateral System and obstacles to use

The estimated percentage of accessions conserved *ex situ* globally and recorded in Genesys and WIEWS as included in the MLS for the 19 genera considered is about 50%. There is some variation when considering each genus separately. The global collections of *Trifolium* and *Medicago*, the two most important temperate forages in terms of collection size, also have the largest number of accessions notified as available in the MLS. The difference in the number of accessions recorded in these databases

<sup>4</sup>The Passport Data Completeness Index ranges from 0 to 10.

**Table 1.** Summary key metrics for 19 genera of temperate forages.

Genus	Number of accessions (Genus level) WIEWS	Number of accessions (Genus level) Genesys	Number of accessions notified in the MLS - Genus level (GLIS 2024)	Number of accessions included in the MLS - Genus level (WIEWS 2024)	Accessions safety duplicated at another genebank (Genesys 2024)	Accessions safety duplicated out of country (Genesys 2024)	Accessions safety duplicated only in country (Genesys 2024)	Accessions safety duplicated in country (Genesys 2024)	Accessions safety duplicated at SDGV (Genesys 2024)	PDCI (Genesys 2024)
<i>Agropyron</i>	2,611	2,342	139	255	727	2	725	725	144	4.9
<i>Agrostis</i>	3,255	2,543	782	1,031	741	414	327	327	691	6.15
<i>Biserrula</i>	869	823	415	484	336	-	333	336	4	7.7
<i>Bromus</i>	6,432	3,432	392	644	1,280	127	1,118	1,153	390	5.3
<i>Dactylis</i>	21,182	16,924	3,775	11,687	2,414	531	1,732	1,883	4,788	6.75
<i>Festuca</i>	25,267	19,587	5,594	10,658	3,489	1,119	2,368	2,370	4,266	5.65
<i>Hedysarum</i>	1,180	720	416	637	236	1	232	235	13	6.05
<i>Lathyrus</i>	23,084	15,181	6,764	9,388	3,705	2,004	577	1,703	4,122	5.9
<i>Lolium</i>	27,655	22,167	5,898	11,834	3,153	958	2,193	2,195	4,673	6.15
<i>Lotus</i>	10,053	7,319	3,695	4,252	1,508	60	1,421	1,448	208	6.05
<i>Lupinus</i>	25,704	19,817	7,533	9,603	1,486	253	1,233	1,233	562	4.9
<i>Medicago</i>	80,359	67,997	40,416	44,237	22,515	6,557	8,445	16,395	23,861	7.05
<i>Onobrychis</i>	3,658	3,265	1,328	800	586	16	559	570	151	5.05
<i>Ornithopus</i>	4,661	4,124	3,077	3,329	1,696	14	1,664	1,682	126	8.55
<i>Phalaris</i>	2,976	1,946	795	787	907	174	732	733	272	5.3
<i>Phleum</i>	9,328	8,264	2,075	5,082	1,451	907	544	544	2,539	4.8
<i>Poa</i>	11,321	10,281	1,825	4,018	2,003	813	1,190	1,190	1,478	5.45
<i>Trifolium</i>	81,847	69,598	30,822	37,402	24,135	4,436	16,665	19,699	8,624	6.85
<i>Vicia</i>	65,990	57,752	29,271	39,312	10,384	6,726	1,796	3,768	9,114	5.45
Total	407,432	334,082	145,012	195,440	82,752	25,112	43,854	58,189	66,026	6.2

as included in the MLS and the amount recorded in GLIS portal as notified as available suggests that there are at least 50,000 accessions of temperate forages which still need to be recorded in GLIS as available in the MLS.

Some of the countries holding temperate forage germplasm are not signatories of the International Treaty on Plant Genetic Resources for Food and Agriculture. Among these, Russia and Ukraine hold large collections of temperate germplasm.

Characterization activity varied greatly across the surveyed genebanks. The 2021 survey participants pointed out that the lack of data about the accessions and phytosanitary standards and access to information had a high impact on the use of forage germplasm collections.

### Partnerships and networks

At the international level, ICARDA conserves about 30,000 accessions of accessions within the 19 genera considered here. At regional level, The European Cooperative Programme for Plant Genetic Resources (ECPGR) includes a Forages Working Group and NordGen is the joint genebank and knowledge center for genetic resources in the Nordic countries (Iceland, Denmark, Finland, Sweden and Norway).

### Recommendations and priorities

- 1 Taxa categorization and prioritization:
  - a. Categorize temperate germplasm and prioritize activity within these groups. Categorization may consider the degree of development of the germplasm, ecogeographic zones within the temperate area and the type of use. Prioritization should consider the conservation status, agronomic traits and existing knowledge/research.

- b. Identify lead organizations with a mandate to focus on the conservation of the taxa identified in the prioritization.
2. Improvement of data curation:
  - a. Update or develop new standardized descriptors for the prioritized species.
  - b. Engage database specialists and taxonomists to work with curators.
  - c. Work with curators to collate data and transfer the data to global databases.
  - d. Incorporate user-generated data in accessible databases where there is no commercial restriction.
3. Germplasm activity rationalization
  - a. Minimize redundant activity within the global collection of any given taxon.
  - b. Fill gaps in the global collection of any given taxon.
4. Human resource development
  - a. Provide support for data curation.
  - b. Support wider participation in existing regional networks or the establishment of new regional networks.

### Bibliography

Khoury, C.K., Sotelo, S., Amariles, D. & Hawtin, G. 2023. The plants that feed the world – Baseline data and metrics to inform strategies for the conservation and use of plant genetic resources for food and agriculture. Rome, FAO.

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