CGIAR | INITIATIVE ON Genebanks

CGIAR Initiative on Genebanks

ANNUAL TECHNICAL REPORT 2022

CGIAR Technical Reporting 2022

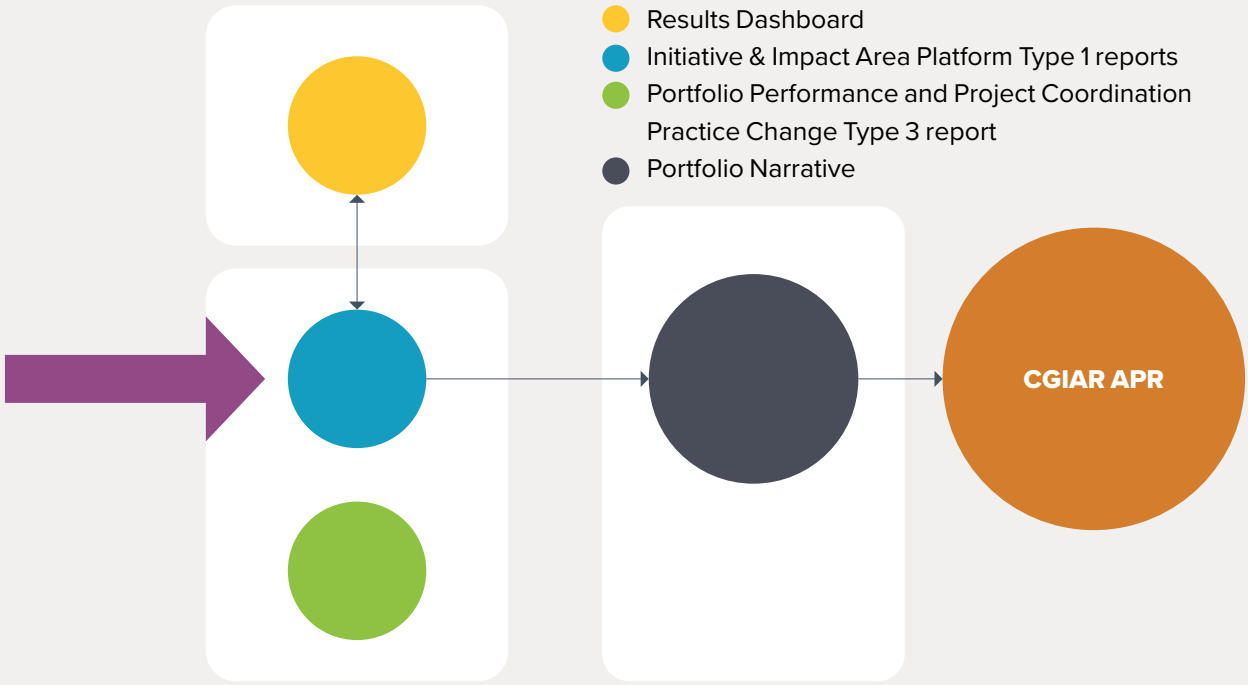
CGIAR Technical Reporting has been developed in alignment with the CGIAR Technical Reporting Arrangement.

This Initiative report is a Type 1 report and constitutes part of the broader CGIAR Technical Report. Each CGIAR Initiative submits an annual Type 1 report, which provides assurance on Initiative-level progress towards End of Initiative outcomes.

The CGIAR Technical Report comprises:

- Type 1 Initiative and Impact Area Platform reports, with quality assured results reported by Initiatives and Platforms available on the CGIAR Results Dashboard.
- The Type 3 Portfolio Performance and Project Coordination Practice Change report, which focuses on internal practice change.
- The Portfolio Narrative, which draws on the Type 1 and Type 3 reports, and the CGIAR Results Dashboard, to provide a broader view on portfolio coherence, including results, partnerships, country and regional engagement, and synergies among the portfolio's constituent parts.

The CGIAR Technical Report constitutes a key component of the CGIAR Annual Performance Report (APR).



US$	2022	2023	2024
Proposal Budget from initial submission	US$25,722,844	US$25,783,682	US$26,493,474
Approved 2022 Budget	US$22,411,618		

2022 Disbursement Target based on Approved FinPlan

Section 1 Fact sheet

Initiative name	Genebanks
Initiative short name	Genebanks
Action Area	Genetic Innovation
Geographic scope	Global
Start date	Jan. 1, 2022
End date	Dec. 31, 2024
Initiative Lead	Charlotte Lusty – c.lusty@cgiar.org
Measurable three-year End of Initiative outcomes (EOI-Os)	**EOI-O 1:** CGIAR breeders and researchers more precisely identify germplasm of value to their work, facilitated by trait-specific subsets and populations, and added value information. **EOI-O 2:** External diverse users increasingly access and use crop diversity, in perpetuity, benefiting from added value information and long-term conservation of in-trust collections. **EOI-O 3:** National and international genebanks conserve and distribute plant genetic resources for food and agriculture more efficiently and reliably in a strengthened global system, through capacity development and implementing enabling policies.
OECD DAC Climate marker adaptation score*	**Score 2:** Principal: The activity is principally about meeting any of the three CGIAR climate-related strategy objectives — namely, climate mitigation, climate adaptation, and climate policy, and would not have been undertaken without this objective.
OECD DAC Climate marker mitigation score*	**Score 1:** Significant: The activity contributes in a significant way to any of the three CGIAR climate-related strategy objectives — namely, climate mitigation, climate adaptation, and climate policy, even though it is not the principal focus of the activity.
OECD DAC Gender equity marker score*	**Score 0:** Not targeted: The Initiative/project has not been found to target gender equality. However, as a minimum requirement for all Initiatives/projects: (i) a gender analysis was conducted; (ii) its findings should be used to ensure that at a minimum, the Initiative activities/interventions do no harm and do not reinforce gender inequalities; and (iii) data that is collected is gender disaggregated.
Website link	https://www.cgiar.org/initiative/03-conservation-and-use-of-genetic-resources-genebanks/

*The Organisation for Economic Co-operation and Development (OECD) Development Assistance Committee (DAC) markers refer to the OECD DAC Rio Markers for Climate and the gender equality policy marker. For climate adaptation and mitigation, scores are: 0 = Not targeted; 1 = Significant; and 2 = Principal.
The CGIAR GENDER Impact Platform has adapted the OECD gender marker, splitting the 1 score into 1A and 1B. For gender equality, scores are: 0 = Not targeted; 1A = Gender accommodative/aware; 1B = Gender responsive; and 2 = Principal.
These scores are derived from Initiative proposals, and refer to the score given to the Initiative overall based on their proposal.

Section 2 Initiative progress on science and towards End of Initiative outcomes

Overall summary of progress against the theory of change

In 2022, genebanks provided nearly 58,000 germplasm samples to 679 requestors in 87 countries, (not including distributions from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the Center for International Forestry Research/International Council for Research in Agroforestry (CIFOR-ICRAF)). The largest percentage of external distributions was received by National Agricultural Research Systems (NARS), universities, and advanced research institutes. Viet Nam, Canada, Laos, Nigeria, and Mexico were the top five recipient countries in 2022. More than 2,000 samples of banana, cassava, potato, sweetpotato, cereals, grasspea, grain legumes, and forages were also disseminated to farmers, NGOs, and farmer organizations in Colombia, Cameroon, Guatemala, Mexico, Peru, Ethiopia, and the Philippines, as well as to North American and European countries. A similar number of samples were shipped to commercial sector users in 29 countries. CGIAR breeders and researchers received 40% of the disseminated germplasm for research and breeding. Every germplasm import and export, including from breeding programs, passed through CGIAR germplasm health units (GHUs), which carried out more than 930,000 diagnostic assays and prevented the movement of 9,000 diseased or contaminated samples, ensuring compliance with national phytosanitary regulations. With the support of the Genebanks Initiative Policy Team, all CGIAR acquisitions and distributions are compliant with national and international policies and laws.

CGIAR genebanks scaled up operations and research projects to pre-pandemic levels over the course of 2022. Out of nine CGIAR genebanks (excluding ICRISAT and CIFOR-ICRAF which did not receive funding under the Initiative), three have seed collections that attained performance targets for availability, safety duplication, documentation,

Characterising wheat diversity in CIMMYT.

and quality management in 2022. These high standards were agreed in 2014 after a quantitative assessment of the collections' status and recommendations from external reviewers. The significance of these genebanks reaching targets is multifaceted. The collections are in a better state of health and security than ever before, which not only means that the genebanks are more resilient but that there are fewer backlogs and materials requiring urgent attention, facilitating planning and a steadier rate of operations. Genebank staff will have more scope to focus on enriching data resources, carrying out research, developing partnerships, and investing in new approaches and tools. Tribute is due to the staff who worked incessantly during the difficult conditions of the past three years and to the consistent, invaluable support of CGIAR Window 1 and bilateral funders.

If further reflection on the value of genetic diversity were needed, it was provided in 2022 by the opening of two new facilities. Morocco's Minister for Agriculture ceremoniously opened the new *Seeds for Life* genebank in Rabat, Morocco. This building houses the collections of barley, wheat, lentil, and chickpea reconstituted from safety duplicated samples stored at the Svalbard Global Seed Vault (SGSV). After the exit of the International Center for Agricultural Research in the Dry Areas (ICARDA) from Syria in 2013, nearly 150,000 duplicated samples were retrieved in batches from the Arctic, regenerated at an accelerated rate in Morocco and Lebanon and processed for long-term storage in both locations. In parallel, ICARDA continued to respond to requests and distribute materials and built new facilities. In 2022, as the new collections found their long-term home in Rabat, duplicate samples were returned to SGSV for safety. ICARDA-Morocco is now on course to reach performance targets in the next two years.

In Colombia, the iconic *Future Seeds* building was opened by the President of Colombia, but not before Jeff Bezos as well as other dignitaries paid personal visits. Future Seeds has attracted attention not only because of the recognized value of its objectives but because of its contemporary design. Its high-vaulted, bright yellow, steel framework and shaded atrium lend the genebank the air of an art gallery, while reaching platinum level Leadership in Energy and Environmental Design (LEED) certification. Thanks to *Future Seeds,* CGIAR leads a worthy race in realizing the vision of a resilient, high-capacity, carbon-zero 21st century genebank and digital resource center.

The governing body of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty) met in 2022 in India and provided a public venue to air disappointment about the perceived divergence of ICRISAT and CIFOR-ICRAF from the rest of the CGIAR Centers undergoing reform. The Genebanks' Policy Team managed CGIAR's submissions and responses to criticisms, ensuring that no additional monitoring or reporting requirements were imposed and that trust in CGIAR and its genebanks is retained as much as possible. Plans are under development to strengthen partnerships with NARS and to build complementary roles in the global community of international and national genebanks. CGIAR also contributed to other international policy outcomes. Negotiations were re-launched to enhance the multilateral system for access and benefit sharing under the Plant Treaty and the Convention on Biological Diversity's Global Biodiversity

Framework, which was formally agreed in December 2022, favored a multilateral solution to sharing digital sequence information.

Cutting across all nine genebanks, existing communities of practice on seed quality management, clonal crop conservation and cryopreservation, diversity gap analysis, GHUs, policy, and genebank data management continued activities under new workplans in Work Packages 2–4. GRIN-Global Community Edition (GGCE) was chosen in 2020 as the genebank inventory management system of choice. GGCE is developed by the Global Crop Diversity Trust (Crop Trust), based on software used by the USDA (United States Department of Agriculture) National Plant Germplasm System. The data system is partially adopted by seven of the nine CGIAR genebanks. Several decades of growth in collection size and data resources, punctuated by moments of poor funding or decision-making, have led to present-day accession data being less useful than it should be. The reform gives a greater incentive to pool resources and commit to a more reliable, shared information management system. Much work and investment have already been committed to this objective, but a successful system is intrinsically linked with workflows, quality controls, and tools such as mobile devices and barcoding. Putting in place a shared system not only involves software development but also changes in operating procedures, sometimes involving sacrifices as well as steps forward.

The Genebanks Initiative's Work Package 3 aims to make substantial progress on shared approaches for generating, managing, analyzing, and making available accession data, and to put in place standards and interfaces to facilitate communication with the Enterprise Breeding System and other breeding information management systems. Multiple approaches were taken in 2022 to enhance, combine, and analyze accession georeferenced, characterization, genotypic, and trait data. A unique subsetting tool was developed and made available online for public use as a means to customize accession subsets according to environmental variables. Subsets were also developed for specific target traits. Systems will be strengthened to improve the response to and management of users' requests for germplasm across CGIAR and to trace the use of genebank materials in research and breeding. Tailored approaches will also be developed to work on collections of crop species that are not the focus of Accelerated Breeding.

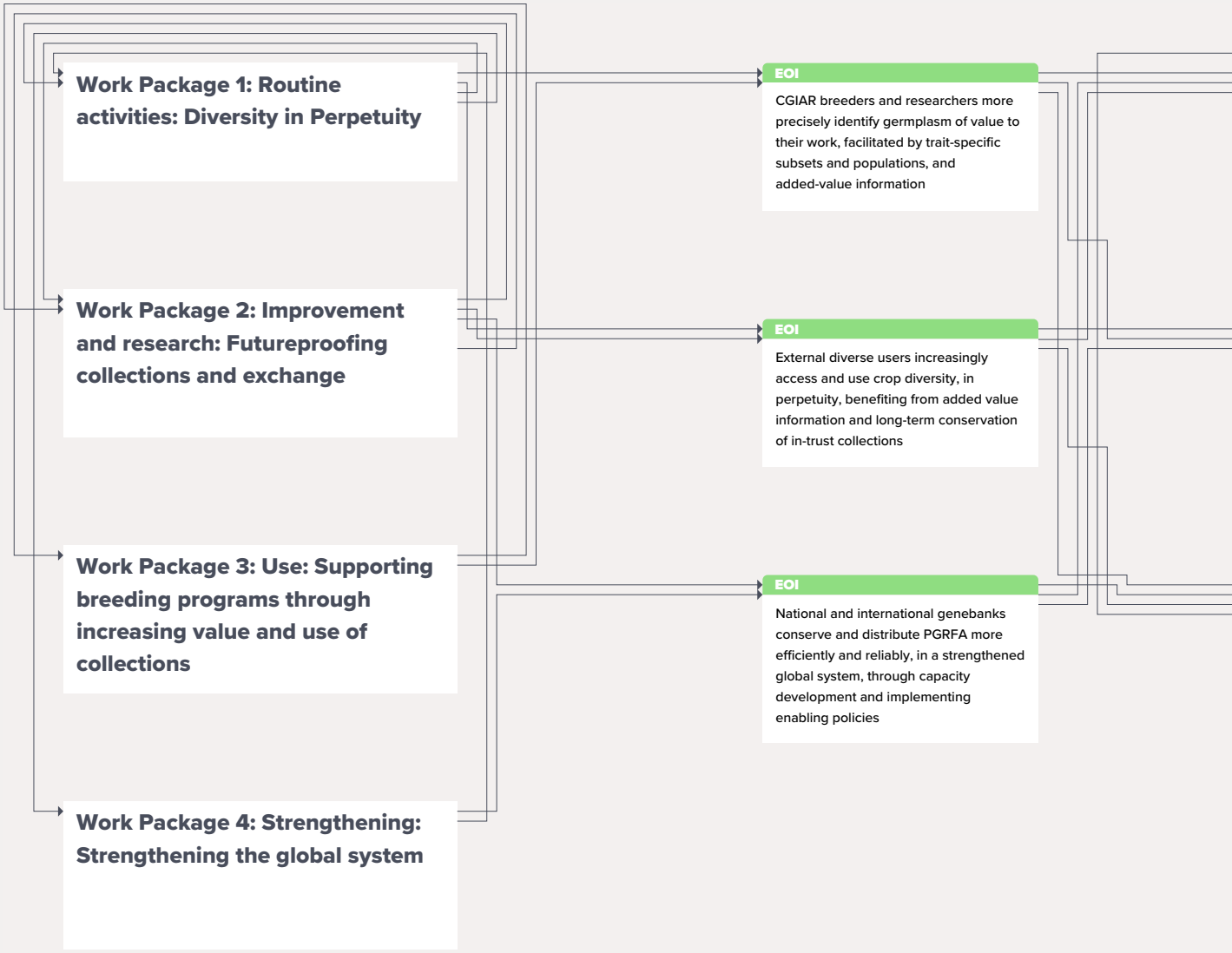
To strengthen the global system of genebanks, directly addressing UN Sustainable Development Goal 2.5 in 2022, more than 50 NARS partners were engaged in capacity-building and collaboration under Work Package 4, covering a range of genebank operations and activities from cryopreservation to the use of genomic tools for collection management and use. Six NARS partners benefited from project funding to develop capacity in international policy implementation. CGIAR genebanks will continue to engage NARS partners through a phased process involving, at first, a regionalized assessment of needs and generic training through shared-language workshops followed by more intensive, one-on-one projects in which the NARS partners receive financial and technical support to implement the training received. Partners for intensive follow up are prioritized through gap analyses showing a lack of representation of crop diversity from their countries in genebanks worldwide.

The Genebanks Initiative is built upon a strong foundation of collaboration among CGIAR and other genebanks over several decades. The current Initiative is shaped most particularly by the Genebanks CGIAR Research Program (CRP) and Platform coordinated by the Crop Trust between 2012 and 2021. In 2022, this role was transferred to interim co-leaders at CGIAR and then to an appointed Senior Director under Genetic Innovation. New management administrative teams will be established in 2023.

Harvest of potato landraces repatriated from CIP genebank to the Aymara community for sharing with other communities

Initiative-level theory of change diagram

This is a simple, linear, and static representation of a complex, non-linear, and dynamic reality. Feedback loops and connections between this Initiative and other Initiatives' theories of change are excluded for clarity.



EOI — End of Initiative outcome

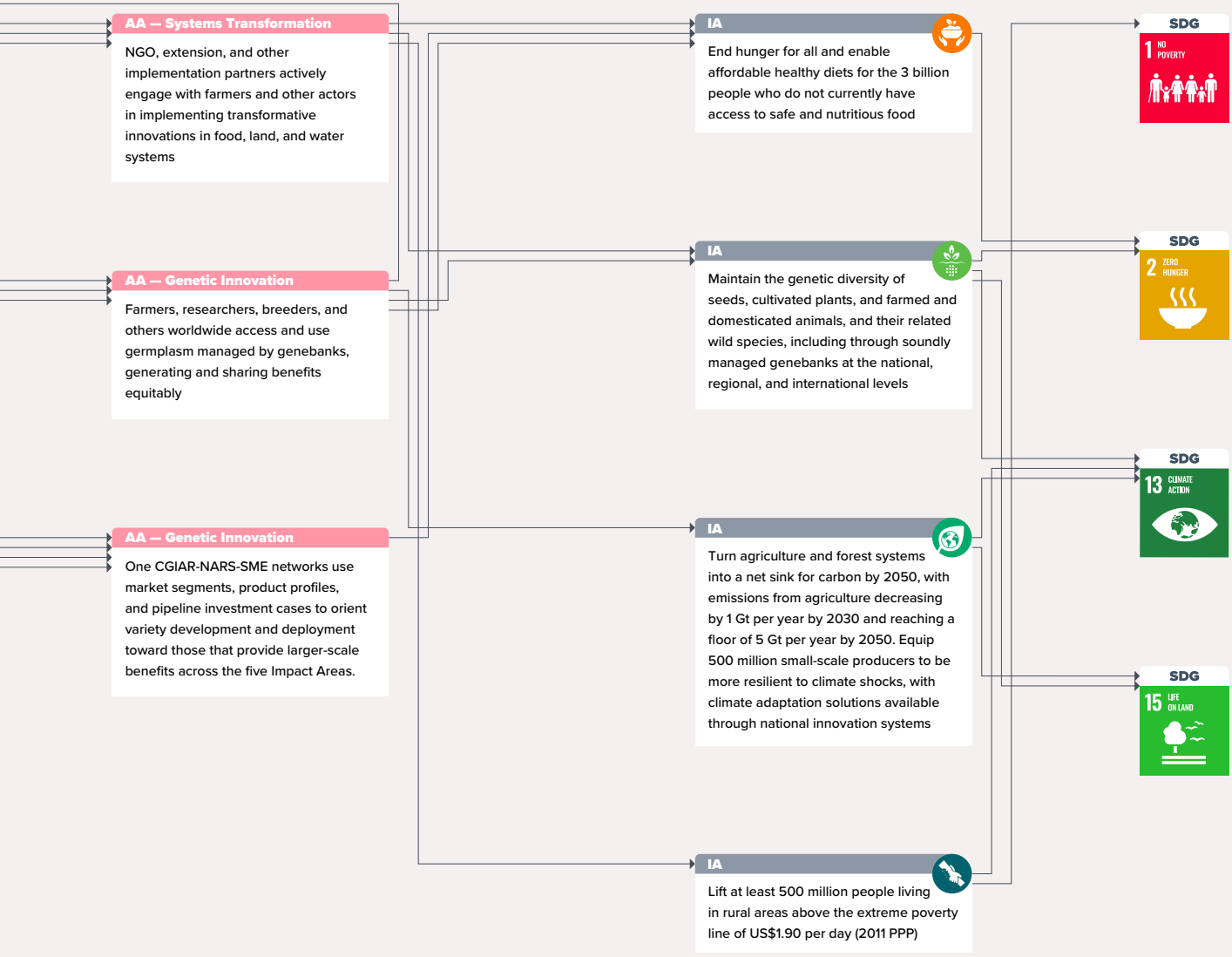
AA — Action Area

IA — Impact Area

SDG — Sustainable Development Goal

- Nutrition, Health, and Food Security
- Poverty Reduction, Livelihoods, and Jobs
- Gender Equality, Youth, and Social Inclusion
- Climate Adaptation and Mitigation
- Environmental Health and Biodiversity

Teams from CGIAR's three Action Areas — System Transformation, Resilient Agrifood Systems and Genetic Innovation — worked to develop an improved set of Action Area outcomes in October 2022. Since this was near the end of the reporting cycle for 2022, it was decided not to update the theories of change based on these new Action Area outcomes.
The exception to this is Genetic Innovation — for this Action Area, as the new outcomes had already been widely discussed among the relevant Initiatives, and with its advisory group of funders and other stakeholders, the decision was made to update their outcomes in time for the 2022 reporting cycle.

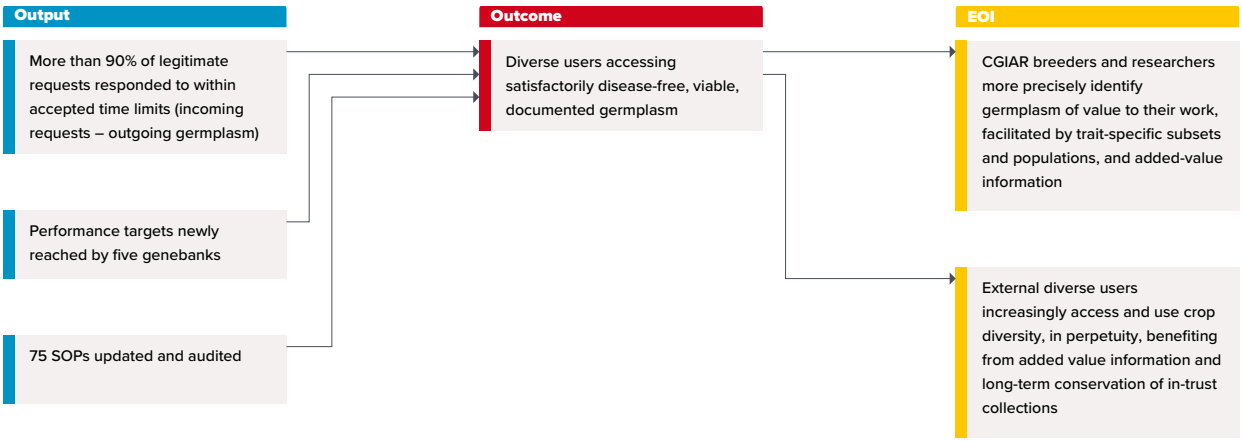


Progress by End of Initiative outcome

EOI-O 1 **CGIAR breeders and researchers more precisely identify germplasm of value to their work.**	Genebanks work continually to enrich accession-level information and develop more powerful accession selection methods. An online subsetting tool to identify germplasm based on environmental variables is launched. Efforts are under way to combine georeferenced, phenotypic, and genotypic data to enhance selection processes and to contribute to environmental GWAS analyses. Genebanks are also piloting multispectral imagining of seeds to generate more information on seed traits and quality. Determining whether breeders are able to more precisely select germplasm depends on a establishing a functioning system for monitoring requests and tracing germplasm use through the breeding pipeline. Consultations are under way across Genetic Innovation to strengthen the request management and germplasm tracking process
EOI-O 2 **External diverse users increasingly access and use crop diversity in perpetuity.**	Good progress is made against the goal to secure collections under CGIAR management in long-term conservation for availability to diverse users in perpetuity. Nine CGIAR genebanks fully recovered from lockdown measures. Four now have collections at performance targets and are eligible for in-perpetuity funding from the Crop Trust. The idea of developing a centralized portal for germplasm request management is being explored. One of the aims will be to improve our knowledge of users and trends in requests for germplasm, including to develop a gender-sensitive approach to promoting requests and use of genebanks.
EOI-O 3 **National and international genebanks conserve and distribute plant genetic resources for food and agriculture (PGRFA) more efficiently and reliably.**	More than 50 NARS partners have been engaged, their needs assessed, and capacity-building activities tailored and undertaken to strengthen the global system for plant genetic resources conservation and use and to address SDG target 2.5. Capacity strengthening activities have been wide-ranging, including gap analysis, genebank operations, cryopreservation, using genomics methods to manage and study the collection, managing phyotsanitary health and implementation of international policy. CGIAR genebanks and scientists have also supported the capacity building activities of the Global Crop Diversity Trust. The support was acknowledged in the Ninth Session of the Governing Body of the Plant Treaty

Section 3 Work Package-specific progress

Work Package 1:
Routine activities: Diversity in perpetuity



Work Package 1 progress against the theory of change

CGIAR genebanks continued routine operations to ensure that crop collections are conserved and made available upon request. Seed lots and tissue culture samples were regenerated and multiplied in the field, screenhouse, and laboratory (120,000 accessions in 2022), viability tested (76,000), health tested (48,000), and disease cleaned (21,000). Acquisitions (792) were received from Guinea, Mali, Peru, South Sudan, Togo, and French Polynesia.

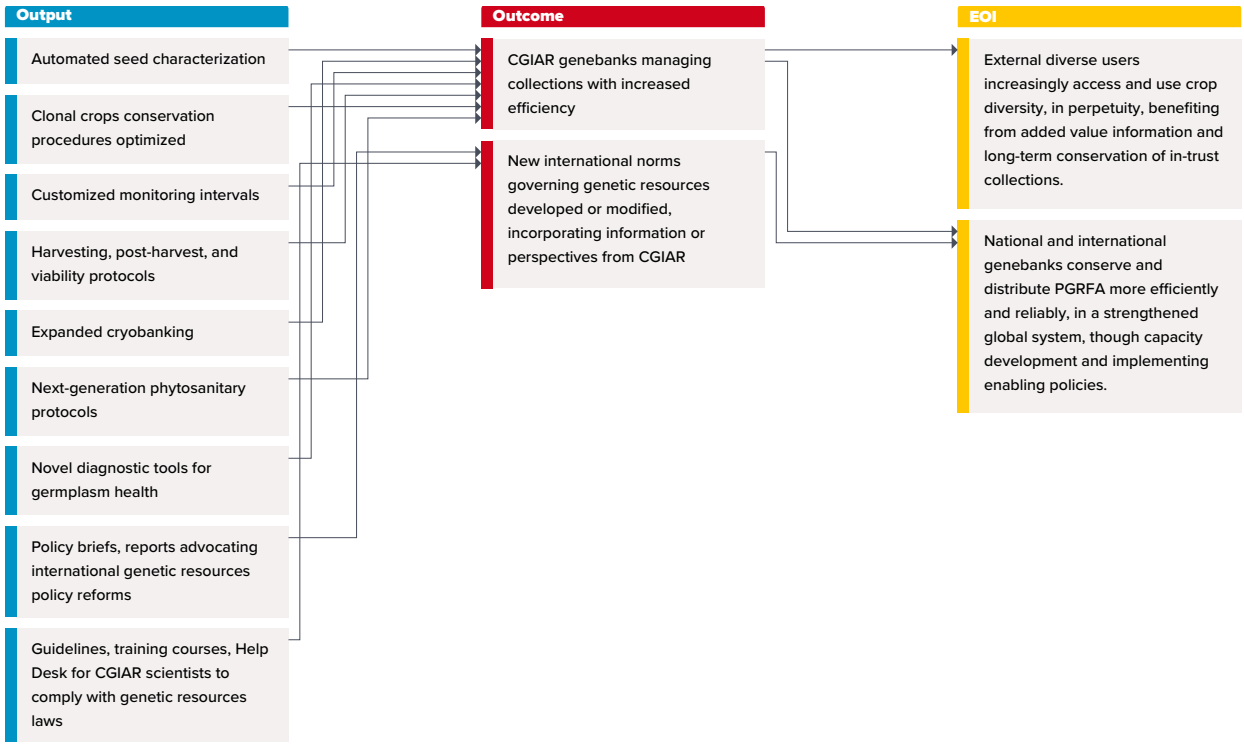
57,518 germplasm samples were distributed to 87 countries. Overall, 60% were sent in response to 679 requests from users outside CGIAR, mostly NARS, advanced research institutes, and universities (87%), as well as the commercial sector (6%), farmers, NGOs, and farmer organizations (6%). The rest went to CGIAR users (see Annex 1).

Four genebanks have reached performance targets for all or part of their collections. Centro Internacional de Agricultura Tropical (CIAT) and the International Institute of Tropical Agriculture (IITA) negotiated long-term partnership agreements (LPA) with the Crop Trust. From 2023, a large part of the running costs to maintain CIAT, IITA, and International Rice Research Institute (IRRI) seed collections will be financed in perpetuity. Notable in 2022, was the safety duplication of 41,000 accessions in the Svalbard Global Seed Vault and other institutes — a 17% increase on 2021. Overall, 78% of the collections are physically and legally available and 83% are safety duplicated (target is 90%). The Crop Trust provided US$4.6 million to CGIAR genebanks in 2022 in long-term funding.

Germplasm health units (GHUs) in nine CGIAR Centers processed 253,752 accessions and 169,751 samples to facilitate 1379 import/export events with 136 countries, of which 56% were for CGIAR breeders and the rest for genebanks.

In 2022, 49 newly drafted or improved procedures were mainstreamed as a result of research and optimization undertaken in Work Package 2.

Work Package 2:
Improvement and research: Futureproofing collections and exchange



Work Package 2 progress against the theory of change

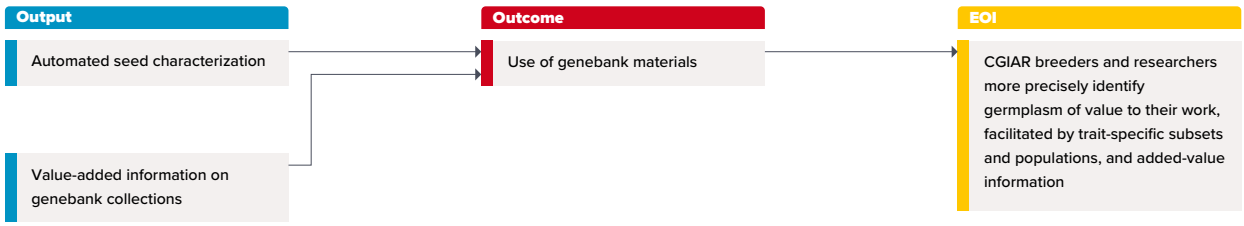
The seed quality management Community of Practice, initiated in 2017 to support piloting of improved technologies and protocols for maximizing seed quality and longevity across all genebanks, now focuses working groups and small projects on three areas: (i) automating seed phenotyping; (ii) customizing viability monitoring; and (iii) dormancy breaking poorly germinating species. In 2022, VideometerLab instruments were installed in three genebanks, training took place, and multispectral seed imaging was initiated at AfricaRice and IITA.

In 2022, 567 accessions of banana, cassava, potato, and sweetpotato were cryobanked. Cryopreservation protocols were tested or optimized for taro, cassava, coconut, sweetpotato, yam, and ulluco. Seed conservation methods for wild species of banana and potato were trialed. Clonal accessions continue to be genetically verified on a systematic basis, contributing to diversity studies, quality control, and rationalization of the collections.

More than eight new phytosanitary cleaning and 20 diagnostic protocols were mainstreamed by GHUs. The Alliance Bioversity International and CIAT, CIP, and IITA jointly worked on therapy procedures and policies to manage cryptic viruses in clonal crops.

CGIAR made submissions to the governing body of the Plant Treaty to ensure that CGIAR is compliant with legal obligations and responds to policy advice and published criticisms concerning CGIAR's restrictive licenses and the reform process. Efforts to advocate for strengthening the multilateral system for access and benefit sharing paid off with the re-launch of negotiations under the Plant Treaty and recognition for the need of such mechanisms in CBD's conference of the parties.

Work Package 3:
Use: Supporting breeding programs through increasing value and use of collections



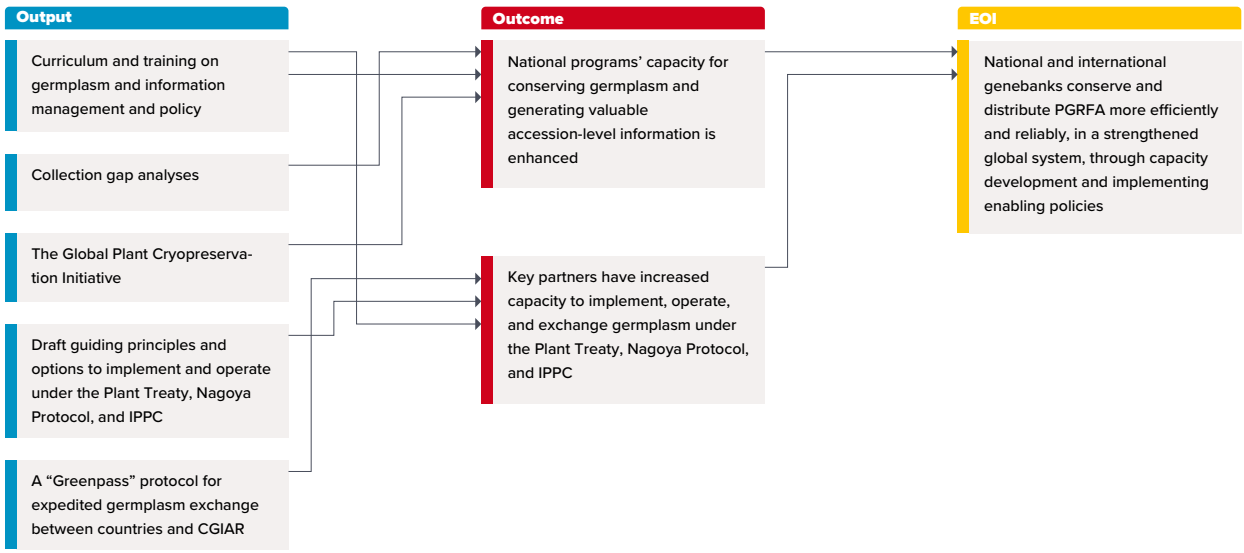
Work Package 3 progress against the theory of change

CGIAR genebanks are developing richer digital resources for diversity analyses and germplasm selection. More than 30 crops and 3,000 species are conserved. Approaches to enriching data are tailored to crops and their potential uses. In 2022, these included:

- Digitized seed and plant images, georeferences, and characterization data were generated, refined, and made available.
- Diversity subsets of *Oryza glaberrima,* banana, potato, barley, cassava, cowpea, yam, and Rhodes grass were evaluated for abiotic, biotic, and nutritional traits in partnership with NARS and CGIAR breeders (e.g. for iron toxicity, salinity, drought and heat tolerance, anaerobic germination and submergence, pro-Vitamin A content, NIR profiling, and resistance to numerous diseases: rice blast, *Fusarium wilt* Tropical Race 4, tomato-potato psyllid, etc.);
- Subsets of *Oryza glaberrima*, banana, common beans, tepary beans, *Brachiaria* spp, wheat, potato and rice crop wild relatives, oca and ulluco, and cowpea were genotyped for diversity analyses.
- New subsets or core collections were developed of African *Oryza sativa*, potato for cyst nematode resistance, sweetpotato for virus disease resistance, Andean roots and tubers – oca, ulluco, mashua, and yacon.
- Tools to analyze and visualize accession data were developed in GIGWA and Germinate for banana, barley, wheat, and grasspea.
- EnvGWAS analyses for climate-related traits in cassava, cowpea, rice, wheat, and barley were initiated in partnership with ABI-WP4 and the Bill and Melinda Gates Foundation.

ICARDA and CIAT launched the first edition of a subsetting tool to enable users to select accessions based on environmental parameters determined by their geographical origins and WorldClim data.

Work Package 4:
Strengthening: Strengthening the global system



Work Package 4 progress against the theory of change

Work Package 4 enables NARS to identify its priority needs and to benefit from the skills, experience, and data generated in Work Packages 1–3. In 2022, an intensive course on plant genetic resources (PGR) policy, co-created with the UK's Open University, was run for the third time, including live lectures and online multi-media resources. Further modules will be developed on phytosanitary health, seed quality management, cryopreservation, and genebank operations. Responding to needs expressed by Plant Treaty Contracting Parties in Compliance reports, six NARS partners developed workplans and received support to build capacity to implement international PGR policy.

Genebanks co-developed approaches to capacity building within their regions. In 2022, a total of 38 training events took place in genebanks and 19 in GHUs involving 625 people from more than 50 countries, including capacity-building in:

- GWAS, genebank data management, seed quality management, *in vitro* conservation, gap analyses, and subsetting with West and Central Africa (WCA) NARS partners.
- Genomics tools for genebanks, cryobanking, and other conservation techniques with Latin America NARS partners.
- Conservation and use of plant genetic resources with Central and West Asia and North Africa (CWANA) partners.
- PGR policy training with NARS partners in East and Southern Africa.
- Virus indexing at the Center for Pacific Crops and Trees in Fiji.

In addition, genebanks continue to provide assistance on demand to numerous NARS partners through regenerating, processing, health testing, and safety duplicating seed on their behalf. In total, 72 PhD, MSc and BSc students were hosted by genebanks, nearly 5,000 visitors received guided tours around genebank facilities, and genebank staff acted as resource people in 29 events.

Work Package progress rating

WORK PACKAGE	TRAFFIC LIGHT / RATIONALE
1	 Good progress has been made towards performance targets and germplasm distributions have returned to pre-pandemic levels.
2	 Activities on seed quality management, cryopreservation, policy, and phytosanitary methods were able to continue under the new Initiative and plans made for more system-wide adoption of practices and technologies. Improved procedures from Work Package 2 (were mainstreamed in 49 standard operating procedures) and have now become routine operations in Work Package 1.
3	 Genebanks are generating data to enrich collection information to promote use of crop diversity. Plans are being refined and unrolled to create more system-wide approaches and tools. A subsetting tool is available on Genesys and plans are made to share genotypic data in GIGWA and to create a common genebank instance in Germinate. Collaboration with the Accelerated Breeding Initiative will aim to develop systems for tracking the use of genebank materials in the breeding pipeline.
4	 An active year for partnership and capacity-building with NARS in Latin America, CWANA, and sub-Saharan Africa. Online training tools also proving effective in sharing the unique skills and experience of CGIAR genebanks, GHUs, and the policy team.

KEY	
On track	 • Annual progress largely aligns with Plan of Results and Budget and Work Package theory of change • Can include small deviations/issues/ delays/risks that do not jeopardise success of Work Package
Delayed	 • Annual progress slightly falls behind Plan of Results and Budget and Work Package theory of change in key areas • Deviations/issues/delays/risks could jeopardise success of Work Package if not managed appropriately
Off track	 • Annual progress clearly falls behind Plan of Results and Budget and Work Package theory of change in most/all areas • Deviations/issues/delays/risks do jeopardise success of Work Package

Section 4 Initiative key results

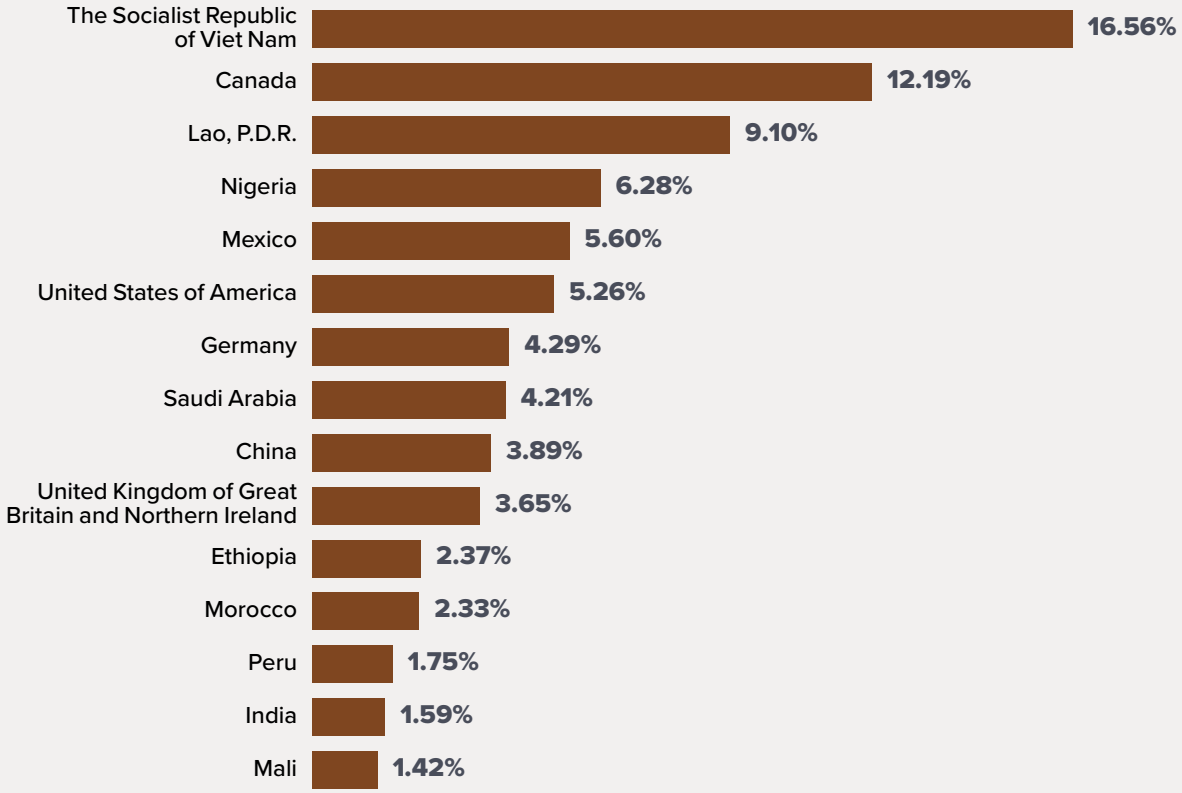
This section provides an overview of 2022 results reported by Genebanks. These results align with the CGIAR Results Framework and Genebanks' theory of change. Further information on these results is available through the CGIAR Results Dashboard.

Overview

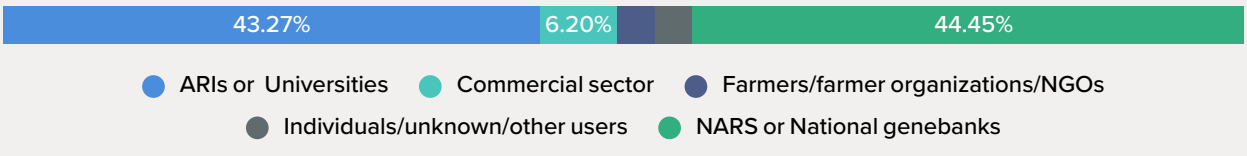
34,667	87	22,851
External genebank distributions (outside CGIAR)	Countries	Internal genebank distributions (within CGIAR)

Results	Outputs				Outcomes	
89	14	13	40	18	1	3
	Capacity sharing for development	Innovation development	Knowledge products	Other outputs	Innovation use	Policy change

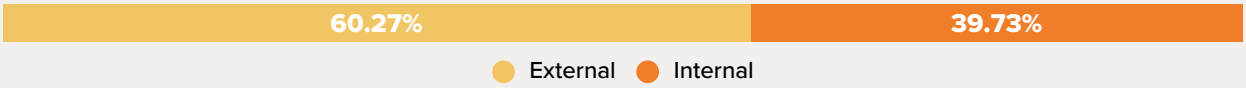
Top 15 countries receiving germplasm from CGIAR Genebanks



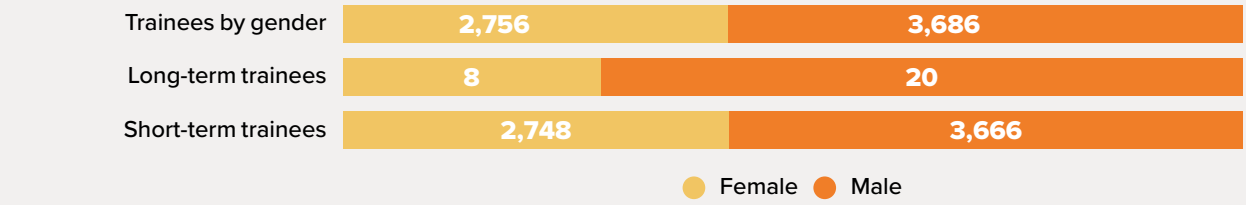
Germplasm distributions outside CGIAR by user category



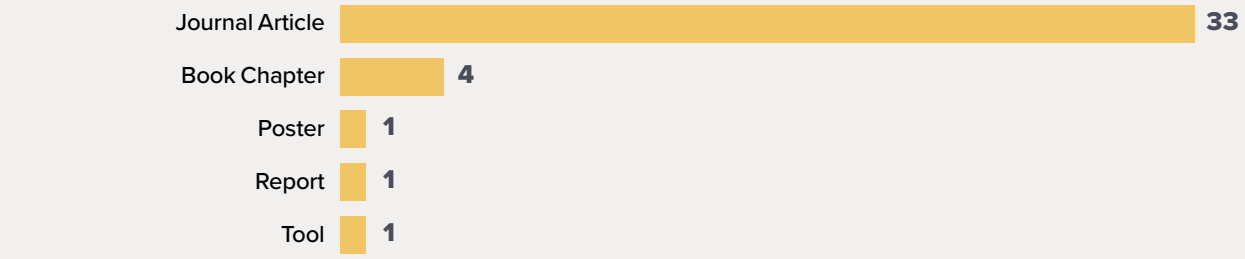
Percentage of external and internal germplasm distributions



Number of people involved in capacity development events and genebank tours

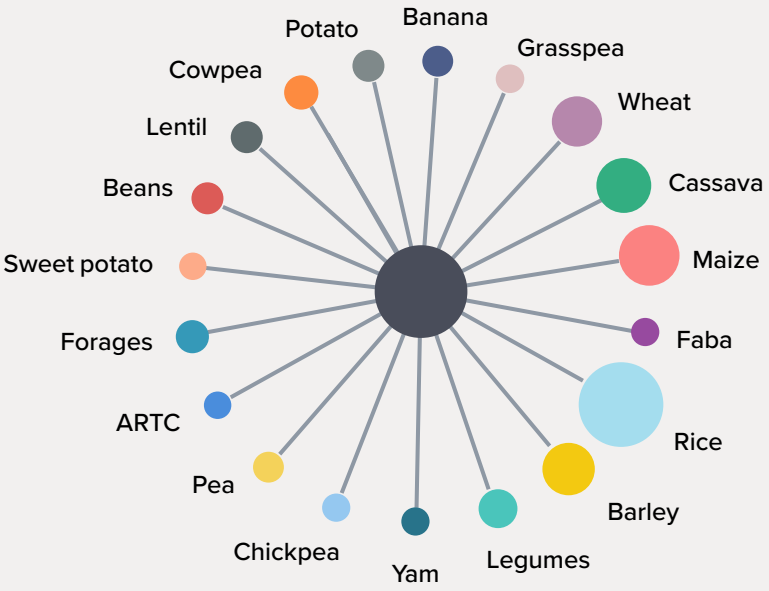


Knowledge products by category



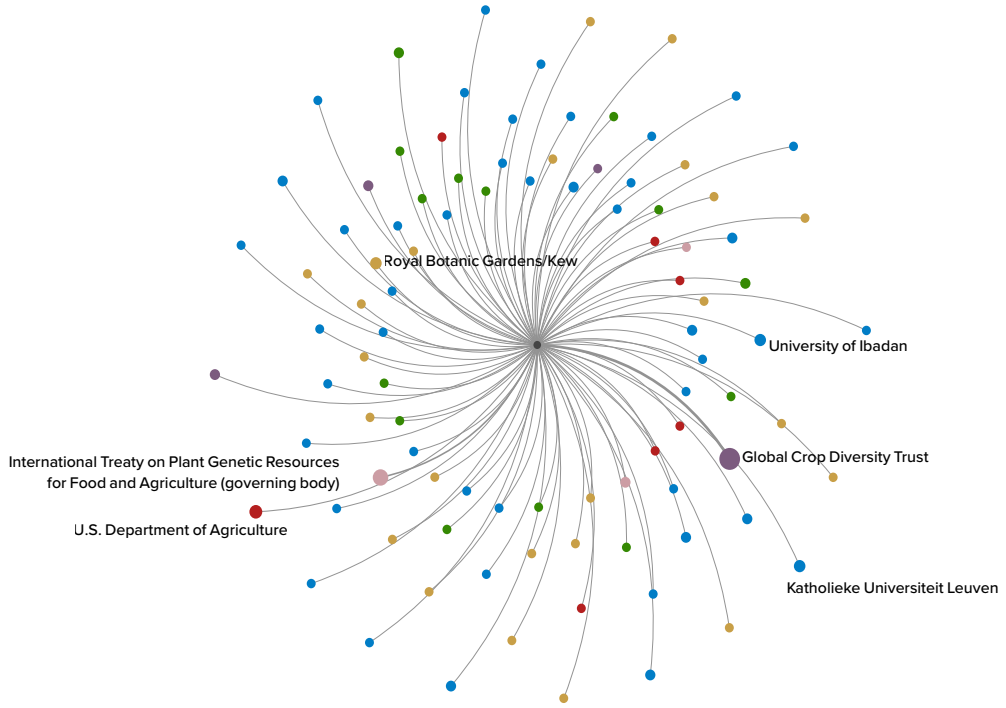
Countries receiving germplasm from CGIAR Genebanks

Germplasm distributions by crop



ARTC Banana Barley Beans Cassava Chickpea Cowpea Faba Forages
Grasspea Legumes Lentil Maize Pea Potato Rice Sweet potato Wheat Yam

Section 5 Impact pathway integration – External partners



Top 5 institution types

All other categories · Government (National) · Not applicable · Org. (other than fin. or res.) Intl. · Other · Research organizations and universities (O&U) (National) (NARS) · Research O&U (National) (Universities)

Note: CGIAR Centres are excluded from the analysis. Partners and edges are sized by the number of results. Labels are shown for the partners involved in 13 or more results.

Partnerships and Genebanks' impact pathways

Work Packages 1 and 2 revolve around routine operations of genebanks and germplasm health units and their optimization. The Global Crop Diversity Trust (Crop Trust) plays an important role in funding and providing program inputs. The Commission on Genetic Resources for Food and Agriculture and International Plant Protection Convention publishes standards on genebank operations and safe movement of germplasm. The Plant Treaty provides the plant genetic resources policy framework under which CGIAR operates, and regularly reviews CGIAR compliance, providing policy recommendations when required.
Partners fall into three main categories:

- Genebank users and beneficiaries.
- Partners in generating data and evaluating germplasm.
- Peers in the genebank community who benefit from sharing capacity or learning from each other's experience.

In 2022, the genebanks responded to 679 users requesting germplasm from a range of public and private institutions in 87 countries, as well as from colleagues working on Initiatives in CGIAR. Further services were provided to NARS and CGIAR colleagues in the form of providing data, supporting accession selection, advising and backstopping, hosting safety duplicates, etc.

Universities, NARS, and CGIAR researchers are partners in generating data and evaluating germplasm in Work Package 3. NARS partners in prioritized low- and middle-income countries are the primary audience for capacity-building in Work Package 4.

Section 6 Adaptive management

RECOMMENDATION	SUPPORTING RATIONALE
The evolution of Genebanks' essential operations will need to take account of the Crop Trust's plans in providing funding and a supporting role to CGIAR genebanks.	In 2022, CGIAR took over the coordination of Genebanks from Crop Trust. Crop Trust's role and contribution continue to evolve. Expected funding from the Crop Trust in 2023 is approx. US$2 million less than initially communicated. As a result, Genebanks' plans were modified to protect essential operations. An assessment of Genebanks' roadmap to reach performance targets needs to be reviewed and activities that were previously undertaken by the Crop Trust, such as quality management and genebank reviews re-visited.
Funding and coordination of germplasm health units (GHUs) should be reviewed and strengthened to ensure a more networked approach in the next business cycle.	The funding and oversight of GHUs' staff and costs are managed differently in each Center. Full costs for staff, operations, etc., cannot be covered adequately in service charges to users (e.g. genebanks and breeders). Standards and targets for phytosanitary performance should be harmonized and communicated at a System level and requirements assessed for implementing these standards for each Center and station from which germplasm is distributed. Shared mechanisms for monitoring user requests and quickly identifying bottlenecks should be developed.
Work Package 3 should focus on data enrichment, management, and availability, and genebank services.	The workplan for Work Package 3 was refined. Although challenging to find common ground among such wide-ranging crops (from Andean roots and tubers to major staples), the universal theme is data. Efforts to verify and annotate georeference data, manage and analyze genotypic data, combine and visualize different data types in analytic tools can be refined, coordinated, and supported through increased cross-Center exchanges and staff roles. A special assessment will be undertaken of diversity in species and crops across CGIAR genebanks, their level of use and the optimal role of CGIAR genebanks for each crop/species. Plans will be developed to systematize user request management and pedigree tracing in collaboration with BRS and ABI.
Engagement with NARS in Working Package 4 requires a coordinated approach with the Crop Trust and Plant Treaty.	We will take better advantage of CGIAR's capabilities to act globally, regionally, and locally in a coordinated way in 2023. The workplan for Work Package 4 has been refined to coordinate more closely with the Crop Trust and Plant Treaty in a phased approach: regional shared-language events with broad representation will respond to shared priorities and needs expressed by NARS within regions and followed up with more intensive one-on-one projects with target countries or partners for specific needs.
Partnership with ICRISAT and CIFOR-ICRAF as well as other international genebanks should be deepened.	Ensuring a close and synergistic relationship with ICRISAT, CIFOR-ICRAF, and other Article 15 institutes is a priority for 2023. Funding is limiting for all these international genebanks, and CGIAR cannot provide the level of support that may be needed for capacity development. However, more can be done to identify shared outputs and capacity exchanges that can be achieved with minimal funding.

Section 7 Key result story

Seed sorting at CIAT genebank.
Photo credit: Jen Watson/Shutterstock

CGIAR genebanks modernize their approach to conservation through a shared policy framework that enables more dynamic curation of materials

Collections held *in trust* for the international community are conserved following high standards, making it challenging to remove redundant accessions or accept material that has no long-term conservation value. The new dynamic curation policy, developed in consultation with the Crop Trust, the Plant Treaty, and Commission on Genetic Resources for Food and Agriculture, represents a step-change in collection management. CGIAR genebanks can conserve unique diversity in a rationalized way, while extending help to researchers to make available genetic stocks that are better conserved in the short term.

CGIAR is responsible for the conservation and availability of crop diversity managed under the framework of various legal agreements, including: (i) agreements with germplasm providers (e.g. Standard Material Transfer Agreement); (ii) "in trust" agreements signed in 1994 with the UN FAO; and (iii) Article 15 agreements signed in 2006 with the Plant Treaty. In addition, the genebanks are subject to international standards as defined by FAO and by CGIAR's Ethical Principles Relating to Genetic Resources. All reinforce that CGIAR genebanks will conserve agreed materials through the regular implementation of essential operations, such as viability and health monitoring, regeneration, characterization, and safety backup, and make these materials available freely to requestors in perpetuity. The *full curation* of accessions is, therefore, the default to meet these commitments.

However, past acquisition and germplasm sharing have resulted in many collections of considerable size having a high degree of genetic similarity among accessions and/or with other collections. Furthermore, with the advances of genomics research, there is a demand to make available large numbers of well-researched materials that may be purposely genetically similar and have little long-term conservation value. With no reliable basis for deciding whether one accession is more or less "important" than another, the approach has been to treat every accession as equal in importance and therefore to conserve them

all in the same way. New methods to characterize accessions and analyze diversity encourages more critical thinking about collection structure and composition. Plus, genebanks need to control costs while carrying out more operations and dealing with more sophisticated germplasm requests. Curating a collection, now more than ever, needs informed decision-making to determine conservation and research priorities. A more refined, stratified, and policy-compliant approach to curation is called for to facilitate and rationalize collection management.

> **"Proactive management is critical for ensuring that germplasm is efficiently conserved and made timely available and in adequate quantity for further use by plant breeders, farmers, researchers, and other users. It emphasizes the importance of securing and sharing material as well as the related information, and sets in place a functional strategy for management of human and financial resources for a rational system."**
>
> **FAO 2014. Genebank standards**

In 2018, the Genebank Platform embarked on a consultation process among genebank managers and partners to establish a detailed, standard framework for applying categories to accessions: *fully curated, partially curated, archived, and historical.* The framework was developed by a small drafting team and involved a series of discussions and fact-checking, culminating in a process of consultation with and incorporating advice from the Plant Treaty Secretariat and Commission on Genetic Resources for Food and Agriculture. The final document provides detailed policy and technical guidance to support decision- making in curating collections and categorizing accessions, ensuring that stakeholders, as well as the international community, are appropriately informed regarding the status of accessions donated to CGIAR by a vast number of countries and communities in the belief that they will be available in the future when needed. The final version was reviewed and approved by Center Directors General and the System Executive Board.

Now that it is in place, the dynamic curation policy provides the basis by which genebanks may modernize the management and composition of collections and provide genebank services to a growing body of researchers who need access to well genotyped and phenotyped germplasm. Already, 36,205 accessions have been archived and 39,456 assigned to partial curation. While it may remain a point of contention deciding which stocks are a priority to conserve and fund, the policy framework is now in place to safely implement a more dynamic form of curation that will allow genebanks to stay relevant to users who are working ever more urgently in a race against climate change to achieve a wide range of objectives in breeding and research.

LINKS TO IMPACT AREAS

Primary Impact Area:
Environmental Health and Biodiversity

Other relevant Impact Area(s): Climate Adaptation and Mitigation; Nutrition, Health, and Food Security; Poverty Reduction, Livelihoods, and Jobs

Which collective global targets for the relevant Impact Area(s) from the CGIAR 2030 Research and Innovation Strategy does the key result contribute to?

- End hunger for all and enable affordable healthy diets for the 3 billion people who do not currently have access to safe and nutritious food.
- Equip 500 million small-scale producers to be more resilient to climate shocks, with climate adaptation solutions available through national innovation systems.
- Lift at least 500 million people living in rural areas above the extreme poverty line of US$1.90 per day (2011 PPP).
- Maintain the genetic diversity of seeds, cultivated plants, and farmed and domesticated animals and their related wild species, including through soundly managed genebanks at the national, regional, and international levels.
- Turn agriculture and forest systems into a net sink for carbon by 2050, with emissions from agriculture decreasing by 1 Gt per year by 2030 and reaching a floor of 5 Gt per year by 2050.

GEOGRAPHIC SCOPE

Country/ies: Global

KEY CONTRIBUTORS

Contributing Initiative(s): Genebanks
Contributing Center(s):
AfricaRice
Alliance of Bioversity International and CIAT
CIMMYT
CIP
ICARDA
ICRAF
ICRISAT
IITA
ILRI
IRRI
Contributing external partner(s):

- CGRFA – Commission on Genetic Resources for Food and Agriculture
- GCDT – Global Crop Diversity Trust
- ITPGRFA – International Treaty on Plant Genetic Resources for Food and Agriculture

LINK TO CGIAR RESEARCH PROGRAMS

Work was initiated as part of the Genebank Platform

References

1. *CGIAR Genebank Platform (2022) Guidance note for CGIAR Genebanks on improving accession management: Approved by CGIAR EMT on 28 April 2022. 12 p.* https://hdl.handle.net/10568/126835

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COVER PHOTO: Mariana Yazbek in ICARDA's genebank at Terbol station in Lebanon Beqaa Valley. Photo credit: M. Major/Crop Trust