2019 ANNUAL REPORT

CGIAR Genebank Platform

CGIAR Genebank Platform

CROP TRUST

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Acronyms

A15	Group of managers of genebanks designated under Article 15 of the Plant Treaty
ACIAR	Australian Center for International Agricultural Research
AFS CRP	Agri-Food System CGIAR Research Program
AGM	Annual Genebanks Meeting
AOCC	African Orphan Crop Consortium
ARI	Advanced Research Institute
BBTV	Banana Bunchy Top Virus
BMZ	Federal Ministry of Economic Cooperation and Development (Germany)
CBD	Convention on Biological Diversity
CGRFA	Commission on Genetic Resources for Food and Agriculture
CIAT	International Center for Tropical Agriculture
CIMMYT	International Maize and Wheat Improvement Center
CIP	International Potato Center
CLIPNet	CGIAR Legal/IP Network
CoP	Community of practice
Crop Trust	Global Crop Diversity Trust
CRP	CGIAR Research Program
DArTseq	Diversity Arrays Technology Sequencing
DOI	Digital Object Identifier
DSI	Digital Sequencing Information
EiB	Excellence in Breeding Platform
EMBRAPA	Brazilian Agricultural Research Corporation
FAO	Food and Agriculture Organization of the United Nations
FTA	CGIAR Research Program on Forests, Trees and Agroforestry
FTE	Full-time equivalent
GBS	Genotyping-by-sequencing
GHU	Germplasm Health Unit
GLDC	CGIAR Research Program on Grain Legumes and Dryland Cereals
GLIS	Global Information System
GOAL	Genebank Operations and Advanced Learning
GPA	Global Plan of Action
GRIN	Germplasm Resources Information Network
IA	Intellectual Assets
ICARDA	International Center for Agricultural Research in the Dry Areas
ICRAF	World Agroforestry (International Council for Research in Agroforestry)
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IEA	Independent Evaluation Agreement
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Research Institute
IPPC	International Plant Protection Convention
IRRI	International Rice Research Institute
ISI	Institute of Scientific Information
ITC	International *Musa* Germplasm Transit Centre (
KEPHIS	Kenya Plant Health Inspectorate Services
LPA	Long-Term Partnership Agreement
MELIA	Monitoring, Evaluation, Impact Assessment and Learning
MLS	Multilateral system of access and benefit-sharing
NARES	National Agricultural Research Extension and Education System
NARS	National Agricultural Research System(s)
NGO	Non-governmental organization
ORT	On-line Reporting Tool
PATSPO	Provision of Adequate Tree Seeds Portfolio
PDCI	Passport Data Completeness Index
PGRFA	Plant Genetic Resources for Food and Agriculture
Plant Treaty	International Treaty for Plant Genetic Resources for Food and Agriculture
PNG	Papua New Guinea
QMS	Quality Management System
OWG-EFMLS	Open-Ended Working Group to Enhance the Functioning of the Multilateral System of Access and Benefit-Sharing
RTB	CGIAR Research Program on Roots, Tubers and Bananas
SCIP	System Council Intellectual Property Group
SDG	Sustainable Development Goal
SGSV	Svalbard Global Seed Vault
SMB	System Management Board
SMO	System Management Office
SMTA	Standard Material Transfer Agreement
SNP	Single Nucleotide Polymorphism
SOP	Standard Operating Procedures
SQM	Seed quality management
USDA	United States Department of Agriculture
W1/2	Windows 1 and 2

ILRI Forage Field Genebank, Zwai, Ethiopia. Photo: Shawn Landersz

1. Key Results

1.1 Highlight Platform Outputs

CGIAR Germplasm distribution

The activities of the Genebank Platform are targeted specifically to bring about increased conservation and use of crop and tree genetic resources with the aim of achieving CGIAR System Level Outcomes (Sub-IDO 1.4) and UN Sustainable Development Goals (Target 2.5). The annual distribution of germplasm from CGIAR genebanks provides a rough indicator for the demand for crop and tree genetic resources in any one year. For the third year in a row, germplasm distribution to requesters outside the CGIAR exceeded that inside the CGIAR. In 2019, a total of 79,633 germplasm samples (67,864 accessions) were distributed by the CGIAR genebanks to users (Figure 1). 33,692 samples (42%) were provided to CGIAR Research Programs (CRPs) and 45,941 (58%) were distributed to recipients outside the CGIAR in 97 countries. As in previous years, developing countries received the largest proportion of germplasm in 2019 (83%) (Figure 2). Annex Figures 1 and 2 provide more details of the distribution of germplasm to countries from individual Centers and by crop.

Of the external distributions in 2019, samples were sent to universities or research institutes (38%), and National Agriculture Research Systems (NARS) (31%), the rest being sent to the commercial sector, NGOs, farmers and others (Annex Figure 3). 76% of the samples distributed were traditional cultivars or crop wild relatives (Annex Figure 4). Table 1 lists the top country recipients of germplasm from CGIAR genebanks (not including materials transferred within or between CGIAR Centers).

1.2 Platform Progress towards Outputs and Outcomes

1.2.1 Overall Platform progress

By the end of 2019, CGIAR genebanks were managing 760,467 accessions, including 25,811 *in vitro* accessions and 32,995 accessions held as plants or trees in the screenhouse and field. Approximately 78% of total accessions are immediately available for international distribution (Figure 3).

Of the seed accessions, 60% is secured in safety duplication at two levels and 77% is duplicated at the Svalbard Global Seed Vault (SGSV). 72% of clonal crop collections is safety duplicated in the form of cryopreserved or *in vitro* cultures (Figure 3).

An update of the current accession numbers of the aggregate collection under CGIAR management is provided in Table 2. Table 3 presents the achievement of milestones.

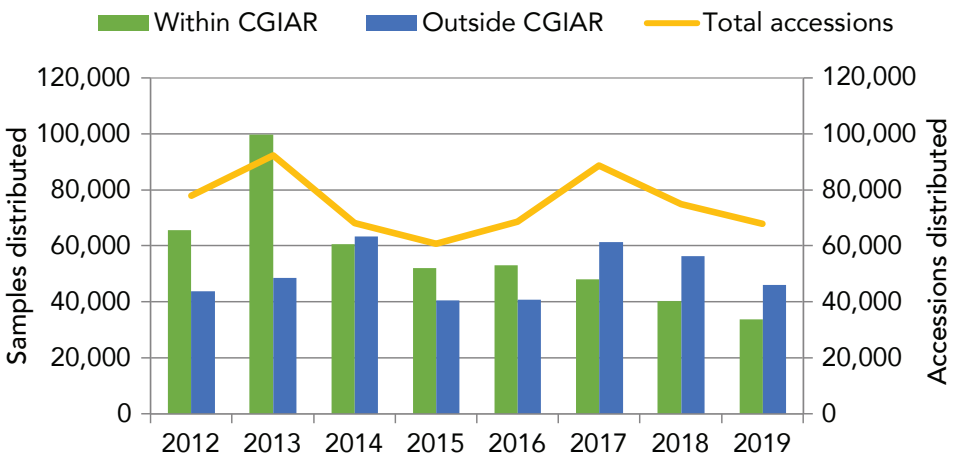


Figure 1. Samples and accessions distributed annually by CGIAR genebanks from 2012 to 2019

The ICRAF genebank, under the management of Alice Muchugi, works in partnership with NARS to conserve nearly 10,000 priority tree accessions in 15 sites in 10 countries. Photo: Shawn Landersz

Banana plantlets ready for distribution from Alliance-Bioversity. Photo: Michael Major

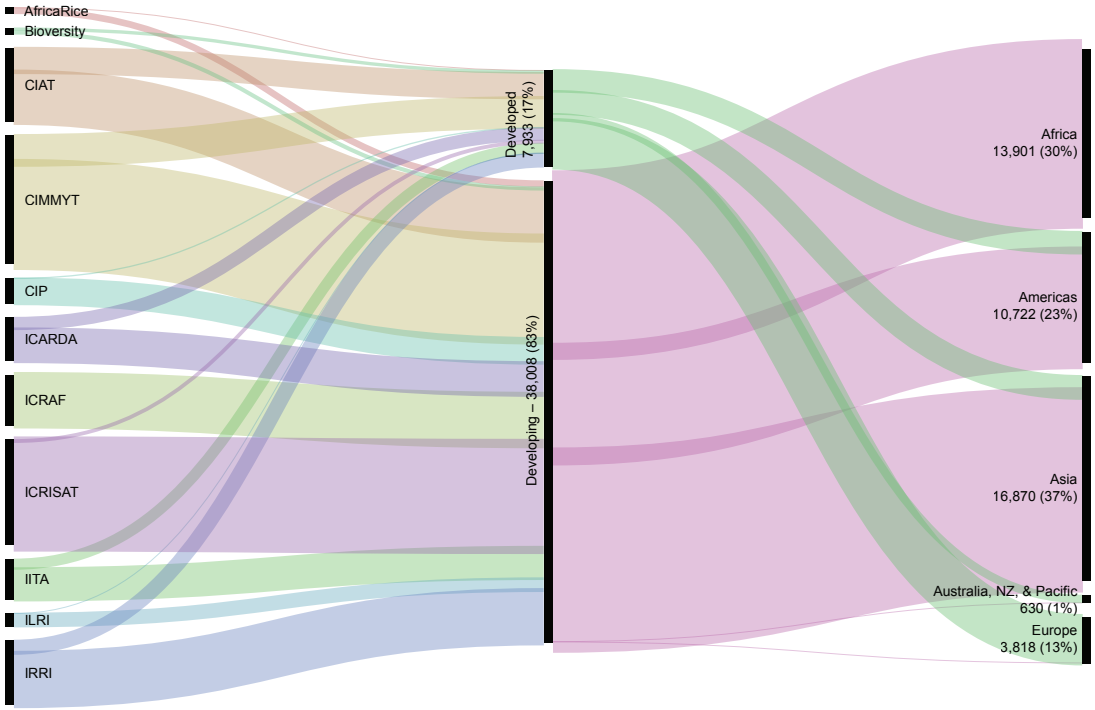


Figure 2a. Distribution of germplasm from CGIAR genebanks in 2019 (see Annex Figure 1 for geographical distribution by Center).

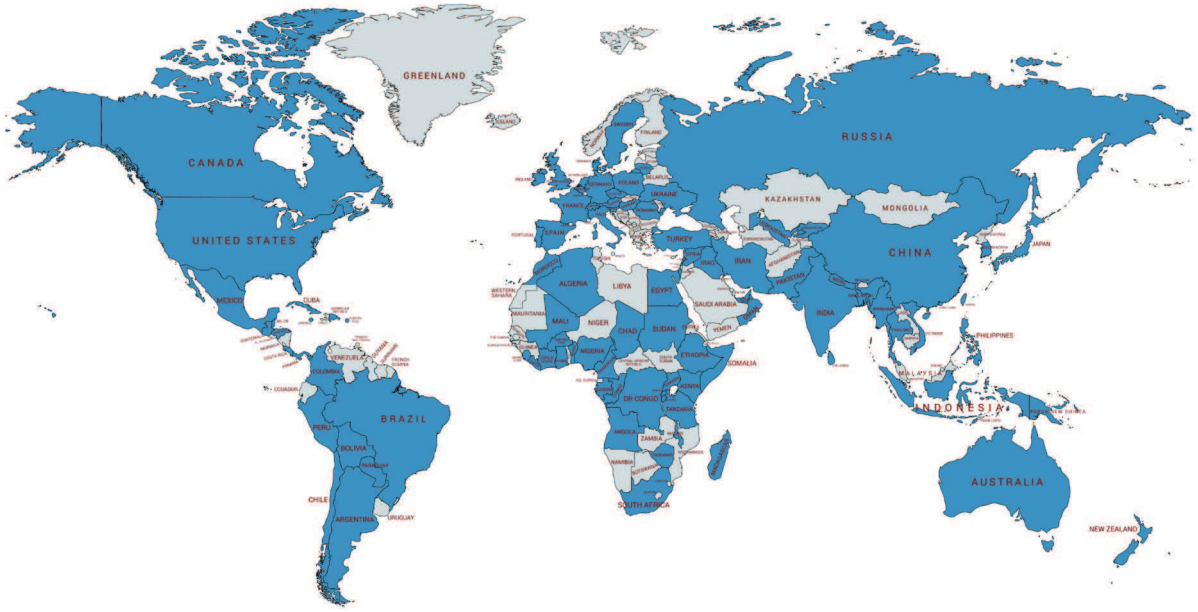


Figure 2b. Countries (colored blue) receiving germplasm from CGIAR genebanks in 2019

Table 1. Top 10 developing and developed countries receiving germplasm from CGIAR Centers in 2019 (excluding distributions to CGIAR programs)

Rank*	Developing			Developed		
	Country	Number of Accessions	Number of Samples	Country	Number of Accessions	Number of Samples
1	India	4,449	5,693	Italy	1,767	1,767
2	China	3,822	3,846	United States	1,538	1,543
3	Sudan	3,116	3,116	Korea, Rep.	738	738
4	Mexico	2,637	2,667	Spain	628	631
5	Colombia	1,983	2,338	Australia	611	611
6	Nigeria	1,495	2,069	Israel	434	439
7	Peru	671	2,049	Japan	408	409
8	Ethiopia	1,704	1,792	United Kingdom	322	322
9	Kenya	178	1,411	Taiwan	182	184
10	Vietnam	1,155	1,300	Sweden	180	180
	Sub-total	**21,210**	**26,281**	**Sub-total**	**6,808**	**6,824**
	(% from total)	**70%**	**69%**	**(% from total)**	**86%**	**86%**
	Others	8,990	11,727	Others	1,091	1,109
	(% from total)	30%	31%	(% from total)	14%	14%
	Total	**30,200**	**38,008**	**Total**	**7,899**	**7,933**

Note: *Ranking by number of samples.

Table 2. Key statistics of the aggregate CGIAR collection from 2012 to 2019

Indicator	2012	2013	2014	2015	2016	2017	2018	2019
1. Total number of accessions	710,001	725,244	738,215	750,604	757,767	768,576	773,402	760,467
2. Total number of accessions that are immediately available	465,358	492,654	525,410	559,053	580,706	608,751	621,915	592,118
3. Seed accessions held in long-term storage and safety duplicated at two levels	386,037	375,271	413,448	381,932	404,074	408,323	420,164	439,206
4. RTB accessions in cryopreservation or safety duplicated at one level	15,643	16,141	15,554	19,356	19,803	18,144	18,427	18,524

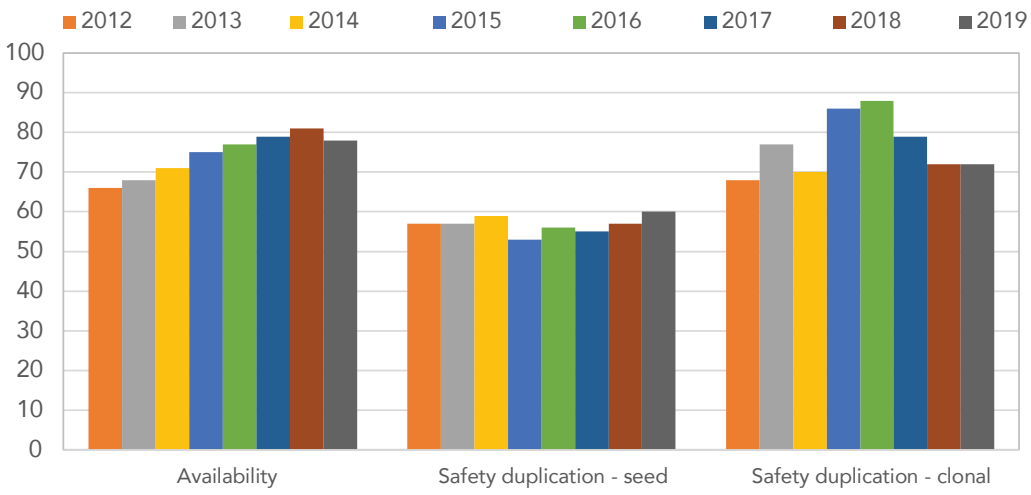


Figure 3. Status (%) of availability and safety duplication of CGIAR genebanks from 2012 to 2019 (Target 90%)

Table 3. Summary of status of Planned Outcomes and Milestones

Milestone	2019 milestones status	Completed milestones or explanation for extended, cancelled or changed
Conservation Module		
Outcome 1.1: Disease-free, viable, documented germplasm made available All genebanks and germplasm health units are working towards attaining or sustaining 90% targets of availability and safety duplication.		
1. 81% accessions available	Changed	In 2019, 78% accessions are available. The change in percentage downwards has come about because of several genebanks (AfricaRice, Bioversity CIMMYT, ICARDA, ICRISAT) undertaking inventory processes, trueness-to-type checking and responding to recent review recommendations. The overall progress towards increasing availability of collections is still evident with 144,739 samples being regenerated, multiplied or subcultured, 92,983 samples viability tested and 76,766 health tested in 2019.
2. 62% seed accessions safety duplicated	Changed	In 2019, 60% seed accessions are safety duplicated in two locations. Significant increase from 57% in 2018, which represents slow progress. Seed shipments are ready for dispatch but legal and political processes are still being pursued.
3. 75% clonal accessions safety duplicated	Complete	In 2019, 72% clonal accessions are safety duplicated in at least one location. This figure represents the annual effort to duplicate living tissue culture collections at a distant safe location. The target is 75%. Cryobanking the collections will improve this process considerably.
Outcome 1.2: Crop diversity conserved in a rational and effective global system All genebanks are working on improving quality management systems and assessing and improving the representation of crop gene pools within collections managed by the CGIAR.		
4. 60 SOPs in place and 18 audited	Complete	In 2019, 157 SOPs are in place and 108 audited.
5. Diversity trees developed representing 22 crop genepools	Complete	Diversity trees are developed for 22 crop gene pools.
Use Module		
Outcome 2.0: More effective access and use of germplasm enabled All genebanks are working to promote the use of collections through improving data associated with accessions, data quality and its availability.		
6. Use of DOIs promoted in 11 NARS genebanks	Complete	Digital Object Identifiers were promoted to 20 NARS and 2 international genebanks: Australia, Bhutan, Laos, Malaysia, Mongolia, Myanmar, Nepal, Pakistan, Philippines, Sri Lanka, Vietnam, Argentina, Bolivia, Chile, Colombia, Ecuador, Paraguay, Perú, Uruguay, Venezuela, WorldVeg and Centre for Pacific Crops and Trees.
7. Uploading of at least one new phenotypic dataset per genebank into Genesys	Complete	In 2019, 23 new datasets were uploaded to Genesys by AfricaRice, CIAT, ICRISAT, ICRAF, IITA and CIP.
Policy Module		
Outcome 3: Supportive policy environment developed The Policy Module of the Genebank Platform continues to work to ensure that the activities, guidelines and reporting processes of the genebanks comply with legal requirements and the CGIAR engages in the development of international policy.		
8. Guidance Notes for Centers Disclosures concerning restrictive licenses and IP over intellectual assets incorporating genetic resources	Complete	Guidance Note is produced and can be found at following link: https://www.cgiar.org/wp/wp-content/uploads/2019/03/SMB13-03_GR-policy-issues.pdf.
9. Representation at eight international policy meetings, plus CGIAR reports to Plant Treaty Governing Body, CGRFA and specialized subsidiary bodies.	Complete	Representation at nine international policy meetings: 1. Eighth Session of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty) 2. Resumed Ninth meeting of the Ad Hoc Open-ended Working Group to enhance the functioning of the Multilateral System 3. Ninth meeting of the Ad Hoc Open-ended Working Group to Enhance the Functioning of the Multilateral System of Access and Benefit Sharing (OWG-EFMLS-9) 4. Consultation on the Enhancement of the Functioning of the Multilateral System convened by Secretariat/Co-chairs of the OWG-EFMLS 5. Second meeting of the Ad Hoc Technical Expert Group on Farmers' Rights (AHTEG-FR-2) 6. Ad Hoc Committee on Sustainable Use (Virtual Consultations) 7. Consultation on the Enhancement of the Functioning of the Multilateral System convened by Secretariat/Co-chairs of the OWG-EFMLS 8. Consultation on the Enhancement of the Functioning of the Multilateral System convened by Secretariat and Co-chairs of the OWG-EFMLS 9. Informal Group of Experts on the Plant Treaty's Funding Strategy Targets.

1.2.2 Progress by Platform Modules
Conservation Module

The progress of individual genebanks in reaching performance targets is presented in Figure 4 and in Table 4. Availability and safety duplication are the two most challenging of the four performance targets. The first is calculated from the number of accessions that are cleaned, healthy, viable, in sufficient quantity, legally and physically available for immediate international distribution; the second from the number of accessions conserved in long-term storage conditions and safety duplicated in two distant locations for seed and one location for clonal crop accessions. Every genebank is actively working towards reaching or maintaining targets of 90% availability and safety duplication[1]. As collections are continuously growing and seeds stocks are gradually being used or losing viability, sustaining or reaching targets depends on maintaining an adequate rate of operation to keep up stocks.

ICRISAT, IITA and IRRI have succeeded in reaching and sustaining the target for availability. However, for the first time since 2012, percentage availability at the Platform level decreased marginally in 2019. The numbers of accessions available increased in six genebanks (Alliance-CIAT seed and clonal collections, CIP, ICRAF, IITA seed and clonal collections, ILRI and IRRI) but decreased in five (AfricaRice, Alliance – Bioversity, CIMMYT, ICARDA and ICRISAT). ICARDA presents a unique case in that accessions from the collections located in Syria are no longer included in the figures, as was the case in previous years. In addition, partly due to the current phase of external reviews, several genebanks are implementing a thorough and systematic inventory of collections that has resulted in a revision of accession numbers reaching acceptable thresholds for availability. The expectation is that accession numbers and status with respect to performance targets will change further in 2020 and the following years due to several factors, aside from the ongoing efforts to reach performance targets, including: 1) negative impact of COVID-19 measures, 2) further inventorying results, and 3) archiving of accessions or rationalization of collections.

Those genebanks reaching or sustaining performance targets will be eligible for a long-term partnership agreement (LPA) with the Crop Trust, which will provide financial support for essential genebank operations in perpetuity from the Endowment Fund. IRRI genebank's essential operations are now funded through an LPA. Collections managed by Alliance-CIAT, AfricaRice, IITA, ICARDA and CIMMYT are expected to reach targets and become eligible for LPAs in the next two years.

[1]Clonal crop collections are aiming ultimately to safety duplicate accessions in cryopreservation, in the meantime *in vitro* or other forms of conservation are acceptable.

Figure 4. Trends in % Availability of CGIAR collections

Table 4. Status of CGIAR genebanks with respect to performance targets in 2019

Center	% Availability 2019	% Increase from 2018	% Safety duplication 2019	% Increase from 2018	Comments
AfricaRice	66	-28	65	5	Inventorying the collection for the first time since it was brought together in Cote d'Ivoire has revealed that approx 5,000 accessions are below threshold for viability and seed number. These will be regenerated in 2020. Expect to reach targets in 2021.
Alliance - Bioversity	59	-4	65	0	Several accessions were removed from the active collection due to confirmation that they are off-types. They will be replaced from the cryopreserved collection where possible. Germplasm health remains a major bottleneck to reaching availability target.
Alliance - CIAT seed	83	5	87	3	Steady progress towards performance targets. Given the possibility to archive some forage accessions the collections should meet targets in 2021.
Alliance- CIAT cassava	86	10	37	-37	Alternative methods are being explored for safety duplication including using bonsai plants and nano-propagation. Expect to reach targets in 2021.
CIMMYT wheat	79	-13	80	0	Inventorying the collection has revealed some accessions are below threshold for viability and seed number. Given the possibility to archive specific parts of the collection, it is expected that the targets will be reached in 2021.
CIMMYT maize	62	-2	75	0	A major effort to systematically recount, test and clean seed lots from storage is under way and will result in changes to the status of the collection. Expect to reach targets after 2021.
CIP	44	19	89	4	Important progress to make more accessions available. Expect to reach targets after 2021.
ICARDA	60	n/a	47	n/a	2019 is the first year for reported figures to exclude the collections in Syria. Fresh seed is gradually being returned for safety duplication at Svalbard Global Seed Vault. Wheat, barley, lentil and chickpea collections are due to reach targets in 2021.
ICRAF seed	68	30	17	40	Continued effort to systematically check viability of seed collection and archive accessions that are not a priority for conservation or use. Expect to reach targets after 2021.
ICRISAT	92	-2	15	0	Agreements with host institutes for safety duplication are under negotiation and shipments are expected to take place in 2020. Expect to reach targets after 2021.
IITA seed	95	2	61	27	Safety duplication of batches of accessions has commenced and will continue in 2020. Expect to reach targets in 2020.
IITA clonal	44	13	40	36	Progress in introducing accessions into tissue culture continues. Expect to reach targets after 2021.
ILRI	14	n/a	28	35	Accessions newly health tested and available since ILRI adopted same standards for phytosanitary testing as Alliance-CIAT Tropical Forages. Expect to reach targets after 2021.
IRRI	92	1	89	0	Safety duplication due to take place as soon as legal agreements are in place. Currently provided long-term partnership agreement (LPA).

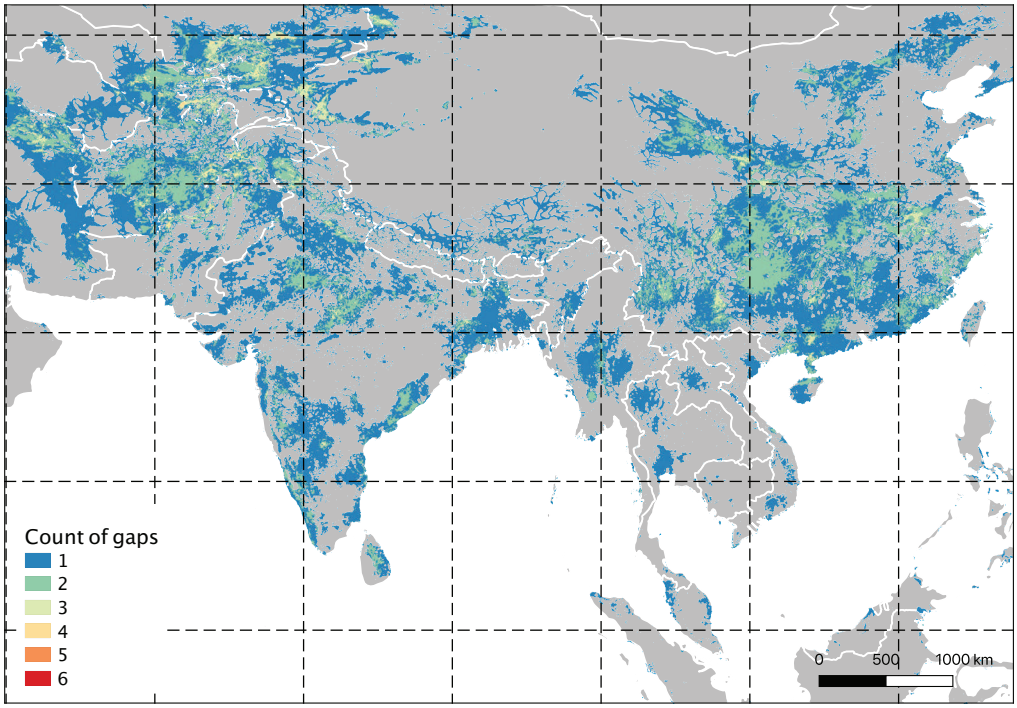


Figure 5a. Predicted gaps in CGIAR collections of beans, maize, wheat, rice, potato, banana, taro, sorghum, chickpea, lentil and cassava landraces. Count represents number of crops with gaps at a specific geographical location. Grey areas either have no cultivation or no gaps for these crops.

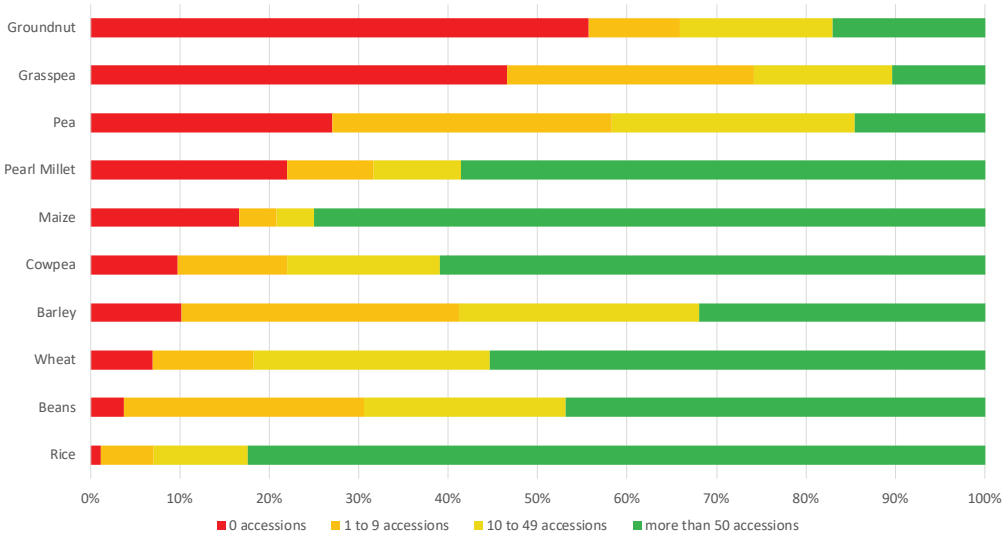


Figure 5b. Preliminary assessment of the coverage of traditional landraces in collections managed by CGIAR based on mapping accessions onto diversity trees. The colors correspond to numbers of accessions representing identified landrace end-groups or varieties making up the crop genepool.

Acting on gap analysis of collections

Gaps in collection coverage for 22 crop genepools have been identified using a combination of taxonomic, geographic and trait-based analyses, involving consultations with more than 60 experts and of 375 scientific papers. Preliminary assessments highlight where global coverage in collections managed by the CGIAR is good and where crops or countries are significantly under-represented (Figure 5). Efforts are already under way to address identified gaps. In 2019, CIP, working in partnership with NARS, brought 144 sweetpotato landraces from Ghana, Mozambique, Sierra Leone and Uganda into disease-free *in vitro* culture, IITA collected 152 new accessions of Bambara groundnut and yam from northern Cameroon, Alliance-Bioversity partnered with research institutes in the Cook Islands, Samoa and Papua New Guinea in an attempt to secure the conservation of rare orange-fleshed Pacific Island banana varieties, ICARDA collected traditional landraces in Lebanon and Tajikistan and ICRISAT collected more than 3,000 accessions of indigenous grains and legume crops in Nigeria, Niger, Ghana, Burkina Faso and Kenya. In addition, Alliance-CIAT collaborated with EMBRAPA to rescue threatened wild cassava materials and IITA is working with the Kenya Plant Health Inspectorate Services (KEPHIS) and partners in Tanzania, Rwanda and Burundi to rescue 163 accessions of unique cassava diversity not currently represented in *ex situ* conservation.

Seed quality management (SQM)

The community of practice (CoP) of CGIAR scientists working on seed quality management shared results and developed new collaborations at a 2019 meeting held in IRRI. New findings suggest that high-temperature drying treatment applied in certain instances to rice seeds at IRRI also results in improved seed longevity for Bambara groundnut and

soybean accessions at IITA. ILRI, working with ICRAF and CIAT, improved dormancy breaking techniques for 12 forage and tree species; ICRISAT explored post-harvest changes in dormancy in foxtail and finger millets; and ICARDA evaluated the effects of different harvesting protocols on subsequent seed quality for wild and cultivated wheat accessions.

Germplasm Health Units (GHUs)

In 2019, the GHUs health-tested 152,469 samples (Table 5), facilitating 2,004 exchanges of materials with 141 countries. CRPs account for 52% of the exchange events. A core part of the GHU activities under the Genebank Platform is to remove bottlenecks slowing the rate of health testing. Specific examples include efforts to develop and validate a method using small RNA sequencing and assembly (sRSA) for virus indexing of clonally propagated crops by Alliance-Bioversity & CIAT, CIP and IITA. In the three Centers that do not have dedicated GHUs (AfricaRice, ICRAF, ILRI), the genebanks are carrying out health testing instead. ILRI has converted an existing tissue culture room into a seed incubation facility to increase its capacity to process seed samples for pathogen testing and a mycology lab has been set up for the identification of various seedborne fungi.

Quality management systems (QMS)

Standard Operating Procedures (SOPs) for key genebank operations were systematically audited for conformity to FAO genebank standards, continuing a process initiated in 2017. In 2019, SOPs for safety duplication and germplasm acquisition were audited. For these two SOPs, 187 findings were identified and addressed. So far, 169 SOPs have been drafted by CGIAR genebanks and germplasm health units (GHUs). In addition to the document audit, SOPs for key genebank operations (acquisition, distribution, safety duplication, conservation and regeneration and characterization) are being externally validated through on-site reviews. In 2019, external reviews took place in six genebanks and in two regional stations. The reviews also validated the reported status of collections with regard to performance targets and subsequent recommendations have impacted on reported figures in 2019.

Imaging of rice accessions at AfricaRice as part of seed quality management. Photo: Neil Palmer

Rainer Vollmer demonstrating cryopreservation processes to Steve Adkins, external reviewer in CIP genebank review. Photo: Charlotte Lusty

Table 5. Germplasm samples processed for conservation and distribution by GHUs in 2019

Center	Accessions analyzed	Samples analyzed	Samples rejected	Diagnostic reactions
AfricaRice	4,635	5,712	–	11,424
Bioversity	104	376	–	1,192
CIAT	14,255	15,723	699	92,323
CIMMYT	8,542	1,240	350	22,307
CIP	1,238	4,207	469	30,934
ICARDA	42,782	24,700	105	294,889
ICRAF	66	49	34	136
ICRISAT	11,166	11,209	2,015	22,890
IITA	8,366	82,150	6,544	101,164
ILRI	3,211	7,103	2,265	17,650
IRRI	11,596	–	767	–
Total	**105,961**	**152,469**	**13,248**	**594,909**

Use Module

Using genotypic data to manage collections

Two collaborative projects are using genotypic data to answer challenging questions influencing the management of *ex situ* collections. CIP and CIMMYT are analyzing genotypic data derived from Diversity Arrays Technology (DArTseq) from 15,000 samples of 865 accessions from seven genebanks. The analyses will begin to illustrate the levels of genetic diversity within accessions as well as among accessions for specific crops and help guide improved sampling of genebank materials and their prioritization for specific conservation actions and use. DArTseq profiling has been deployed more extensively for studying the cassava collections under IITA and CIAT's management. A preliminary analysis (not including wild species) produced more than 55,000 SNPs and 68,000 SilicoDArT markers, which seem to reveal surprising levels of distinction between the accessions of African and American origin (Figure 6).

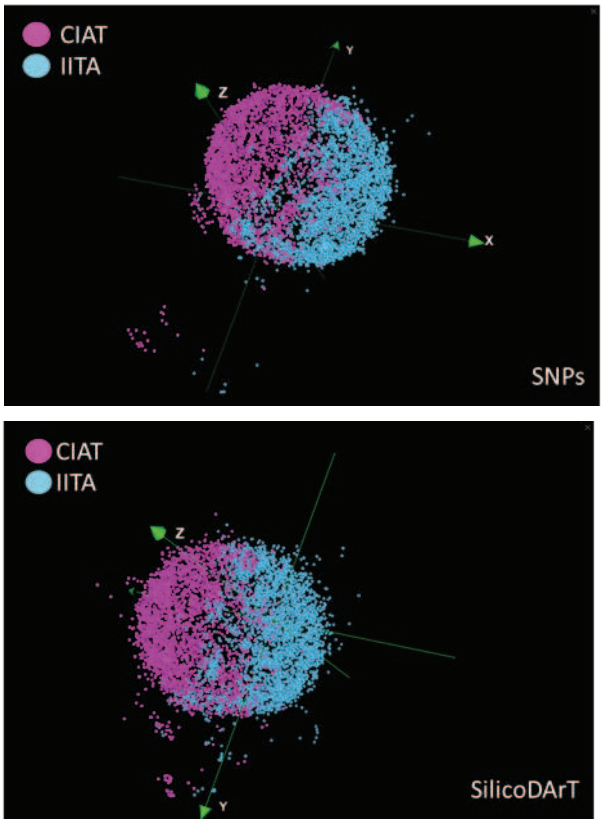


Figure 6. Preliminary visualization of population structure among genebank accessions using currently available genotypic data using Multi-Dimensional Scaling (MDS) and the CurlyWhirly software. Coordinates were calculated using mrd (SNP) and jacc (SilicoDArT) distances.

*Genesys (*www.genesys-pgr.org*)*

Genesys, the online portal for accession data for genebanks worldwide, is part of the Plant Treaty's Global Information System (GLIS). By the end of 2019, the passport data of four million accessions were searchable from Genesys, including accessions from the 11 CGIAR genebanks and the networks of European and USDA genebanks. The Passport Data Completeness Index (PDCI) continues to improve in CGIAR genebanks (Table 6). A major initiative on publishing trait and subset data has resulted in more than 100 subsets now being available, with the aim of encouraging breeders and other users to explore the diversity in the collections. Several additional activities continue to improve the interconnectivity of Genesys with other databases and tools, for example with the online portal to agricultural research data, GARDIAN, and with GRIN-Global, an accession data management software increasingly being adopted by genebanks worldwide, including the CGIAR.

Table 6. CGIAR germplasm data publicly available in 2019

Center	Number of accessions uploaded	% of DOIs	Passport Data Completeness Index (PDCI)		
			2017	2018	2019
AfricaRice	21,300	100%	5.60	5.89	7.67
Bioversity	1,600	97%	5.57	5.94	6.22
CIAT	66,787	100%	6.70	6.94	6.80
CIMMYT	174,500	98%	5.65	6.22	7.11
CIP	17,783	100%	5.61	7.53	7.39
ICARDA	156,929	100%	6.76	6.65	5.84
ICRAF	13,224	98%	6.69	6.68	6.33
ICRISAT	128,155	94%	6.89	6.95	7.27
IITA	36,217	100%	4.69	5.12	4.64
ILRI	18,646	100%	6.88	6.80	5.71
IRRI	132,126	96%	5.45	5.09	6.35
All	**767,267**	**98%**	**6.04**	**6.28**	**6.48**

Minicores from the ICRISAT genebank undergoing high-throughput phenotyping to screen for water efficiency. Photo: Shawn Landersz

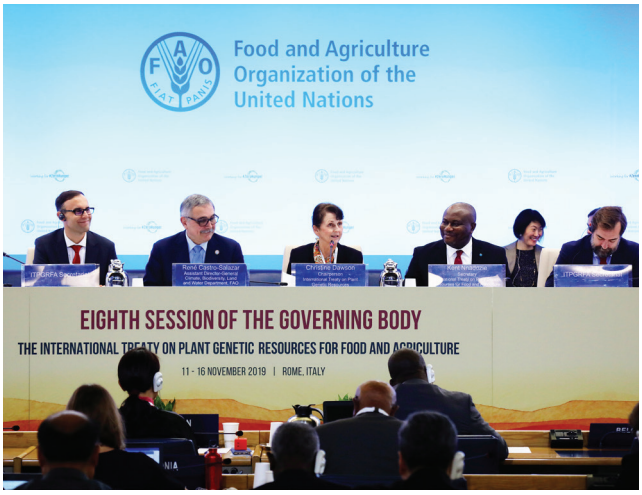
Denise Costich, CIMMYT maize genebank manager, measuring jala maize – a Mexican landrace producing the longest maize ears. Photo: Shawn Landersz

Subsetting

All genebanks continue to develop and characterize user-focused subsets of genebank accessions to help facilitate the selection of useful material, based on published research or by carrying out characterization studies. New subsets developed and made available online are listed in Table 7. In 2019, Alliance-CIAT and ICARDA started to develop a tool that will allow users to customize subsets based on criteria that can be determined from passport and characterization data available in Genesys or elsewhere such as climate conditions and likely presence of a trait. Users will be able to filter accessions based on single or multiple variables, constructing their own core collections that maximize environmental and/or phenotypic diversity. The tool will be developed in consultation with a wide range of users.

Table 7. New subsets made publicly available from genebanks in 2019

Genebank	Subsets
Bioversity	Growth and transpiration efficient banana genotypes under osmotic stress treatment
CIMMYT	Salt toxicity tolerance in wheat Flag smut resistance in wheat Australian, Canadian, French, New England, North African, UK, CIMMYT-bred heirloom, heritage and hallmark wheat varieties Flavorful bread wheat flour Club wheat, better suited for cookie production Multiple disease resistance in synthetic wheat hexaploids Wheat blast (*Magnaporthe oryzae* pv. *triticum*) Resistance/tolerance to *Pratylenchus neglectus*, *P. thornei*, root lession, cereal cyst nematode Loose smut in wheat Source of durable resistance in wheat Aluminium or boron toxicity tolerance Crown rot tolerance in wheat Norman Borlaug wheat varieties Heat tolerance in bread wheat High protein bread wheat wholegrain and flour Large, long-spike bread wheat Short, semi-dwarf, long coleoptile bread wheat Various bread wheat baked goods
CIP	Topmost distributed advanced or improved cultivars of potato Topmost distributed traditional cultivar/landraces of potato Topmost distributed sweetpotato germplasm
ILRI	Promising drought-resistant Rhodes grass (*Chloris gayana*) accessions



The 8th Session of the Governing Body was held in Rome in November 2019. Photo: Shawn Landersz

Michael Halewood, Policy Module leader, representing the CGIAR at the Plant Treaty Governing Body. Photo: Shawn Landersz

Policy Module

Coordinating CGIAR engagement in international policy negotiations

The Policy Module coordinates CGIAR's engagement in the negotiations of the Plant Treaty's Multilateral System (MLS) of access and benefit-sharing. By the end of 2018, it seemed that the Governing Body of the Plant Treaty might be able to adopt a package of measures to reform the MLS. However, unfortunately, the negotiations broke down at the 8th Session of the Governing Body in November 2019, largely because the Contracting Parties could not agree on monetary benefit sharing for commercial use of genomic sequence information. Nevertheless, the main positions that CGIAR had been promoting were positively reflected in the negotiating text. The Policy Module is currently working with the Centers to monitor the effects of the suspension of the negotiations, and consulting with stakeholders to prepare for negotiations potentially being relaunched in 2021 at the 9th session of the Governing Body.

The Policy Module explored possibilities for promoting the Plant Treaty and the agricultural sector in general in the context of the development of the Post-2020 Global Biodiversity Framework of the Convention on Biological Diversity (CBD). In 2019, the Policy Module developed a submission to the CBD's Subsidiary Body on Scientific, Technical and Technological Advice, arguing that it is important for Contracting Parties to promote and monitor implementation of both the Plant Treaty and the Nagoya and overcome historical divisions between the agriculture and environment sectors that inhibit progress on the Sustainable Development Goals (SDGs). The Policy Module also organized a side event with the Plant Treaty Secretariat, United Nations Environment Programme and other organizations to highlight the same points. A subsequent draft of the Post-2020 Framework, published in January 2020 by co-chairs of the negotiation process, reflected these perspectives.

Supporting a System-wide CGIAR response to Resolution 4/2017

In 2019, the Policy Module redoubled its efforts to support CGIAR to respond to Resolution 4/2017 of the Plant Treaty's Governing Body, which asked CGIAR to submit annual reports on restrictive licenses and intellectual property applications in line with CGIAR's Principles for the Management of Intellectual Assets (IA). Following the advice of the SMB, the Policy Module worked with the System Management Office (SMO) and individual Centers to ensure that annual reports and disclosures on Restrictive Use Agreements, Limited Exclusivity Agreements and intellectual property applications are published in ways that would satisfy the concerns of Contracting Parties. A "Guidance Note on CGIAR Research Center Public Disclosures related to the Management of Intellectual Assets" has been prepared with inputs from the CGIAR Genetic Resources Policy Working Group and CGIAR Legal/IP Network (CLIPNet) members. The Governing Body at its 8th Session was satisfied with CGIAR's efforts and the System Council Intellectual Property Group (SCIP) also expressed its appreciation for the Policy Module in contributing to "a trend of more fulsome public disclosures."

Strengthening Centers' capacity to comply with PGRFA policies and laws

The Policy Module maintains a Policy Helpdesk[2] for CGIAR scientists and organized several capacity building workshops and webinars for CGIAR scientists, national partners, policy focal points and other staff to raise awareness about genetic resources policy issues.

[2]Requests for assistance can be sent to: GRPolicy-Helpdesk@groups.cgiar.org

1.2.3 Variance from Planned Program

The Genebank Platform activities follow a relatively fixed program of work focused on the essential operations of the genebanks and germplasm health units. There are no areas of variance from the planned program to report.

1.2.4 Data and Publications

The genebanks' data management complies with the CGIAR Principles on the Management of Intellectual Assets and Open Access Policy. Genesys publishes data supplied by CGIAR and other data providers in accordance with data sharing agreements between the Crop Trust and individual data providers. In total, more than four million accessions are recorded in Genesys and more than three million records were updated in 2019 alone.

The Genebank Platform website (www.genebanks.org) provides links to research papers, policy briefs, conservation protocols, training materials, and submissions to international policy fora in conformance with the CGIAR Open Access and Data Management Policy. In 2019, the genebanks reported a total of 144 publications by genebank staff in journals, conference proceedings, books and book chapters, covering a wide range of topics. Out of 80 peer-reviewed journal articles, 71% are publicly available in open-access publications and 93% are published in ISI journals (Table 8).

Table 8. Number of peer-reviewed publications in 2019

	Number	Percent
Peer-Reviewed publications	80	100%
Open Access	57	71%
ISI	74	93%

1.3 Cross-Cutting Dimensions

1.3.1 Capacity Development

The Genebank Platform and individual genebanks undertake numerous capacity building activities thanks to funding via the Platform and from bilateral donors. In 2019, 12 Platform-level capacity building events took place involving 300 participants from 11 CGIAR Centers plus national partners (Table 9). The participants of the listed capacity building events gained knowledge and skills in a wide range of thematic areas involving genetic resources management, phytosanitary health and international policy.

CGIAR genebanks and GHUs carry out services to CRPs and national partners to conserve, test, clean and distribute germplasm. They also serve as knowledge hubs for phytosanitary health, taxonomy, genetic diversity, seed conservation science, cryopreservation, genebank operation, etc. and they act as hosts for safety duplicated materials for NARS partners. In 2019, more than 700 capacity building events took place across the genebanks. The activities involved more than 8,000 participants (5,952 male, 2,682 female) from 73 countries (Table 10 and Annex 2), including 606 genebank tours to promote the importance of crop diversity and the work of CGIAR.

Table 9. Platform and Module level capacity building events in 2019

Date	Event	Location	Total number of participants	% CGIAR	% Female
11–15 Mar	Quality Management System: Genebank Operations and Advanced Learning (GOAL) Workshop	Lisbon, Portugal	26	85%	42%
29 Apr–3 May	4th International Workshop of the CGIAR Germplasm Health Units (GHUs)	ICARDA, Morocco	42	69%	48%
4–7 Jun	Policy: Capacity Building Workshop on Genetic Resource Policies for CGIAR Scientists and Partners in East Africa	ILRI, Ethiopia	40	75%	28%
10–14 Jun	Seed Quality Management (SQM) Workshop	IRRI, Philippines	44	73%	43%
24–28 Jun	GHUs: Application of Videometer for Non-invasive Seed Health Diagnostic	IITA, Nigeria	17	94%	47%
26–31 Aug	A15 DArTseq data analysis workshop	CIMMYT, Mexico	23	100%	39%
27–28 Sep	Meeting of the Genebank Managers of the ASEAN Region	Hanoi, Vietnam	20	20%	20%
28–30 Sep	Genebank Impacts Closing workshop	Hanoi, Vietnam	8	0%	75%
30 Sep–4 Oct	Annual Genebanks Meeting (AGM)	Hanoi, Vietnam	57	51%	44%
8–14 Nov	QMS intensive training	ICRISAT, Niger	5	100%	40%
18–22 Nov	QMS intensive training	AfricaRice, Cote d'Ivoire	10	100%	50%
25–28 Nov	Germplasm Health Units: sRSA Methods for Virus Indexing	University of Liège, Belgium	8	100%	38%
		Total	**300**	**69%**	**41%**

Table 10. Participants in capacity development activities in 2019

Event category	Number of events	Number of participants
Genebank visits and tours	606	6,676
Genebank-organized training/workshop	17	291
Genebank staff as resource person in a capacity development event	17	340
Visit from partners for research/scientific work	18	42
Hosting a scholar/student in the genebank for educational purpose	26	67
Farmers' open day	22	1,218
Total	**706**	**8,634**

Threshers being introduced into the genebank at ICRISAT. Photo: Shawn Landersz

IITA is helping to put East African cassava landraces into disease-free tissue culture in partnership with KEPHIS in Kenya. Photo: Michael Major

4th International Workshop of the CGIAR Germplasm Health Units (GHUs), Morocco

Bean regeneration at CIAT. Photo: Neil Palmer

ICRISAT genebank staff in Niger receive QMS training by Janny van Beem

2. Effectiveness and Efficiency

2.1 Management and governance

There have been no changes to governance arrangements.

2.2 Partnerships

2.2.1 External partnerships

The primary partners of the genebanks and GHUs are the wide range of users from many countries who requested germplasm, advice and information in 2019 (Table 11). The exchange of germplasm takes place within a policy framework that demands close partnership with the Plant Treaty, the Commission on Genetic Resources for Food and Agriculture (CGRFA) and the International Plant Protection Convention (IPPC). The Svalbard Global Seed Vault is an essential partner in long-term conservation, as well as in communicating to the wider world the importance of crop diversity and the organizations that conserve it. CGIAR genebanks provide more than germplasm to users. Individual genebanks provide a range of services (including hosting safety duplicates), information, advice, capacity building, and other support to national partners. The services rendered involved working with 53 institutes in 31 countries.

2.2.1 Cross-CGIAR Partnerships (CRPs and other Platforms)

The most significant cross-CGIAR exchange occurring within the framework of the Genebank Platform concerns the movement of germplasm and associated data: the acquisition of materials from CGIAR breeding programs by genebanks and the distribution of germplasm from genebanks to research and breeding programs, and the phytosanitary testing of materials by GHUs. In 2019, 1,768 samples were acquired from CGIAR breeding programs and 33,692 samples were sent to breeding programs. In addition, many exchanges occurred between genebanks and Platforms or CRPs, some of which are captured in Table 12.

Table 11. Key external partnerships of the Genebank Platform in 2019

Module	Description	Name of partner	Main area of partnership
Conservation	Ultimate safety duplication of CGIAR germplasm	Svalbard Global Seed Vault	Risk management
	Research collaboration, partnership for germplasm distribution, safeguarding of genetic resources, recipient of capacity building and other genebank services	National genebanks	Capacity development and risk management
	Collaboration in the delivery of the Global Plan of Action	Commission on Genetic Resources for Food and Agriculture (CGRFA)	International policy
	Collaboration in safe exchange of germplasm	International Plant Protection Convention (IPPC) and national plant protection agencies	Phytosanitary and international policy
	Provision of germplasm, clean planting materials, information and advice	97 countries	Delivery
Use	Global information system (GLIS) on plant genetic resources for food and agriculture	International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty)	Delivery and policy
Policy	International PGRFA policy development and compliance, capacity building for policy implementation at national level	Plant Treaty and Convention on Biological Diversity (CBD) Secretariats	International policy

Freshly regenerated germplasm being re-deposited by ICARDA at the Svalbard Global Seed Vault. Photo: Riccardo Gangales

2.3 Intellectual assets

(a) How have intellectual assets been strategically managed by the Platform in order to maximize their global accessibility and/or impact in line with the CGIAR Principles on the Management of Intellectual Assets?

All CGIAR genebanks have agreements with the Plant Treaty, placing their germplasm collections under its Multilateral System of Access and Benefit Sharing. In 2019, 97% of samples externally distributed by the Centers where transferred under Standard Material Transfer Agreements (SMTA). The remaining 3% of transfers were to Svalbard or for service contracts where the materials where control of the materials was not transferred and the service provider was required to destroy or return the materials

(b) Indicate any published patents and/or plant variety right applications (or equivalent) associated with intellectual assets developed in the Platform and filed by Centers and/or partners involved in the Platform

The collections, and the germplasm contained within them, remain publicly available and no patents or plant variety protection rights are sought on the germplasm.

(c) List any critical issues or challenges encountered in the management of intellectual assets in the context of the Platform

Critical issues and challenges involving the CGIAR genebanks are addressed and reported under the Policy Module.

Table 12. Cross-CGIAR Collaborations (beyond the exchange of germplasm) in 2019

Brief description of the collaboration	Collaborating CRPs, Platforms, Centers
Exploration of different types of proximal and remote sensors for evaluating physiological traits of bean germplasm (CIAT)	Grain Legumes and Dryland Cereals
Evaluation of genebank collection through various projects: African Orphan Crop Consortium (AOCC) genome sequencing and FruitAfrica Promotion of use of genebank collection through various bilateral projects: Fruit Africa, AGBio-Ethiopia, PATSPO-Ethiopia, ACIAR-Rwanda, Re-greening Africa (Sahel/East Africa) (ICRAF)	Forests, Trees & Agroforestry
Extended the application of genotyping-by-sequencing (GBS) to assess genetic diversity in forage germplasm collections, including: Napier grass (*Cenchrus purpureus*); Buffel grass (*Cenchrus ciliaris*); Rhodes grass (*Chloris gayana*); Lablab (*Lablab purpureus*); and Sesbania (*Sesbania sesban*) (ILRI)	Livestock
Collaboration with Center breeders on phenotypic evaluation of mini core set of African rice for different types of stresses and grain quality traits (AfricaRice) Molecular characterization of 5,000 African sativa ssp indica using 45,335 high density DArTseq-based SNPs, resulting to the genotyping of 2,063 accessions (AfricaRice) Development, evaluation and promotion of rice subsets (IRRI)	Rice
Monitoring of in situ diversity of banana in PNG (Bioversity) Monitoring of in situ diversity of potato in Peru (CIP) On farm diversity analysis of yams and cassava in Benin (IITA) Sampling of diversity hotspots for DNA analysis for IITA yam and cassava (IITA) Bill and Melinda Gates project BBTV mitigation: Community management in Nigeria, and screening wild banana progenitors for resistance (Bioversity)	Roots, Tubers & Bananas
Wheat wild relative regeneration protocols and longevity estimation at CIMMYT and ICARDA (CIMMYT, ICARDA)	Wheat
Development and promotion of Open Access data, including tracking of germplasm use (CIAT, Bioversity, ICRAF, IRRI)	Big Data Platform
Promotion on the use of genebank collections, including trait discovery and breeding, genotyping and sequencing, phenotyping, and bioinformatics and biometrics (Bioversity, CIP, ICRAF, ICRISAT, IITA, ILRI, IRRI)	EiB
CGIAR Genetic Resources Policy Working Group (Policy Module)	EiB, Big Data, SMO, Science Leaders, CLIPNet, Article 15 Group

2.4 Monitoring, Evaluation, Impact Assessment and Learning (MELIA)

The Genebank Platform continues to be monitored through the Crop Trust online reporting tool using agreed performance targets, which are applied to multiple international and national genebanks (Table 13). The targets are based on FAO genebank standards and determine the eligibility of all genebanks seeking long-term funding from the endowment mechanism of the Crop Trust. Germplasm distribution, the status of collections and other indicators relating to CGIAR genebanks and breeding programs are reported to international instruments such as the Global Plan of Action of the CGRFA and to the Governing Body of the Plant Treaty.

In 2018, a special initiative was set up to study some of the diverse impacts of CGIAR genebanks through a fellowship scheme overseen by the Crop Trust and Michigan State University. In a first phase, seven fellows were recruited to conduct impact studies on individual genebanks.[3] A "Sourcebook" on the economics of conserving plant genetic resources has been developed to summarize the state of knowledge and help tackle research questions related to genebank impact evaluation, including sections on cost analysis and diversity representation in collections.

The seven fellows conducted short impact research projects that highlighted not only the value and use of crop diversity managed by genebanks but also a range of genebank functions. The studies were interdisciplinary in nature, employing quantitative and qualitative methods with the aim of providing evidence to enhance the understanding of the role and value of genebanks. Several studies were able to trace the ancestry in modern varieties adopted by farmers directly to specific genebank accessions and apportion benefits by drawing from extensive information on pedigrees.

[3]See https://www.genebanks.org/resources/impacts

Vivian Bernal estimated the gross benefit of potato cultivar, Victoria, in Uganda at USD $1.04 billion (2016 value). Victoria (DOI:10.18730/P5MW4) was developed by CIP breeders using genebank materials. According to her study, 72% of the economic benefits can be attributed to the CIP genebank.

Donald Villanueva's study revealed that one in five of the improved varieties cultivated on 95% of the rice area in Eastern India (10.8 million hectares) had at least one parent supplied directly by the genebank at IRRI and 45 to 77% of the genetic composition of the improved varieties in the area is derived from genes from genebank accessions. Estimated coefficients indicate that a 10% increase in the genetic contribution from genebank accessions is associated with a 27% increase in yield.

Table 13. Monitoring, Evaluation, Learning and Impact Assessment (MELIA) in 2019

Studies/learning exercises planned for this year	Status	Type of study or activity	Comments	Links to evidence
External technical reviews and validation of quality management systems (QMS)	Ongoing	Program evaluation	A panel of external technical reviewers was convened in December 2018 in Germany. In 2019, six genebank reviews took place: CIAT, CIMMYT, CIP, ICARDA, IITA, and IRRI using a standard format and approach, including the validation of SOPs and annually reported data on the status of collections. ICRISAT Regional Stations in Niger and Zimbabwe were also reviewed. As of the end of 2019, 83 recommendations have been made and are being addressed.	Report to made available in 2020
Costing reviews	Ongoing	Program evaluation	A costing review started in late 2017 with a visit to IRRI to collate data on routine costs for genebank operation. In 2018, reviewers visited CIAT, CIMMYT, CIP and ICARDA and in 2019, ICRISAT, ILRI, ICRAF, and Bioversity. The results of the analysis will feed into a systematic review of the financial allocations to genebanks for essential operations.	Report to made available in 2020
Document audits for Safety duplication and Acquisition	Complete	Audit	During 2019, two documentation audits were performed: Safety duplication and Acquisition Standard Operating Procedures (SOPs). The Safety duplication SOP was audited for the following nine genebanks: AfricaRice, Bioversity, CIAT, ICARDA, ICRAF, ICRISAT, IITA, ILRI and IRRI and the Acquisition SOP for the same genebanks except ILRI. In total, 187 findings were found and addressed during the two audits.	Closure reports Safety duplication: https://bit.ly/3ccEjqh Acquisition: https://bit.ly/2A01Jkv
Genebank Impacts Fellowship	Complete	Outcome study	The impact of the work of the CGIAR genebanks was documented as part of the Genebank Impacts Fellowship launched in 2018. The following 11 working papers are published in 2019 at the Platform website: • A Sourcebook: Economics of conserving plant genetic resources in genebanks / Melinda Smale • Transferring the diversity of goat grass to farmers' fields through the development of synthetic hexaploid wheat / Hafid Aberkane • The contribution of the International Rice Genebank to varietal improvement and crop productivity in Eastern India / Donald Villanueva • The demand for Bioversity's banana germplasm in Africa and Asia / Vanessa Ocampo-Giraldo • On the trail of taro: Safeguarding the prestige crop of the Pacific / Sefra Alexandra • Tracing the benefits of ICRAF tree germplasm distributions: *Calliandra calothyrsus* and *Gliricidia sepium* / Kavengi Kitonga • Tracing the benefits of ILRI forage germplasm distributions: *Medicago sativa*, *Sesbania sesban*, and *Pennisetum purpureum* / Kavengi Kitonga • Andean potato diversity helps agricultural development in Uganda: Victoria and the contribution of the CIP genebank / Vivian Bernal-Galeano • Dynamic conservation of genetic resources: The maize landrace Jala / Vanessa Ocampo-Giraldo • The contribution of CIAT genebank in the development of iron-biofortified bean varieties and farm-level impacts in Rwanda / Stefania Sellitti • Impact and use assessment of genetic plant materials from the Bioversity's International *Musa* Germplasm Transit Centre (ITC) in the Latin America and Caribbean Region / Sirena Montalvo-Katz	https://www.genebanks.org/resources/impacts/

2.5 Efficiency

The Genebank Platform works on building efficiencies at different levels (Table 14). Every genebank pursues an objective of reaching performance targets while also addressing users' requests for germplasm, data and support. Once at performance targets, the collection will be largely in good health so theoretically there should be no backlogs or bottlenecks causing inefficiency or loss of accessions. Furthermore, each genebank has a fixed annual budget to carry out essential routine operations based on precisely costed and defined activities. There is no scope for expanding or over-spending. Instead the budgets are periodically reviewed and, where relevant, costs compared or benchmarked against other genebanks. A costing review process is currently under way and will culminate in a system level review in 2020.

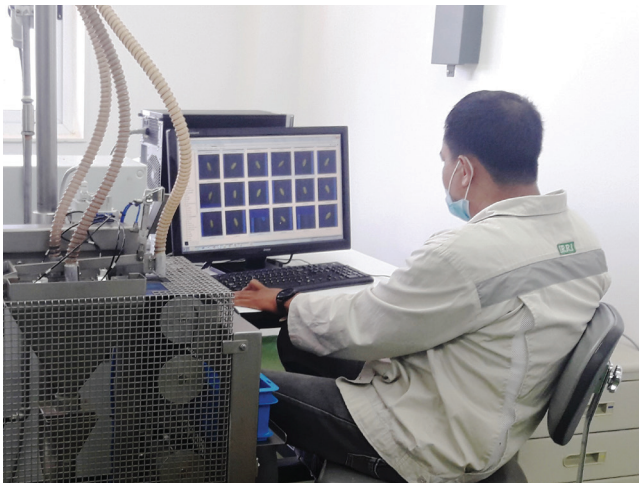
At an individual genebank level, many small efficiencies are being made. The following are examples of efficiencies reported by genebanks in 2019:

- 80–100% operations now recorded on mobile devices in nine genebanks
- 80–100% operations tracked with barcodes in eight genebanks
- Regeneration success rate of 80–100% for seed crops in six genebanks
- Staff time (24 FTE) on seed sorting reduced through automation at IRRI
- Reduced time from harvest to storage by more than 50% at ICRISAT and AfricaRice
- Increased interval for seed viability monitoring by at least 10 years for all crops (excluding groundnut) at ICRISAT
- Average recovery rate of potato accessions from cryopreservation at CIP has increased from 50% in 2013 to 62% in 2019

At a thematic level, communities of practice are in place where either specialists in genebanks are able to meet, collaborate, share practices and learning (e.g. GHUs, data management) or staff or focal points in genebanks are able to benefit from specialist knowledge in another institute (e.g. QMS, SQM) (Table 15).

80–100% operations now recorded on mobile devices in nine genebanks. Photo: Michael Major


Average recovery rate of potato accessions from cryopreservation at CIP has increased. Photo: Luis Salazar


Staff time on seed sorting reduced through automation at IRRI

80–100% operations tracked with barcodes in eight genebanks. Photo: Neil Palmer

Table 14. Building efficiencies in the Genebank Platform

Level of entry	Methods	Expected outputs
Individual genebanks	• Quality management systems • Annual improvement reports • External technical reviews (5-yr) • Costing reviews (10-yr) • Testing of new technologies • Protocol optimization	• Documented standard operating procedures (SOPs) and system for auditing, review and improvement • Improvements triggered by recommendations from expert reviews • Compiled costs per activity/accession • Annual assessments of efficiency aims and progress • Piloting of imaging, automated seed sorting, automated germination testing
Thematic areas	Communities of practice & specialization (see Table 15)	Workplans, strategies, research projects, revised procedures or SOPs, shared specialism, etc. (see Table 15)
Platform level	• Shared performance targets/ FAO standards/QMS • GOAL workshops • Platform level recommendations from technical and costing reviews • Benchmark studies • 2020 System Level Review of Genebank Costs and Operations	• Progress to "steady-state" operations • Aligned SOPs, templates and, in some cases, procedures (e.g. for same crops) • Adoption of good practices across Centers • System level actions to address recommendations • Shared policy and technical framework for strategic curation of collections (including archiving) • Consolidation & rationalization of roles, activities and collections

Table 15. Communities of practice and specialization

Community of practice and specialization	Membership	Activities
Accession data management	Genebank data curators and managers, Crop Trust	Developing best practices for accession data management, introducing new technologies (e.g. barcoding, mobile devices and digital object identifiers), developing and adopting applications and software for GRIN-Global Community Edition, publishing data on Genesys
Germplasm Health Units	GHU leaders	Upgrading and improving protocols, sharing of practices, QMS, developing recognized "GreenPass" system to facilitate international movement of germplasm from CGIAR distribution points, etc.
Seed quality management	Aarhus and Reading Universities, other partners, genebank technical staff	Conducting research and Improving processes for regeneration, post-harvest treatment, seed processing, dormancy breaking, viability testing and monitoring, automation with the aim of improving seed longevity in storage
Clonal crop collections	IITA, Alliance, CIP plus specialists	Developing and implementing strategies for medium and long-term conservation of RTB crops, sharing best practice, developing a proposal for a global cryopreservation initiative
Impact fellows	Michigan State University, Crop Trust, recruited fellows and genebank managers	Developing resources on genebank impact, developing, sharing and conducting user surveys, conducting and publishing research on impacts of genebanks
Quality management	Crop Trust, thematic specialists, QMS focal points in genebanks	Building overall genebank QMS system, editing, auditing and validating SOPs, developing templates for SOPs, policies and other documents, training and conducting GOAL workshops, feeding into development of FAO genebank standards
Gap analysis	CIAT, ICARDA, Crop Trust and genebank collaborators	Refining and building capacity to implement methods and tools for analyzing gaps in collections using taxonomic, expert, geographical, environmental, trait and genetic information
Genotyping in genebanks	CIMMYT, CIP, CIAT, IITA, IRRI, EiB and other CGIAR specialists, Diversity Arrays	Implementing and analyzing genotypic (DArTseq) data of genebank accessions for the purposes of improving genebank management and promoting the sampling and use of genebank accessions
Genebank expert reviewers	Genebank experts, Crop Trust	Designing and implementing external technical reviews for genebanks

2.6 Management of Risks

Programmatic risks: The Crop Trust is currently raising funds for both the Genebank Platform and its endowment fund to ensure the long-term support of the CGIAR genebanks. Without assured funding from both CGIAR and the Crop Trust, the essential operations and activities of the genebanks, and their progress towards performance targets, would be heavily impacted. As the endowment raised by the Crop Trust for the CGIAR genebanks is not yet at its target value of USD 500 million, the revised Investment Policy Statement approved by the Crop Trust's Executive Board states that spending will be capped at 2%. Exceptionally, in 2019, the Crop Trust's Finance and Investment Committee agreed to withdraw 4% from the endowment fund, of which 98% was provided to the international genebanks of CGIAR. The Crop Trust raised an additional USD 1.3 million in bilateral funds from the European Commission and the Government of Finland and used its own reserves to make up the full commitment of USD 11 million to the Genebank Platform. The commitment from the Crop Trust rises to USD 13 million in 2020 and USD 15 million in 2021, which presents a very considerable fundraising challenge to the Crop Trust.

Contextual risks: Two host countries continue to impose procedural constraints on the ability of two Centers' genebanks to distribute germplasm in compliance with those Article 15 agreement obligations under the Plant Treaty. The respective Centers' management are in active negotiation with the countries in question and discussing the issue with the Plant Treaty Secretariat and Policy Module. More concrete measures will be taken in 2020 in order to ensure that these Centers are able to function as required of an international Center and according to their Headquarter Agreements.

Institutional risks: Institutional financial management practices continue to constrain the management of genebank budgets and the pursuit of cost efficiencies. Several genebank budget holders appear to have access only to limited up-to-date information on expenditures and minor inputs into the attribution and reporting of expenditures. Challenges revolve around general financial management practices, attribution of full-cost recoveries, effectiveness of data management tools, procurement practices and the effects of unexpected and last-minute changes in institutional income. The unexpected shortfall in funding from the German Federal Ministry for Economic Cooperation and Development (BMZ) in 2019 has added to the difficulty of dealing with these vagaries despite all the efforts to provide guaranteed fixed funding for essential genebank operation. It also restricts the incentives and the capacity of managers to pursue efficiencies.

3. Financial Summary

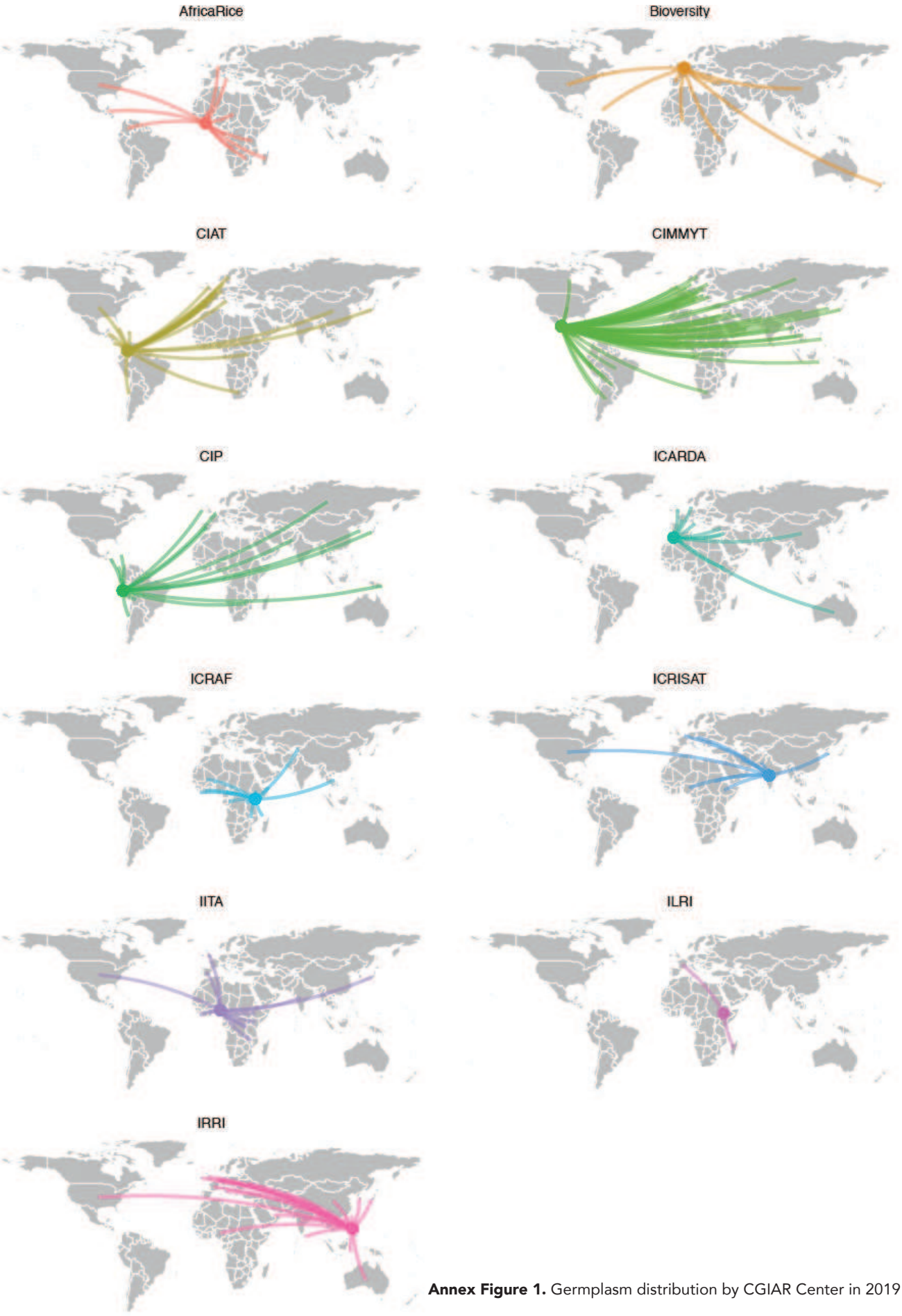
In 2019, 37% of the Genebank Platform costs was funded by the Crop Trust and the remaining for 63% was funded by W1/2 funding. Nine of the 11 genebanks have long-term grants with the Crop Trust and the costs of the essential operations and the other activities of these genebanks are split between the Crop Trust and W1/2 funding. The remaining two genebanks, are funded entirely by W1/2. The Crop Trust funding includes the funds raised by Crop Trust from the European Commission and Finland.

Table 16. Financial Summary

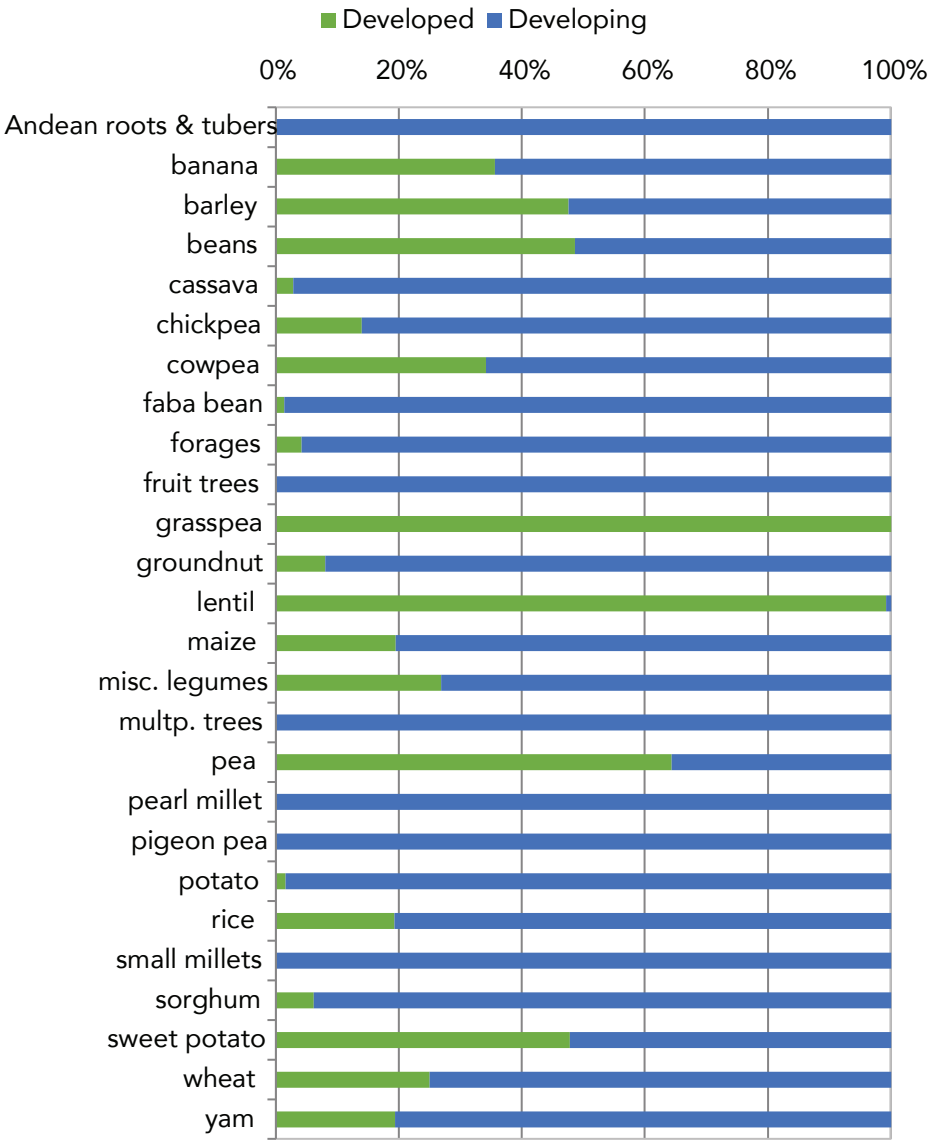
	Planned budget 2019			Actual expenditure 2019			Difference		
	W1/2	W3/ bilateral	Total	W1/2	W3/ bilateral	Total	W1/2	W3/ bilateral	Total
Module 1	17.34	10.03	27.37	17.13	9.98	27.11	0.21	0.05	0.26
Module 2	0.23	0.92	1.15	0.25	0.86	1.11	-0.02	0.06	0.04
Module 3	0.78	0.00	0.78	0.78	0.00	0.78	0.00	0.00	0.00
Management & Support Costs	0.69	0.00	0.69	0.69	0.00	0.69	0.00	0.00	0.00
Platform Total	**19.04**	**10.95**	**29.99**	**18.85**	**10.84**	**29.69**	**0.19**	**0.11**	**0.30**

Note: Values in US$ millions. Some numbers do not add up due to rounding.

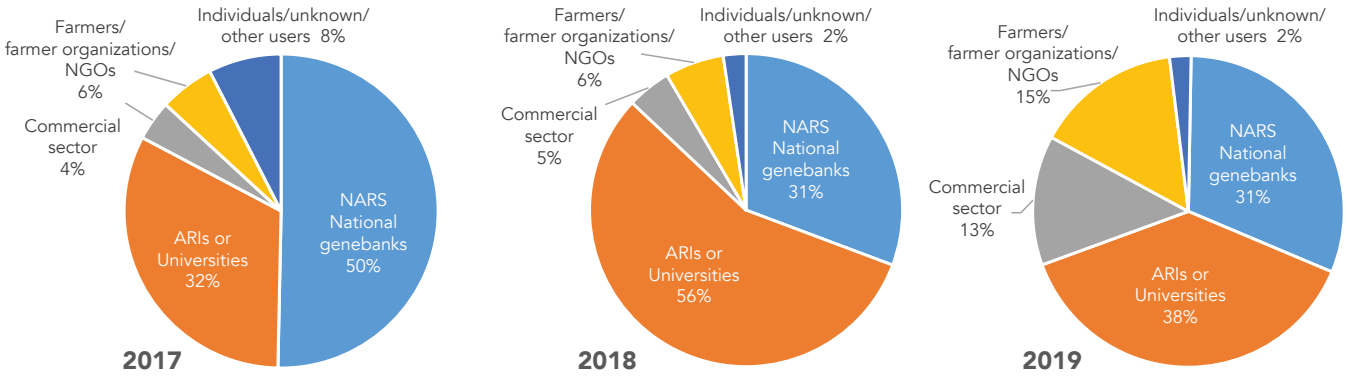
Annex



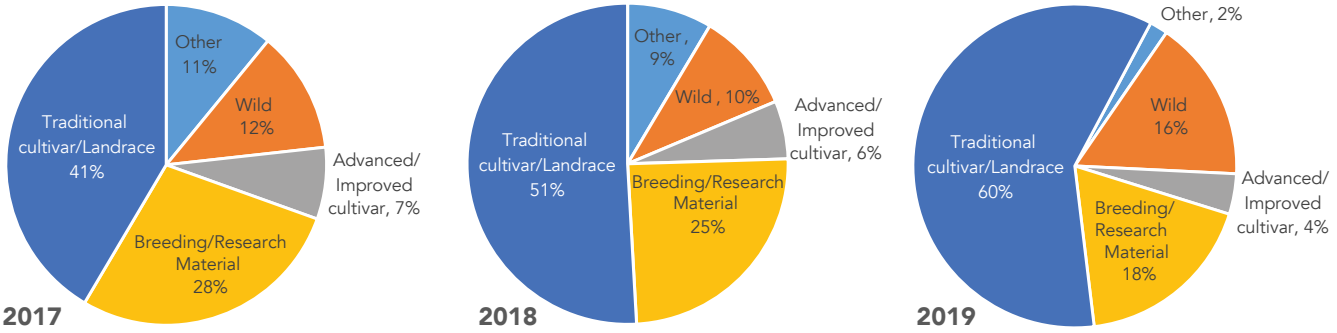
Annex Figure 1. Germplasm distribution by CGIAR Center in 2019



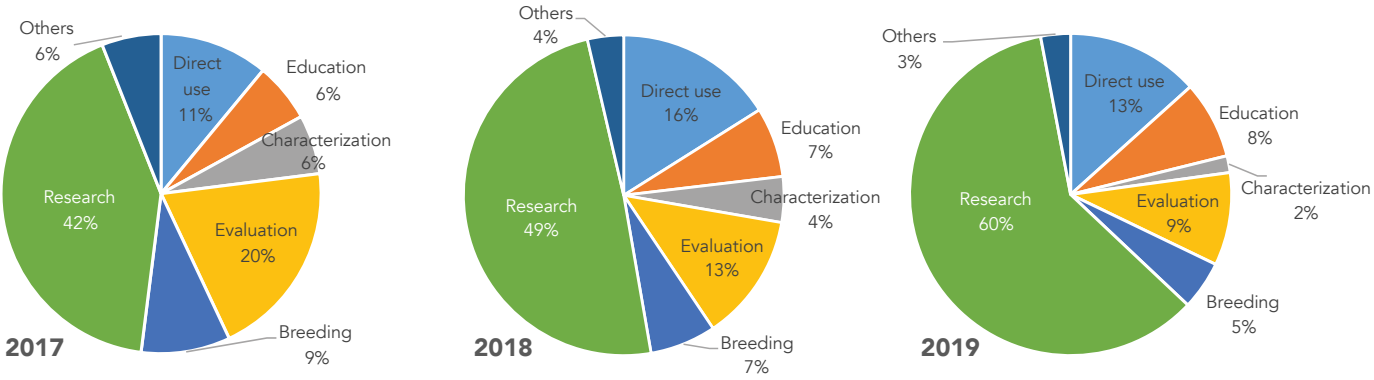
Annex Figure 2. Distribution by crop to developed and developing countries in 2019



Annex Figure 3. Recipients of germplasm distributed by CGIAR genebanks, 2017 to 2019



Annex Figure 4. Types of materials requested, 2017 to 2019



Annex Figure 5. Types of request for stated purposes, 2017 to 2019

Annex Table 1. Participants in capacity development activities in 2019

Number of trainees	Female	Male
In short-term programs facilitated by the Platform	2,682	5,952
In long-term programs facilitated by Platform	0	0
PhDs	0	0

Annex Table 2. Update on actions taken in response to the IEA evaluation of the CGIAR research support program for Managing and Sustaining Crop Collections: Genebanks CRP

Text of recommendation	Status of response to this recommendation	Concrete actions taken for this recommendation	By whom	When	Comments	Link to evidence
Revisit the Parity Study to establish realistic and transparent budget for each Center genebank	Ongoing	Costing reviews	Platform management	Visits per Center planned in 2018-2020	2017: IRRI 2018: CIAT, CIMMYT, CIP, ICARDA 2019: ICRISAT, ILRI, ICRAF, Bioversity 2020: AfricaRice, IITA	Report to made available in 2020
Promote the Genebank Platform communications	Ongoing	Genebank Platform website actively maintained and promoted. Facebook and Flickr pages were launched in mid-2018	Science communications specialist	Annual	2019: The website received 19,637 users during 2019 who accounted for 40,037 page views. The Facebook page has more than 900 followers and monthly reaches nearly 7,500 people. The Flickr page offers 814 images. Two email newsletters were sent out in 2019.	www.genebanks.org www.facebook.com/GenebanksCGIAR/ www.flickr.com/photos/138595851@N03/
External validation of QMS	Ongoing	Technical reviews	External reviewers	Visits per Center planned in 2019-2020	2019: CIAT, CIMMYT, CIP, ICARDA, IITA, IRRI 2020: AfricaRice, Bioversity, ICRAF, ICRISAT, ILRI	Report to made available in 2020
Enhance linkages between genebank characterization and breeders' evaluation and pedigree data	Ongoing	Minting of DOIs Enriching data on collections through focal subsets	Use module	Annual	98% of accessions with DOIs Genesys has 113 subsets published and 345 characterization and evaluation datasets uploaded from CGIAR genebanks.	https://www.genesys-pgr.org/

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CGIAR Genebank Platform

CROP TRUST

CIP genebank's herbarium
Photo: Michael Major