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联合国粮食及农业组织 Food and Agriculture Organization of the United Nations Organisation des Nations Unies pour l'alimentation et l'agriculture Продовольственная и сельскохозяйственная организация Объединенных Наций Organización de las Naciones Unidas para la Alimentación y la Agricultura منظمة الأغذية والزراعة للأمم المتحدة

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Item 9 of the Provisional Agenda
INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE
Eleventh Session
Rome, 18–20 April 2023
SUBMISSIONS FROM INTERNATIONAL ORGANIZATIONS AND INSTRUMENTS

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I. INTRODUCTION

1. The Commission, at its Eighteenth Session, thanked the international instruments and organizations for providing information on their policies, programmes and activities relevant to its prioritized themes. The Commission requested its Secretary to continue seeking inputs on prioritized themes of the regular sessions from international instruments and organizations and to make them available for its information.[1]

2. In December 2022, FAO invited international organizations and instruments to report activities undertaken in relation to plant genetic resources for this session of the Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture (Working Group).

3. The reports from the Global Crop Diversity Trust[2], the International Seed Federation (ISF)[3], the International Union for the Protection of New Varieties of Plants (UPOV)[4], the CGIAR system[5], and the International Treaty on Plant Genetic Resources for Food and Agriculture[6] are presented as annexes to this document.

[1] CGRFA-18/21/Report, paragraphs 116-117.
[2] Submission of 25 January 2023
[3] Submission of 3 February 2023
[4] Submission of 3 February 2023
[5] Submission of 1 March 2023
[6] Submission on 16 March 2023

ANNEX 1

REPORT FROM THE GLOBAL CROP DIVERSITY TRUST

I. INTRODUCTION

1. Established in 2004 as an independent international organization, the Global Crop Diversity Trust (Crop Trust) operates from Bonn, Germany within the framework of the International Treaty on Plant Genetic Resources for Food and Agriculture (the Treaty), in accordance with the overall policy guidance provided by the Governing Body (GB) of the Treaty. The Crop Trust's objective, as stated in its Constitution, is "to ensure the long-term conservation and availability of plant genetic resources for food and agriculture with a view to achieving global food security and sustainable agriculture." The Crop Trust is pleased to present this report to the Eleventh Session of the Intergovernmental Technical Working Group on PGRFA.

II. SCIENTIFIC AND TECHNICAL MATTERS

A. Global crop conservation strategies

Breathing new life into the Global Crop Conservation Strategies

2. The "Breathing new life into the Global Crop Conservation Strategies" project started in July 2019, funded by the Federal Ministry of Food and Agriculture of Germany (BMEL). The Global Crop Conservation Strategies (GCCS) promote the prioritization and rationalization of conservation efforts at global level for specific genepools. The Treaty Governing Body has recognized that they are key guiding documents for collaboration among national and international genebanks (Resolution 8/2015), and for the further development of the global system of *ex situ* conservation and the Treaty's Multilateral System (MLS).

3. This project[7] is near to completing its deliverables: i.e. update five of the existing global crop conservation strategies and deliver 10 new strategies (Table 1). The selection of the crops to be covered was discussed at the beginning of the project by 23 experts from around the world and in collaboration with the Treaty Secretariat. The project mobilised communities of crop experts and other stakeholders to develop the strategies. It also used updated information on the status of crop diversity collections available through the Global Information System on PGRFA (GLIS), Genesys, the World Information and Early Warning System (WIEWS), the Global Biodiversity Information Facility (GBIF), and specifically tailored surveys.

4. Additionally, an opinion paper[8] discussing options for how to mainstream the strategies in Treaty processes was produced and discussed during two meetings in Bonn with experts and representatives of the Crop Trust, the Treaty, One CGIAR, FAO (including Commission Secretariat), the German government, and national genebanks. The key recommendations of the opinion paper are:

(1) clarify leadership, governance, and ownership over the GCCS
(2) develop new GCCS for other priority crops
(3) increase awareness of and buy-in to the GCCS
(4) make the GCCS easier to produce and to consume
(5) pivot to implementation

5. These recommendations and the discussion with stakeholders informed a new project proposal on "Mainstreaming the Global Crop Conservation Strategies in Plant Treaty Processes" that has been approved for funding by the German government (see next section).

[7] https://www.croptrust.org/science-blog/breathing-new-life-into-the-global-crop-conservation-strategies/
[8] https://doi.org/10.5281/zenodo.7548352

Crop	Lead author	Status
CUCURBITACEAE	A. Ebert	Completed
YAMS (Update)	V. Lebot	Completed
TEMPERATE FORAGES	M. Dodd	Completed
VANILLA	P. Bramel	Completed
MILLETS (Update)	P. Bramel	Completed
GROUNDNUT	D. Williams	Completed
SORGHUM (Update)	P. Bramel	Completed
EGGPLANT	S. Solberg	Completed
CAPSICUM	D. Barchenger	Completed
POTATO (Update)	M. Nagel	Completed
BRASSICA	C. Allender	Completed
PEA	M. Ambrose	Completed
SUNFLOWER	E. Drummond	Revision
CITRUS CROPS	G. Volk	Review
VIGNA (Update)	R. Nair	Preparing final layout

Mainstreaming the Global Crop Conservation Strategies in Plant Treaty Processes

6. This new three-year project started in December 2022, funded by the Federal Ministry of Food and Agriculture of Germany (BMEL), informed by the findings of the opinion paper "Towards mainstreaming Global Crop Conservation Strategies." This project aims to integrate the GCCS into the processes and decision-making of the Treaty with the specific objectives to:

(1) support evidence-based decision-making by stakeholders of the Treaty
(2) contribute to the implementation of the GCCS

7. Key project activities and outputs include:

(1) A meeting with key stakeholders to discuss the future governance structure of the GCCS. The options described in the opinion paper produced by the project "Breathing new life into the Global Crop Conservation Strategies" will be considered and the best way forward agreed.
(2) A study to identify key entry points and gaps for the GCCS with regards to the Plant Treaty's main areas.
(3) Through consultations with the Commission on Genetic Resources for Food and Agriculture, the project will identify possible synergies between the GCCS and the processes of FAO's State of the World's Plant Genetic Resources for Food and Agriculture Reports and accompanying Global Plan of Action.

(4) A white paper with recommendations on governance, development and implementation of the GCCS. This white paper will be shared at the end of 2023 with the Governing Body of the Treaty during its 10th session.
(5) Dissemination of information in relevant Plant Treaty fora.

B. Long-term conservation and availability of crop diversity

8. At the core of the Crop Trust is an endowment fund, created to provide financial security to globally important collections of crop diversity in perpetuity. Currently, the Crop Trust manages long-term agreements supported by the endowment fund and bilateral donors with 11 CGIAR genebanks, including ICRISAT and CIFOR-ICRAF, and the genebank of the Pacific Community (SPC). These collections serve an international role as crucial components of a rational, efficient and effective global system, as recognized under Article 15 of the Treaty. In addition, the Crop Trust funds the annual operating costs of the Svalbard Global Seed Vault, another key component of the global system. Since 2006, support amounting to USD 57 million has been provided by the Crop Trust endowment income and bilateral donors for the essential operations of these international genebanks.

CGIAR Genebank Platform

9. In 2017, funding for the essential operations of all 11 international genebanks managed by CGIAR under Article 15 (AfricaRice, Alliance-Bioversity, Alliance-CIAT, CIMMYT, CIP, ICARDA, ICRAF, ICRISAT, IITA, ILRI, and IRRI) was secured through a partnership between CGIAR and the Crop Trust under the CGIAR Genebank Platform. This complemented long-term funding from the Crop Trust endowment, and continued the arrangements put in place with the Genebank CGIAR Research Program (CRP), which ran from 2012-2016. The Genebank Platform[9] itself came to an end in December 2021, and CGIAR initiated the new Genebanks Initiative in January 2022. Although the Crop Trust does not play a coordinating role in the Genebanks Initiative, it was involved in its design, will continue to be a partner, and is of course continuing to provide the genebanks with long-term funding for essential operations as per existing agreements.

10. The Crop Trust developed an online reporting tool (ORT) to monitor the progress of the genebanks towards performance targets. Meeting performance targets triggers consideration for a Long-term Partnership Agreement (LPA) covering most of the costs of essential operations. All CGIAR genebanks made progress towards these targets. Although currently the only LPA is with IRRI[10], a number of additional collections are on course to reach performance targets, with CIAT and IITA approved for LPAs starting in 2023. Genesys reported a total of 822,965 accessions in the CGIAR genebanks as of 31 December 2022. The following figures on the activities of these genebanks were extracted from the Genebank Platform Report for 2021[11], as reports covering 2022 were not available at time of writing.

(1) Approximately 83 percent of accessions are immediately available for international distribution. This continues the steady increase in the availability of accessions since the Genebank CRP was launched, and it is particularly significant when the ongoing distribution and acquisition of germplasm is taken into account.
(2) Of the seed accessions, 71 percent is secured in safety duplication at two levels, and 70 percent of accessions of clonal crop collections is safety-duplicated in the form of *in vitro* or cryopreserved samples.
(3) 100 percent of the accessions have passport or characterization data accessible online, and 99 percent have a Digital Object Identifier (DOI).
(4) 96 590 germplasm samples were distributed to users in 2021; 32 130 distinct accessions were provided to users within CGIAR and 64 460 were sent to advanced research institutes and universities (51 percent), national agricultural research systems (NARS) (34 percent) and to farmers and the private sector (10 percent) in 91 countries.

[9] https://www.genebanks.org/
[10] https://www.irri.org/ar2018-worlds-rice-bowl-protected-perpetuity
[11] https://www.genebanks.org/resources/publications/2021-genebank-platform-annual-report/

11. The demand for germplasm regained its previous levels in 2021, after dropping to half the normal rate in 2020 due to the pandemic. All CGIAR genebanks and Germplasm Health Units (GHU) have been able to respond to requests and send out germplasm despite the pandemic, although in some cases the help of other units within the institute was required. During lockdowns, the focus of all genebanks, aside from keeping staff safe, was on sustaining sufficient staff in the laboratories, screenhouses and fields to carry out all operations needed to avoid the loss of accessions. These included monitoring cold rooms, subculturing *in vitro* accessions and processing harvested seed. Several CGIAR centers invested in automated irrigation equipment in 2021 to ensure that harvests were not jeopardized by restrictions on workers going into the fields.

11. The value of CGIAR genebanks was documented as part of the Genebank Impacts Fellowship program, launched in 2018 and overseen by the Crop Trust and Michigan State University. In total, twelve genebank impact fellows conducted short interdisciplinary research projects, employing quantitative and qualitative methods to enhance our understanding of the impacts of the international genebanks. Several studies were able to trace the ancestry of modern varieties adopted by farmers to specific genebank accessions and apportion benefits by drawing from extensive information on pedigrees. The outputs from the first cohort of fellowships were published in a special issue of the journal Food Security in 2020, entitled "Genebanks and Food Security in a Changing Agriculture".[12] The studies from the second cohort were published in a special issue of the journal CABI Agriculture & Bioscience in 2022, entitled "The Value of Genebanks on Farms in Developing Agriculture".[13]

CATIE

12. During the past biennium, the Crop Trust joined with the Treaty Secretariat to support the rejuvenation of the Article 15 coffee collection maintained by the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) in Costa Rica. Based on the recommendations of the global coffee conservation strategy, and a follow-up, detailed, accession-by-accession study funded by Felco SA, the collection is being moved to a new, better field site at CATIE, while making sure that all accessions are represented by adequate numbers of trees and are fully documented. This work has started with the most at-risk accessions. Support has also been provided, in close coordination with the Treaty Secretariat, to the conservation of the seed collection at CATIE, by helping to ensure the power supply for the cold room and a strategic rationalization of the collection.

Svalbard Global Seed Vault

13. The Treaty cites the need "to take appropriate steps to minimize or, if possible, eliminate threats to PGRFA" (Article 5.2) and the Second Global Plan of Action has as an objective "to provide for the planned replication and safe storage of materials not currently safety duplicated". Safety duplication is recognized by the FAO Genebank Standards for PGRFA as an essential element of good genebank practice. The Crop Trust supports the duplication under black-box conditions of crop diversity collections at the SGSV as an ultimate safety net. A ten-year agreement was signed in 2017 between the Crop Trust, the Government of Norway and NordGen for the management of the SGSV.

14. Currently, the SGSV holds 1 195 244 samples from 93 genebanks, corresponding to 1 138 genera and 5 968 species. Despite the pandemic, many genebanks still deposited a large number of accessions. In 2022, for example, 30 genebanks, four of which were first time depositors (Iraq, Lithuania, Spain and Uruguay), backed up 69 656 seed samples. 706 samples from two countries (Sudan and Bosnia and Herzegovina) were sent with support from the Crop Trust. New test samples for a 100-year seed germination experiment were deployed in the Seed Vault.

[12] https://link.springer.com/journal/12571/topicalCollection/AC_237153bc6fd0c500cecd8b578c865869
[13] https://www.biomedcentral.com/collections/genebanks-agriculture

15. Twelve of the depositors are international organizations, 69 are national genebanks and universities, two are regional genebanks (SPGRC and NordGen), five are NGOs and one is a private company. A new version of the SGSV online portal[14] was finalized in 2021.

C. Support to national genebanks

Crop Wild Relatives (CWR) Project

16. "Adapting Agriculture to Climate Change: Collecting, Protecting and Preparing Crop Wild Relatives" (the CWR Project[15]) was an 11-year project funded by the Government of Norway (via Norad), with the overall goal of collecting and conserving diversity of crop wild relatives (CWR) and facilitating its use in crop breeding for food security under climate change. Coming to an end in 2021, the project succeeded in meeting and, in some cases, surpassing its targets, despite the challenges presented by the global pandemic during its last two years. According to an external review, it has significantly contributed to advancing the implementation of the MLS, leaving behind an important legacy on which future initiatives of this kind can build. Its main achievements are listed below.

(1) During the initial research and planning phase, a comprehensive master list of 1,667 globally important CWR taxa of 173 crops (in 37 families, 108 genera and 1 392 species) was developed, along with a searchable, curated occurrence dataset containing records for 445 priority CWR taxa within the 25 genepools targeted by the project. A gap analysis, performed for 1,076 CWR species in 81 crop genepools, served as the basis for planning and implementing the second phase of the project, i.e. CWR collecting and conservation.

(2) Collecting activities were undertaken between 2013 and 2019 by 47 national partner institutions and were jointly coordinated by the Millennium Seed Bank (MSB) and the Crop Trust. A total of 4 587 seed samples of 321 species were collected from 25 genepools in 25 countries across five continents, exceeding the Project's target of 4 000 samples.[16] The MSB has thus far received 3 667 unique samples of 253 species. It has shipped onward 4 019 samples (3 279 unique accessions) of 223 species to ten international and national genebanks for multiplication, use and safety backup. All this material is in the MLS. The preliminary results of a recently conducted re-run of the gap analysis testify to the successful outcomes of the CWR collection and conservation activities. The analysis revealed that at least 40 percent of the taxa originally in the high-priority category for conservation are now better represented thanks to the collecting.

(3) There were 19 pre-breeding projects in total, involving 62 national and international partners in 34 countries. The crops included in pre-breeding were alfalfa, banana, barley, bean, carrot, chickpea, cowpea, durum wheat, eggplant, finger millet, grasspea, lentil, pearl millet, pigeonpea, potato, rice, sorghum, sunflower and sweetpotato. The evaluation projects covered 13 of the 19 project crops and involved 59 partner organizations across 38 countries. More than 14,000 CWR-derived lines were cumulatively developed across the pre-breeding projects, with the most promising of these available in national and international genebanks via the SMTA. Moreover, the outputs of the evaluation projects are now entering the breeding pipelines of project partners as well as of commercial breeders. The first CWR-derived varieties have been released, including the new drought-tolerant and high-yielding durum variety Jabal[17] in Morocco in July 2022 and the late blight-resistant potato variety CIP-Matilde[18] in Peru in August 2022. In the case of CIP-Matilde, farmers were involved from the outset, and in the case of Jabal, during variety selection.

[14] https://seedvault.nordgen.org/
[15] https://www.cwrdiversity.org/
[16] https://www.mdpi.com/2223-7747/11/14/1840
[17] https://www.croptrust.org/news-events/campaigns/jabal-durum-wheat-variety/
[18] https://www.croptrust.org/news-events/campaigns/cip-matilde-potato-variety/

(4) A partnership between the CWR Project and the James Hutton Institute in Scotland has ensured that the pre-breeding and evaluation data are presented in a format that allows easy viewing and analysis by breeders and other researchers on the Germinate platform. All the data uploads have been completed for the 14 CWR Project crops which did not already have existing data platforms.[19] Germplasm is linked to Genesys entries via DOIs.

(5) A total of 12 686 persons across 71 countries, of whom 37percent were women, received training through the CWR Project. This figure includes over 10 000 farmers who were trained in evaluating and selecting pre-bred lines derived from crosses with CWR. It also includes 211 post-doctoral researchers, graduate students (PhD and MSc) and undergraduate students within the pre-breeding and evaluation projects. A total of 174 staff from collecting partner organizations were trained at the MSB or through in-country and regional courses, as well as through a series of Seed Conservation Techniques Courses[20].

17. The CWR Project partnered with the editors at the journal Crop Science for a special issue focused on the use of CWR by project partners and others in pre-breeding and evaluation efforts aimed at adapting crops to climate change. This was published in 2021, entitled "Adapting Agriculture to Climate Change: A Walk on the Wild Side".[21] Two of these research studies have won awards for excellence.[22]

18. The mid-term review of the project[23] in 2019, and the final review in late 2021, provided important opportunities for learning and reflection as well as insights and inputs for planning its successor, the project entitled "Biodiversity for Opportunities, Livelihoods and Development" (BOLD).

BOLD

19. The BOLD Project[24] was officially launched in June 2021. This 10-year initiative is funded by the Government of Norway (via Norad). BOLD is coordinated by the Crop Trust in close partnership with the Norwegian University of Life Sciences (NMBU), and with the participation of NordGen and the Treaty Secretariat. The new Project builds on the successes, partnerships and achievements of the CWR Project. As with the CWR Project before it, BOLD receives advice from a panel of experts, which includes the Treaty Secretariat. The project is divided into the following work packages (WPs).

(1) **WP1: Capacity and Resource Development.** This element of the project will endeavor to strengthen the capacity of 15 national genebanks (prioritizing collecting partners of the CWR Project) to manage, document, conserve and duplicate crop diversity and make it available to farmers and breeders. Initial external reviews of potential partner genebanks have been completed, which will result in plans for: (1) upgrading facilities and equipment; (2) training staff on genebank operations and policies; (3) implementing genebank quality management systems (QMS); and (4) identifying and making available useful diversity. Policy training will be provided by the Treaty Secretariat. An Emergency Reserve for Genebanks[25], managed together with the Treaty Secretariat, has been established as part of this WP. It will provide urgent support to genebanks facing imminent threats. The first disbursement was made in mid-2022 to the Yemen national genebank. In 2022, technical genebank reviews were conducted in 15 partner countries (Azerbaijan, Bhutan, Cuba, Ecuador, Egypt, Laos, Lebanon, Morocco,

[19] https://germinateplatform.github.io/get-germinate/
[20] https://brahmsonline.kew.org/msbp/Training/Training
[21] https://acsess.onlinelibrary.wiley.com/doi/toc/10.1002/(ISSN)1435-0653.adapting-agri-to-climate-change
[22] https://www.croptrust.org/news-events/news/crop-science-honors-research-on-crop-wild-relatives/
[23] https://www.norad.no/om-bistand/publikasjon/2019/adapting-agriculture-to-climate-change-collecting-protecting-and-preparing-crop-wild-relatives/
[24] https://www.croptrust.org/blog/biodiversity-for-food-security-a-bold-approach/

[25] https://www.croptrust.org/project/emergency-reserve/

Pakistan, Peru, Sudan, Tanzania, Uganda, Vietnam, Yemen) to identify priority needs for equipment upgrade and staff training.

(2) **WP2: Making New Diversity Available.** Alfalfa, barley, durum wheat, finger millet, grasspea, potato and rice are the focus of this WP, which builds on the work done by pre-breeding and collecting partners in the CWR Project. WP2 will facilitate the use of new diversity of these crops by breeders and farmers for climate change adaptation and food security in partner countries. WP2 will complement the strengthened capacity of national genebank partners to conserve crop diversity addressed in WP1 by extending and advancing selected existing pre-breeding and evaluation partnerships from the CWR Project. It will include on-farm trials and other participatory approaches to ensure a more effective flow of novel crop diversity to breeders and farmers.

(3) **WP3: Genebanks and Seed Systems.** This WP comprises a research component led by the Norwegian University of Life Sciences (NMBU) to explore different, complementary ways of enabling crop diversity to be more readily accessible to farmers. Models for strengthening the connections between genebanks and national seed systems will be explored and developed. Innovative pilot efforts by national genebanks in four partner countries (Bhutan, Ecuador, Tanzania, Uganda) will then be supported to actively contribute diversity to national and regional seed systems as examples for other national programs to adopt or adapt, as appropriate.

(4) **WP4: Regeneration and Safety Duplication at the Svalbard Global Seed Vault.** Having launched a call for proposals[26] in late 2021 in coordination with the Treaty Secretariat, eligible partners were selected after two rounds of reviews. In early 2022, negotiations commenced for 53 selected proposals and agreements have been signed with 39 partners from 29 ODA countries as of January 2023.

(5) **WP5: Communications, Engagement and Outreach.** This WP will proactively communicate and celebrate BOLD achievements, highlighting the vital role of genebanks and project partners, including the SGSV, in the conservation and use of crop diversity in support of climate change adaptation and food and nutrition security. Through the use of social media, traditional media, events, blogging, audiovisual and printed products, and the development of a BOLD website, national and global campaigns will target key stakeholders, including farmers, seed system actors and policymakers. The WP will also create and leverage, over the duration of the project, a sustainable community of practice among BOLD WP1 genebanks to improve communication, outreach capacity and knowledge exchange.

Seed for Resilience Project

20. In mid-2020, thanks to the Government of Germany, the Crop Trust was able to initiate a new five-year project entitled “National Seed Collections for Climate-Resilient Agriculture in Africa” (Seeds for Resilience). The project aims to:

(1) build the capacity of key national *ex situ* collections of PGRFA in Africa
(2) strengthen links between these genebanks and users

21. The partner genebanks are as follows:

[26] https://www.croptrust.org/svalbard-grant-call-for-proposals/

Country	Genebank [Acronym] (FAO WIEWS Institute Code)	Priority crops for clearing backlogs
Ethiopia	Ethiopian Biodiversity Institute [EBI] (ETH085)	Faba bean, barley, sorghum, enset, coffee
Ghana	Council for Scientific and Industrial Research - Plant Genetic Resources Research Institution [PGRRI] (GHA091)	Cowpea, maize, rice, *Solanum* spp., cassava
Kenya	Kenya Agricultural and Livestock Research Organization - Genetic Resources Research Institute [GeRRI] (KEN212)	Sorghum, finger millet, pearl millet, cowpea, pigeon pea, *Vigna radiata*
Nigeria	National Centre for Genetic Resources and Biotechnology [NACGRAB] (NGA010)	Sorghum, okra, pearl millet, cowpea, yam
Zambia	Zambia Agriculture Research Institute - National Plant Genetic Resources Centre [ZARI-NPGRC] (ZMB048)	Beans, cowpea, sweetpotato, cassava, sorghum

22. During 2019, a systematic review process of operations was undertaken with each of the partner genebanks. These reviews gathered information about the upgrading priorities and needs of partners. Then, in 2020, the partner genebanks prepared their project workplans, with a focus on addressing existing operational backlogs, such as seed viability monitoring, regeneration, safety duplication. By 2021, all project agreements were signed and in place and first disbursements to partners were made.

23. Due to the travel and meeting restrictions in place due to the pandemic in 2020 and 2021, the project initiated a series of webinars in genebank data management (including GRIN-Global Community Edition), QMS and communications. This approach has proved effective, particularly for QMS and essential genebank management topics. Since the beginning of the project, the project has organized 44 webinars with partners.

24. As the restrictions to meet and travel were relaxed, the project conducted the first face-to-face capacity-building event in April 2022 in Ibadan, Nigeria, in coordination with IITA's Genetic Resources Center, and its first Genebank Operations and Advanced Learning (GOAL) workshop in May in Nairobi, Kenya. Finally, during May-Oct 2022, "QMS intensives" were conducted at GeRRI (Kenya), ZARI-NPGRC (Zambia), CSIR-PGRRI (Ghana) and NACGRAB (Nigeria). Facilitated in person by the Crop Trust QMS specialist, these include detailed reviews of all current genebank processes and existing standard operating procedures (SOP), followed by discussion of any identified priority gaps and deficiencies in operations.

25. Some key achievements by all project partners to date include the following:

(1) Prepared and conducted documentation audits of six SOPs: distribution, conservation, regeneration, characterization, acquisition and safety duplication.
(2) Shared data on Genesys. First-time data publishers include ZARI-NPGRC[27] (uploaded passport information on 1,203 accessions) and NACGRAB[28] (now sharing 7,699 passport records).
(3) Started establishing "user groups" in different localities and conducting field activities to expose farmers, scientists and other users to the diversity held at the genebank.
(4) ZARI-NPGRC shipped newly collected sweetpotato samples which had previously been lost for safety duplication at CIP (Peru).

[27] https://www.genesys-pgr.org/wiews/ZMB048
[28] https://www.genesys-pgr.org/partners/70c7de36-d218-444b-aa3f-636196e1d185

(5) Partners continue to clear operational backlogs with project support: regenerating samples with low seed number/low viability, preparation for safety duplication, conducting monitoring seed viability tests.

26. Key equipment to conduct genebank activities has started to be delivered to project partners. For example, NACGRAB and ZARI-NPGRC received a motor vehicle each in 2022 to ease transportation to research stations where the genebank conducts its field operations. During the first quarter of 2023, partners are expected to receive shipments of high-quality aluminum foil bags and IT equipment.

Capacity development and quality management

27. Drawing on resources from different sources, the Crop Trust and partners organized three types of major capacity-building events during the past biennium.

(1) GOAL workshops are aimed at building the capacities of national and regional genebanks to manage PGRFA in a global context in alignment with international standards. Genebank staff from 26 countries have attended 10 GOAL workshops since 2015. The pandemic only allowed one GOAL workshop during the past biennium, which was held in Nairobi in 2022 under the Seeds for Resilience project, as described above.
(2) QMS intensives provide one-on-one support in the development of SOPs, risk management, policy compliance, user satisfaction monitoring and management of equipment and infrastructure. From 2016 to 2019, QMS intensives have been conducted at 5 genebanks (WorldVeg, CePaCT, INIA (Spain), MARDI (Malaysia) and the Australian Grains Genebank); 69 genebank staff have attended QMS intensives. Again, travel restrictions due to the pandemic limited QMS intensives during the biennium to 4 in 2022, as described in the previous section.
(3) Finally, in 2021 a series of monthly webinars was organized to tackle new, speculative and provocative issues related to the role that genebanks play in the conservation and distribution of plant diversity. On average, 80 people attended the Genebank Resources on the Web (GROW) webinars[29] and a total of 952 participants attended the online events in 2021.

28. The Crop Trust continues to collaborate with FAO on the development of Practical Guides for the Application of the Genebank Standards for Plant Genetic Resources.[30]

D. Strengthening information systems for genebanks

29. Article 17.1 of the Treaty requires that Contracting Parties "cooperate to develop and strengthen a global information system to facilitate the exchange of information, based on existing information systems, on scientific, technical and environmental matters related to plant genetic resources for food and agriculture, with the expectation that such exchange of information will contribute to the sharing of benefits by making information on plant genetic resources for food and agriculture available to all Contracting Parties." Similarly, Priority Activity 15 of the Second Global Plan of Action calls for "Constructing and strengthening comprehensive information system for plant genetic resources for food and agriculture." To these ends, the Crop Trust has been strengthening its support for the development of two information systems: GRIN-Global[31] and Genesys[32]. Close collaboration with the Treaty's Global Information System (GLIS) continues to focus on building synergies and complementarities. As per the policy guidance provided in Governing Body Resolution 10/2019, the Crop Trust has been participating in the Scientific Advisory Committee of GLIS.

[29] https://www.genebanks.org/resources/grow-webinars/
[30] https://www.fao.org/documents/card/en/c/cc0023en/
[31] https://www.grin-global.org/
[32] https://www.genesys-pgr.org

GRIN-Global Community Edition

30. The Crop Trust collaborated with the US Department of Agriculture (USDA) and Alliance-Bioversity International to develop and deploy an advanced genebank data management software package, GRIN-Global, which was initially released in 2011. In 2019, work started under the Genebank Platform on the next generation of the system, called GRIN-Global Community Edition (GGCE). In 2021, the Crop Trust strengthened the team that supports genebanks in data management and publishing, including through the development and maintenance of GGCE.

31. GGCE is intended for internal use at a genebank, and focuses on supporting the daily genebank operations to simplify data acquisition and improve data quality through the use of barcoding and other information technologies. GGCE integrates with Genesys and with Easy-SMTA the and DOI Registration Service provided by the Treaty Secretariat. GGCE is in active use for genebank collection management at the World Vegetable Center and the genebank of the Alliance of Bioversity and CIAT in Colombia. We presented GGCE to 60 genebanks through webinars and workshops in 2022, and 16 genebanks are currently testing the software, with the prospect of switching to GGCE in 2023.

Genesys

32. The Crop Trust and CGIAR continued to support the development of Genesys through the Genebank Platform as a fundamental component of an effective global conservation system. Genesys has been managed by the Crop Trust since 2013, with the Treaty Secretariat participating in the advisory committee since the beginning. Genesys now allows searching data across over 4.2 million active accessions held in 463 collections. The largest providers of data (by number of accessions) to Genesys are: ECPGR, USDA NPGS (USA), Embrapa (Brazil).

33. The Crop Trust works continuously with existing data providers to help them share up-to-date information about their collections and actively promotes and encourages data publication (automated when feasible) from genebanks. About 94 percent of accessions in Genesys are up-to-date: 71 percent of 4.3M active accessions were refreshed and "confirmed" in 2022, and 23 percent were last updated in 2021 and are still considered to be up to date. Since 2022, new agreements to publish data in Genesys have been established with the following institutes: INIAP (Ecuador), AgResearch (New Zealand), CNRA (Côte d'Ivoire), NPGRC (Zambia), CSIR-PGRRI (Ghana), NARC (Nepal), EBI (Ethiopia). As of 2022, World Vegetable Centre is using Embedded Genesys to make accession data available on their website. CIFOR-ICRAF, Alliance Bioversity-CIAT, IRRI and ICBA are currently exploring this option.

34. The objectives of the three global PGR information systems (GLIS, WIEWS and Genesys) and their relationships were clarified in the document "Strengthening cooperation among global information systems on plant genetic resources for food and agriculture" (CGRFA/WG-PGR-10/21/2/Inf.1).[33] Genesys continues to automatically inform the DOI Registration Service of GLIS about any changes to passport data for registered material. This helps keep the DOI database updated without genebanks having to send separate updates to the two systems.

Supporting information management in national genebanks

35. The Crop Trust assisted national and regional genebanks in 29 countries[34] with upgrading of their IT infrastructure and information systems from 2014-2020. The work was part of the CWR Project and had a significant influence on the design and activities of the follow-up BOLD Project (see above). The BOLD Project will provide support to 15 national genebanks in information technologies and automation of genebank operations, backed by GGCE. The same approach is also taken in the

[33] https://www.fao.org/3/cb6692en/cb6692en.pdf

[34] Azerbaijan, Bhutan, Bolivia (Plurinational State of), Brazil, CATIE (Costa Rica), Chile, Colombia, Cuba, Ecuador, Guatemala, Jordan, Kenya, Lebanon, Malawi, Morocco, Myanmar, Nigeria, Pakistan, Peru, Philippines, Rwanda, SPC (Fiji), SPGRC (Zambia), Sudan, Tunisia, Uganda, United Republic of Tanzania, Uruguay and Viet Nam.

Seeds for Resilience project, where the five partner national genebanks are receiving similar support to upgrade their information infrastructure and data management.

36. To more effectively engage with genebank data managers, we initiated a Community of Practice on Genebank Data Management (CoP-DM) in 2019, then as part of the CGIAR Genebanks Platform, focused primarily on facilitating knowledge exchange on data management within the CGIAR genebank network. In 2022, we extended the membership to genebanks outside CGIAR, and we introduced additional monthly virtual meetings for the Spanish- and French- speaking communities. The CoP-DM now includes 91 staff from 21 national and international genebanks.

III. RESOURCE MOBILIZATION

37. The Crop Trust's fundraising priority continues to be the development of the endowment fund, to provide predictable and reliable in-perpetuity support to key, globally important genebanks, in line with the Crop Trust Fund Disbursement Strategy. Based on genebank costing studies, the endowment needs to yield USD 34 million annually to meet the core long-term funding needs for the essential operations of key genebanks around the world, including the Svalbard Global Seed Vault, and additional system-wide services.

38. In order to generate this level of annual income, the endowment fund needs a market value of USD 850 million, in combination with an investment strategy yielding an annual average return of 4 percent p.a. plus the rate of US dollar inflation[35]. This requires absorbing a commensurate amount of investment risk, with considerable short-term fluctuations of return to be expected. The endowment portfolio is highly diversified and structured for the long-term, and short-term market dislocations do not trigger structural changes to the asset allocation of the portfolio. The Crop Trust, as a responsible asset owner, considers environmental, social and governance (ESG) integration into its investment process to be an important component of its investment strategy, supporting its broader mission and objectives.

39. From its establishment in 2004 to 31 December 2022, the Crop Trust has received USD 253 million in donor contributions paid into the endowment. The Crop Trust has also received a EUR 50 million concessional loan from KfW (German Development Bank) in October 2017 and an additional EUR 4.4 million towards the interest on the loan. The loan and the contribution towards the interest on the loan are invested in a separate EUR Fund. In addition, the Crop Trust has received over USD 310 million from more than 25 donors to invest in 40 projects on the *ex situ* conservation and use of PGRFA.

40. The Crop Trust's fundraising efforts are overseen by both the Executive Board and the Donors' Council. The Donors' Council is composed of governments and private sector donors who contribute at least USD 25 000 or USD 250 000, respectively. The Donors' Council meets biannually and provides financial oversight and advice to the Executive Board.

41. The endowment fund has achieved significant success since the founding of the Crop Trust. However, if the endowment continued to grow at the current pace, it would not reach maturity until 2050. This is far too slow to win the race against the irretrievable loss of crop diversity to secure the world's food supply. The Crop Trust therefore aims to accelerate the growth of the endowment. After careful consideration and the completion of a feasibility study, the Crop Trust is engaging in a systematic, major fundraising initiative to support the growth of the endowment over the next seven years. This initiative is expected to help mobilize resources more quickly and provide a strategic focus both internally for staff, and externally for funders. Key areas of the Crop Trust's resource mobilization work will be strengthened, specifically donor stewardship and messaging. The initiative

[35] The maximum withdrawal in percentage (and corresponding funding items) is applied to the moving average of the endowment market value in the previous 12 quarters. Assuming a linear growth of the market value, this leads to a time-lag of 6 quarters, i.e. one and a half years after the corresponding target endowment market value has been reached

will also focus on highlighting existing partnerships and funding opportunities and showcase global impact and expertise.

42. The Crop Trust is continuing to diversify its funding sources. While public entities remain a major pillar of funding (i.e. over 95 percent of current funding contributions to the Crop Trust stem from public entities), foundations, corporations and individuals are being more systematically included in fundraising outreach. To meaningfully engage private sector actors and mobilize financial support, value propositions are being developed to highlight the risks of narrow crop diversity as well as the impact of supporting crop diversity for businesses in their field of action.

43. In addition to endowment fund giving, the Crop Trust continues to pursue time-bound funding from specific donors for specific projects. Project funding continues to address key aspects of building the global system of *ex situ* conservation and is complementary to the core funding from the endowment's investment income.These fixed-term initiatives build capacity and partnerships in the conservation, characterization, and use of crop diversity As the endowment fund builds, it is crucial to limit avoidable withdrawals, and the Crop Trust therefore continues to also seek support for the operating expenditures of genebanks, the Crop Trust Secretariat and the SGSV.

44. In line with the Treaty's Governing Body Resolution 12/2022[36], the Crop Trust continues to develop joint fundraising initiatives with Article 15 genebanks and the Treaty Secretariat in an effort to solicit endowment funding for specific collections by building upon each institution's strengths and networks.

IV. COMMUNICATION & OUTREACH

45. Fully embracing the digital era is key to the Crop Trust's communications strategy, launched in 2020. In the past biennium, the communications team has worked to strategically target audiences through its digital communications and position the institution and its partners globally in key dialogues on the importance of the conservation and use of crop diversity in a rapidly changing climate. Through strategic engagement in influential global forums, social media campaigning, a renewed focus on traditional media, and an institutional brand re-fresh (including a new institutional website and project subsites), the Crop Trust has significantly increased reach, followers and media placements in key channels and outlets.

Media

46. The Crop Trust's media coverage[37] was broad, with more than 700 mentions, including exposure in major outlets and global wires: Reuters[38], Times Radio[39], New Scientist[40], The Economist, Nature Plants: Editorial[41], BBC, Sky News's Daily Climate Show, The Independent[42], and The Guardian[43] [44]. The top 5 media mentions were:

- The Guardian: Seed Banks: the Last Line of Defense Against a Threatening Global Food Crisis[45]

[36] https://www.fao.org/3/nk248en/nk248en.pdf
[37] https://www.croptrust.org/news-events/in-the-media/
[38] https://news.trust.org/item/20220328114910-rn628/
[39] https://www.croptrust.org/news-events/in-the-media/lucy-fisher-and-stig-abell-with-times-radio-breakfast/
[40] https://www.newscientist.com/article/2321492-global-food-crisis-is-leaving-millions-hungry-but-there-are-solutions/
[41] https://www.nature.com/articles/s41477-022-01166-2
[42] https://www.independent.co.uk/voices/food-prices-increase-crop-diversity-global-south-b2064335.html
[43] https://www.theguardian.com/environment/2022/apr/15/seed-banks-the-last-line-of-defense-against-a-threatening-global-food-crisis
[44] https://www.theguardian.com/food/ng-interactive/2022/apr/14/climate-crisis-food-systems-not-ready-biodiversity
[45] https://www.croptrust.org/news-events/in-the-media/seed-banks-the-last-line-of-defense-against-a-threatening-global-food-crisis/

- New Scientist: Global Food Crisis is Leaving Millions Hungry, But There are Solutions[46]
- Reuters: Ukraine's Giant Seed Bank at Risk of Being Lost as War Rages[47]
- Gizmodo: Climate Change Is Shifting How Plants Evolve. Seed Banks May Have to Adapt, Too[48]
- Independent: Food Prices Are on the Rise – And the Global South Will Be Hit Hardest[49]

Online presence

47. The new institutional website launched in May 2022. The site includes a news hub (*The Crop Diversity Digest*[50]), and a new monthly newsletter (*The Dish*[51]) that rounds up the latest information on PGRFA conservation and use from around the world, and shares institutional, project and partner news. The Crop Trust launched a video celebrating the CWR Project in 2021. Two project subsites and two new videos are due to launch in 2023.

48. With a new focus on coordinated social media campaigning, the Crop Trust social media channels grew significantly: Twitter +31 percent, Facebook +210 percent, LinkedIn +157 percent, Instagram +95 percent (for the period June 2021-June 2022). Combined, the Crop Trust currently reaches more than 1 million people monthly.

49. In addition, the Crop Trust launched a YouTube channel[52] as our institutional home for all video content, including for the scientific community, such as GROW webinar and Genesys trainings. The channel had a total watch time of 335 hours over the last year. In support of BOLD outreach, a recent campaign promoted the new Jabal durum wheat variety[53]: the Crop Trust video reached almost half a million people on Instagram, reaching more than 700 000 people on Facebook, with 12 000 clicks to the campaign page on the Crop Trust website.

Key moments

50. Recent outreach highlights include:

- a series of online expert panel discussions in collaboration with the Treaty Secretariat[54]
- two side events during the Ninth Session of the Treaty's Governing Body[55]
- the promotion of the fifth call for proposals for the Treaty's Benefit-Sharing Fund
- the launch, in collaboration with the Treaty Secretariat, of the Emergency Reserve for Genebanks: Adapting Agriculture to Climate Change[56]
- the GLF event Building Resilient Food Systems Through Greater Biodiversity[57]

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[46] https://www.croptrust.org/news-events/in-the-media/global-food-crisis-is-leaving-millions-hungry-but-there-are-solutions/
[47] https://www.croptrust.org/news-events/in-the-media/ukraines-giant-seed-bank-at-risk-of-being-lost-as-war-rages/
[48] https://www.croptrust.org/news-events/in-the-media/climate-change-is-shifting-how-plants-evolve-seed-banks-may-have-to-adapt-too/
[49] https://www.croptrust.org/news-events/opinions/food-prices-are-on-the-rise-and-the-global-south-will-be-hit-hardest/
[50] https://www.croptrust.org/news-events/
[51] https://www.croptrust.org/news-events/subscribe/
[52] https://www.youtube.com/c/croptrust
[53] https://www.croptrust.org/news-events/campaigns/jabal-durum-wheat-variety/
[54] https://www.fao.org/plant-treaty/overview/partnerships/international-expert-panel/en/
[55] https://www.croptrust.org/news-events/events/gb-9-side-event-safeguarding-crop-diversity-in-an-unpredictable-world/
[56] https://events.globallandscapesforum.org/agenda/climate-2021/06-november-2021/it-starts-with-a-seed-adapting-agriculture-to-climate-change/
[57] https://events.globallandscapesforum.org/agenda/biodiversity-2020/28-october-2020/harnessing-the-power-of-nature-building-resilient-food-systems-through-greater-agrobiodiversity/

- the GLF event Harnessing Crops' Potential for Drylands Restoration and Climate Change Adaptation[58]
- the GLF Climate event Food Forever: Climate-proofing Our Crops for Future Generations[59], which was viewed over 60 000+ times, with Stefan Schmitz's keynote speech gaining over 100 000 views[60] [61]
- the Crop Trust's inaugural Crop Diversity Day[62] in Bonn
- the launch of a tree diversity report in collaboration with BGCI and CIFOR/ICRAF[63]

51. Collaboration with the FAO Commission included participation in the International Multi-stakeholder Symposium on Plant Genetic Resources for Food and Agriculture, and contribution to the proceedings[64].

52. Crop Trust Executive Director Stefan Schmitz participated in high-profile panels at UNFCCC COP27[65] and the Norman E. Borlaug International Dialogue of the World Food Prize[66]. Crop Trust staff also participated in the United Nations Food Systems Summit[67], the World Biodiversity Summit, the Second International Agrobiodiversity Congress[68], and the Convention on Biological Diversity COP15[69].

53. In the context of two major projects, Seeds for Resilience and BOLD, in 2021 the Crop Trust launched the first Communications Community of Practice for genebanks to support staff in partner national genebanks to share knowledge and communicate effectively with stakeholders. Activities will include the enhancement of the online strategy and presence of genebanks, and the production of communications materials.

54. The Crop Trust continued to collaborate closely with SGSV partners on various communications initiatives, including on social media. These included:

- a podcast[70]
- a major outreach effort in coordination with the Treaty for the SGSV call for proposals[71] in 2021, including a video[72]
- press releases and opinion pieces around each deposit[73]
- lightning talks with Stefan Schmitz, Daniel van Gilst, and the Norwegian Minister of International Development, Anne Beathe Tvinnereim, at the February 2022 deposit[74]

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[58] https://events.globallandscapesforum.org/agenda/africa-2021/02-june-2021/biodiversity-for-resilience-harnessing-crops-potential-for-drylands-restoration-and-climate-change-adaptation/
[59] https://events.globallandscapesforum.org/agenda/climate-2022/11-november-2022/food-forever-climate-proofing-our-food-for-future-generations/
[60] https://youtu.be/dKbKgVvq2nU
[61] https://youtu.be/YPSUOxwjw3w
[62] https://www.croptrust.org/news-events/events/crop-diversity-day-2022/
[63] https://events.globallandscapesforum.org/agenda/climate-2022/12-november-2022/tree-diversity-for-climate-change-adaptation-and-food-system-resilience/
[64] https://www.fao.org/documents/card/en/c/CB3683EN/
[65] https://www.youtube.com/watch?v=6CoRkej7Rtc
[66] https://www.youtube.com/watch?v=q8L9kAXY0rU
[67] https://www.un.org/en/food-systems-summit
[68] https://www.eatgrowsave.org/
[69] https://www.croptrust.org/news-events/events/cbd-cop-15/
[70] https://www.corteva.com/resources/feature-stories/growing-debate.html
[71] https://www.croptrust.org/news-events/news/deadline-extended-for-grant-proposals-to-safeguard-seeds-in-svalbard/
[72] https://www.youtube.com/watch?v=WwyZgw6qVoI&t=9s
[73] https://www.croptrust.org/blog/take-a-look-inside-the-latest-svalbard-global-seed-vault-deposit/
[74] https://www.youtube.com/watch?v=9dQM7JiESUE&t=1s

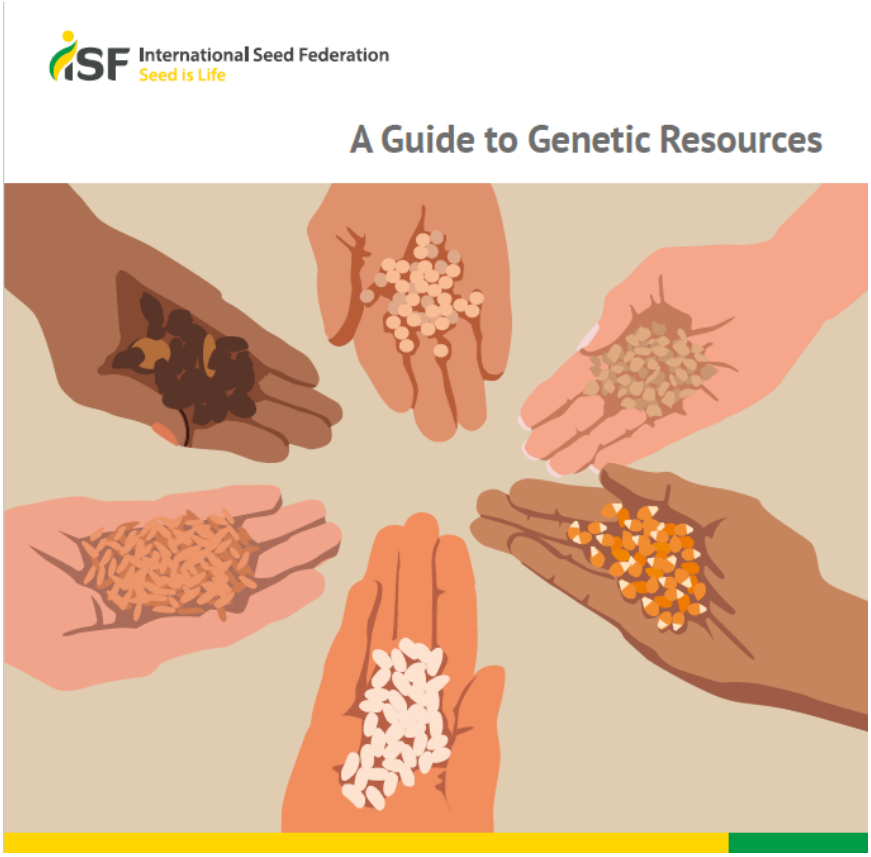
ANNEX 2

REPORT FROM THE INTERNATIONAL SEED FEDERATION

A REPORT PREPARED BY THE INTERNATIONAL SEED FEDERATION TO HIGHLIGHT THE APPROPRIATENESS OF REGULATING ACCESS TO AND THE BENEFIT SHARING RESULTING FROM THE USE OF DIGITAL SEQUENCE INFORMATION (DSI) AND THE ROLE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE IN MITIGATION OF AND ADAPTATION TO CLIMATE CHANGE

1. The International Seed Federation (ISF) (www.worldseed.org) represents the global seed industry through 56 national seed associations representing 7 500 companies and its vision is to build "*A world where the best quality seed is accessible to all, supporting sustainable agriculture and food security*". Through its mission "*to create the best environment for the global movement of seed and promote plant breeding and innovation in seed*", ISF "*promotes the International Treaty as the preferred tool to administer Plant Genetic Resources for Food and Agriculture (PGRFA).*"

2. ISF recognizes the importance of the conservation of plant genetic resources for food and agriculture (PGRFA) and the role they play in addressing global challenges, such as a growing population, climate change, biodiversity loss, poverty alleviation, and food security. To help its members and the public to understand the importance of genetic resources, ISF developed in 2019 a discussion guide available here: https://www.worldseed.org/wp-content/uploads/2020/04/genetic_broch_17avril.pdf



3. In addition to this guide, the seed sector has been actively engaged in voluntary benefit sharing activities and has gathered examples of the voluntary engagement of its members: https://www.euroseeds.eu/seeding-benefits/.

4. ISF is providing this report to the Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture to share ideas and concerns related to "Digital sequence information" (DSI) on plant genetic resources for food and agriculture (item 7 of the Provisional

Agenda) and "The role of plant genetic resources for food and agriculture in mitigation of and adaptation to climate change" (item 5 of the Provisional Agenda).

I. DIGITAL SEQUENCE INFORMATION

5. The debate on DSI began within the Convention on Biological Diversity (CBD) and its Nagoya Protocol, and was then taken up within bodies under the FAO. It became a roadblock to progress within the negotiations on the enhancement of the multilateral system of the ITPGRFA.

6. The recent decision of the 15th COP MOP "to establish […] a multilateral mechanism for benefit-sharing from the use of digital sequence information on genetic resources including a global fund" is of concern for the seed sector.

7. The annex to the decision outlines many issues that should be further considered for the establishment of this multilateral benefit sharing mechanism and the relationship between digital sequence information and physical genetic resources related to plant genetic resources for food and agriculture is not clear.

8. The seed sector has expressed during the past years its concerns around the regulation of DSI under an international access and benefit sharing framework. We believe regulation would negatively impact the benefits currently being realized through freely accessible DSI from public databases. Importantly, many of the benefits from sharing non-confidential information on conservation, pest management, scientific education, public-private partnerships, and other uses of genetic resources would be put in jeopardy.

9. Thus, we are urging the Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture, as well as the Commission on Genetic Resources for Food and Agriculture to follow closely the developments of this new multilateral benefit sharing mechanism under the Convention on Biological Diversity to ensure that users of plant genetic resources for food and agriculture are not negatively impacted by multiple regulations.

To sustain benefits, proceed with caution

10. Aware of the need of some countries to generate benefits arising from the use of any form of genetic resources, ISF would like to remind Parties of the many benefits of the current open access to DSI.

11. Open access to DSI in public databases helps address food security, the conservation of biodiversity, environmental and human health problems through monitoring and early detection, education and other capacity building programs, and sustainable agriculture challenges to name a few.

12. ISF is seeking constructive dialogue and ideas on how to maintain, strengthen and continually enable even greater access to DSI for the benefit of human health and the environment.

Unrealistic expectations for monetary payments do not justify the administrative and opportunity costs associated with vaguely conceived, largely un-enforceable access and benefits sharing approaches.

II. THE ROLE OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE IN MITIGATION OF AND ADAPTATION TO CLIMATE CHANGE

"Climate change is threatening to push the number of hungry even higher in the decades to come, due to new challenges to agriculture and food production. Temperatures across the world could rise up to 6°C by 2050. The main challenges from climate change to agriculture and food production are the more frequent and severe drought and floods, and higher pressure from insects and diseases."

The Global Partnership Initiative for Plant Breeding Capacity Building (GIPB) is a multi-partner platform convened by FAO https://www.fao.org/3/at911e/at911e.pdf

The development of new and improved climate-proof plant varieties, which are, for example, more drought or flood tolerant or disease and pest resistant, play a central role in increasing sustainability, meeting the adaption needs of agriculture, reducing dependency on pesticides and making the food system more resilient.

13. "The world's farmers must have access to seeds for more productive, nutritious and climate-resilient crop varieties if they are to produce the 50 percent more food needed for a global population predicted to reach ten billion by 2050", the Food and Agriculture Organization of the United Nations (FAO) said in November 2021 at the occasion of the Global Conference on Green Development of Seed Industries: https://www.fao.org/events/detail/global-conference-on-green-development-of-seed-industries/en .

14. The Conference provided a forum of exchanges on the role of the breeding sector in the coming years to mitigate the effect of climate change. One of the recommendation made to FAO members is to "breed a diverse portfolio of well-adapted, progressively superior crop varieties, which are more nutritious, produce higher yields with fewer external inputs, are resistant to biotic and abiotic stresses, fit the farming systems and satisfy the needs of consumers and end-users under worsening climate change scenarios;" https://www.fao.org/3/ni993en/ni993en.pdf.

15. Aware of its role, the seed sector, private and public, represented by the ISF, would like to reiterate its engagement in providing better adapted, climate-resilient varieties to farmers all around the world. However, plant breeding is a long-term process that requires long-term investment from public institutions and from private companies. Plant breeders need a regulatory environment that promotes innovation and supports the conservation and utilization of genetic resources.

By valuing, protecting, conserving and using genetic resources, we can adapt our existing plants, making them better: more resilient, more nutritious, more productive with fewer inputs.

16. Genetic resources are the raw materials that breeders use to develop improved seeds. As new opportunities and challenges emerge, plant breeders must continue drawing upon genetic resources whose diversity of characteristics will help to further adapt and improve seeds that serve the diverse needs in each part of the world. The ability to improve seeds is more important now than ever.

17. At the International Union for the Protection of New Varieties of Plants (UPOV) seminar on the role of plant breeding and plant variety protection in enabling agriculture to mitigate and adapt to climate change in October 2022, it was once more outlined that climate change is increasingly affecting everyone around the world: farmers, breeders and consumers. The effects of climate change are biotic (new pests and diseases) and abiotic (heat, drought, rain, seasonal changes). A range of strategies is needed to respond to the challenges and plant breeding has a vital role to play in these strategies as farmers need new plant varieties to adapt to climate change but also to sustainably

increase productivity to minimize climate change. More findings on the seminar are available here: https://www.upov.int/meetings/en/details.jsp?meeting_id=71391.

18. The development of new and improved climate-proof plant varieties, which are, for example, more drought or flood tolerant or disease and pest resistant, play a central role in increasing sustainability, meeting the adaption needs of agriculture, reducing dependency on pesticides and making food systems more resilient.

19. ISF and its members have formalized their engagement for farmers, sustainable food systems and combatting climate changes by a very active contribution to United Nations Food System Summit in 2021, which represented an important opportunity to build a shared understanding and solutions in pursuit of a global food system that contributes to the achievement of all 17 Sustainable Development Goals (SDGs).

SDG 13 - Take urgent action to combat climate change and its impacts

13 CLIMATE ACTION

NOTE that more than one quarter of the world's greenhouse gas emissions come from agriculture, forestry, and land-use change, and that - without action - these emissions are likely to increase as the global population grows;

NOTE that agricultural emissions must be reduced by two-thirds from 2010 levels in order to keep global temperature rise to less than 2°C;

NOTE that farmers are also impacted by climate change, which brings unstable weather patterns, disease, pests, and extreme weather events, such as droughts and flooding;

THE SEED SECTOR CAN HELP FARMERS ADAPT TO CLIMATE CHANGE

ASSERT that the seed sector can help reduce agricultural emissions by breeding crop plants to better capture carbon, for example, by developing plants with extensive root systems;

ASSERT that the seed industry can help farmers adapt to climate change by developing crops that are more resistant to drought and other symptoms of a changing climate.

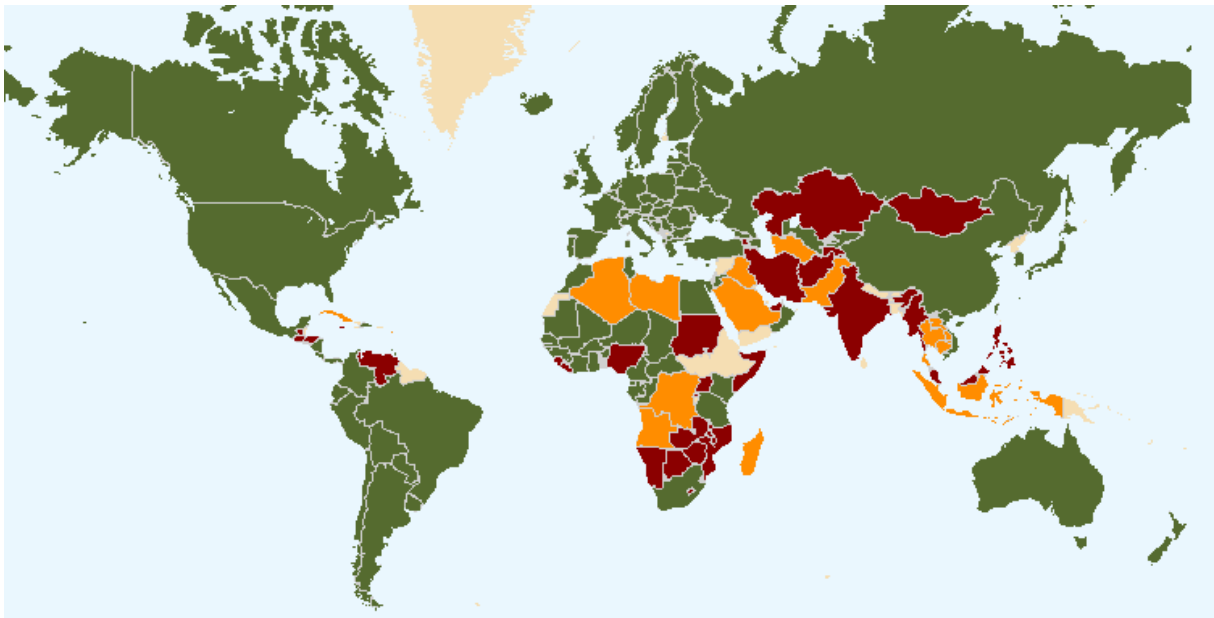
20. More information on the Declaration of the Seed Sector and its contribution to the Sustainable Development Goals here: https://worldseed.org/seed-sector-declaration/. For more information, please contact the ISF Secretariat at h.khanniazi@worldseed.org.

ANNEX 3

REPORT FROM THE INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS

I. INTRODUCTION

21. The International Union for the Protection of New Varieties of Plants (UPOV) was established in 1961 by the International Convention for the Protection of New Varieties of Plants (UPOV Convention). The mission of UPOV is to provide and promote an effective system of plant variety protection, with the aim of encouraging the development of new varieties of plants, for the benefit of society. As of January 31, 2023, UPOV has 78 members (shown in green). Nineteen States and 1 intergovernmental organization have initiated the procedure for acceding to the UPOV Convention (shown in brown), and 24 States and one intergovernmental organization have been in contact with the Office of the Union for assistance in the development of laws based on the UPOV Convention (shown in orange):



The boundaries shown on this map do not imply the expression of any opinion whatsoever on the part of UPOV concerning the legal status of any country or territory.

22. Details are provided in the Annex to this report and in the list of UPOV members available at http://www.upov.int/members/en/.

23. The UPOV Convention provides the basis for members to encourage plant breeding by granting breeders of new plant varieties an intellectual property right: the breeder's right (see http://www.upov.int/upovlex/en/upov_convention.html).

24. The UPOV Convention specifies the acts that require the breeder's authorization in respect of the propagating material of a protected variety and, under certain conditions, in respect of the harvested material. UPOV members may also decide to extend protection to products made directly from harvested material, under certain conditions.

25. In order to obtain protection, the breeder needs to file individual applications with the authorities of UPOV members entrusted with the task of granting breeders' rights. The directory of the PVP Offices of the UPOV members is available at http://www.upov.int/members/en/pvp_offices.html. UPOV has developed UPOV PRISMA, an on line tool to assist with plant variety protection (PVP) applications in participating UPOV members. At the time of this report, 36 UPOV members participated in UPOV PRISMA, including the European Union and the African Intellectual Property Organization. More information is available here https://www.upov.int/upovprisma/en/index.html.

26. A State or intergovernmental organization that wishes to become a UPOV member needs to seek the advice of the UPOV Council in respect of the conformity of its laws with the provisions of UPOV Convention. This procedure leads, in itself, to a high degree of harmony in those laws, thus facilitating cooperation between members in the implementation of the system. Guidance documents on how to develop legislation and become a UPOV member can be found at http://www.upov.int/upov_collection/en/. The legislation of UPOV members can be consulted in UPOV Lex at http://www.upov.int/upovlex/en/.

27. The main objectives of UPOV are, in accordance with the UPOV Convention, to:

- provide and develop the legal, administrative and technical basis for international cooperation in plant variety protection;
- assist States and organizations in the development of legislation and the implementation of an effective plant variety protection system; and
- enhance public awareness and understanding of the UPOV system of plant variety protection.

28. The effectiveness of the UPOV system of plant variety protection is enhanced by the provision of guidance and information materials such as Explanatory Notes ("UPOV/EXN" series), Information Documents ("UPOV/INF" series), the General Introduction to the Examination of Distinctness, Uniformity and Stability and the Development of Harmonized Descriptions of New Varieties of Plants, with its associated TGP documents, and the "Guidelines for the Conduct of Tests for Distinctness, Uniformity and Stability". Such materials provide the basis for harmonization and, thereby, facilitate cooperation between UPOV members (http://www.upov.int/upov_collection/en/).

29. Further measures to support and enhance cooperation between members include the UPOV PRISMA PBR Application Tool (http://www.upov.int/upovprisma/en/index.html), information available in the PLUTO Plant Variety Database (http://www.upov.int/pluto/en/) and in the GENIE database (http://www.upov.int/genie/en/).

II. UPOV AND PLANT GENETIC RESOURCES

30. UPOV considers that plant breeding is a fundamental aspect of the sustainable use and development of genetic resources. It is of the opinion that access to genetic resources is a key requirement for sustainable and substantial progress in plant breeding. The concept of the "breeder's exemption" in the UPOV Convention, whereby acts done for the purpose of breeding other varieties are not subject to any restriction, reflects the view of UPOV that the worldwide community of breeders needs access to all forms of breeding material to sustain greatest progress in plant breeding and, thereby, to maximize the use of genetic resources for the benefit of society.[75]

31. The following paragraphs report on some recent areas of cooperation between UPOV and the Commission on Genetic Resources for Food and Agriculture (CGRFA) and the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA).

Commission on Genetic Resources for Food and Agriculture

32. The Office of the Union attended by electronic means the Eighteenth Regular Session of the Commission on Genetic Resources for Food and Agriculture, held from 27 September to 1 October 2021 (CGRFA/18).

International Treaty on Plant Genetic Resources for Food and Agriculture

33. The Office of the Union attended the Ninth Session of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (GB-9), held from 19 to 24 September 2022, in New Delhi, India.

Other developments

[75] See http://www.upov.int/export/sites/upov/news/en/2003/pdf/cbd_response_oct232003.pdf)

34. At its fifty-sixth ordinary session, held in Geneva on October 28, 2022, the UPOV Council noted that consideration will be given by members of the Union to planning a symposium on interrelations between the Convention on Biological Diversity (CBD), the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) and the International Convention for the Protection of New Varieties of Plants (UPOV Convention) in 2024.

35. On January 13, 2023, UPOV published a video "Diversity in Tomato" on how plant breeding has increased diversity in tomato https://www.upov.int/about/en/benefits_upov_system.html.

III. GENERAL DEVELOPMENTS IN UPOV

New Members

36. **Saint Vincent and the Grenadines** deposited its instrument of accession to the UPOV Convention on February 22, 2021, and became the seventy-seventh UPOV member on 22 March 2021.

37. **Ghana** deposited its instrument of accession to the UPOV Convention on 3 November 2021, and became the seventy-eighth UPOV member on 3 December 2021.

Examination of laws or draft laws

38. The Council of UPOV, on 29 July 2020, by correspondence, took a positive decision on the conformity of the "Draft Law on Plant Variety Protection of the United Arab Emirates" ("Draft Law") with the 1991 Act of the UPOV Convention, which allows the **United Arab Emirates**, once the Draft Law is adopted with no changes and the Law is in force, to deposit its instrument of accession to the 1991 Act.

39. The Council of UPOV, on 28 July 2020, by correspondence, took a positive decision on the conformity of the "Draft Plant Breeders Rights Act of Zimbabwe" ("Draft Act") with the 1991 Act of UPOV Convention, which allows **Zimbabwe**, once the Draft Act is adopted with no changes and the Law is in force, to deposit its instrument of accession to the 1991 Act.

40. The Council of UPOV, at its fifty-fifth ordinary session, held on 29 October 2021, took a positive decision on the conformity of the New Plant Varieties (Rights of Breeders) Bill, 2021, of **Jamaica** ("Draft Law") with the provisions of the 1991 Act of the UPOV Convention, which allows Jamaica, once the Draft Law is adopted with no changes and the Law is in force, to deposit its instrument of accession to the 1991 Act.

41. The Council of UPOV, at its fifty-sixth ordinary session, held on 28 October 2022, took a positive decision on the conformity of the Draft Law on the Protection of Varieties of Plants of **Armenia** with the provisions of the 1991 Act of the UPOV Convention, which allows Armenia, once the Draft Law is adopted with no changes and the Law is in force, to deposit its instrument of accession to the 1991 Act.

42. The Council of UPOV, on 25 August 2021, by correspondence, noted the developments on the Plant Variety Protection Act, 2021 of **Nigeria** and reaffirmed its 2019 decision on conformity with the 1991 Act of the UPOV Convention, allowing Nigeria to become a UPOV member.

Development of new varieties

43. By encouraging the development of new varieties of plants, the UPOV system encourages the use of genetic resources for the benefit of society and adds to diversity.

44. A record number of 25 135 plant variety protection applications were filed in the UPOV members in 2021, representing a rise of 12 percent compared to 2020. The number of titles issued increased by 8.7 percent from 2020 to 15 081 in 2021.

45. From the establishment of UPOV to the end of 2021, more than 331 000 titles for new plant varieties had been issued by UPOV members. More than 187 000 of those titles are no longer in force, meaning those varieties can be grown without the breeder's authorization.

Events

46. On 20 October 2021, UPOV organized a seminar on strategies that address policies involving plant breeding and plant variety protection. The Seminar was attended by 132 participants from 45 members of the Union and 13 observers. The proceedings and a video of the seminar are available at https://www.upov.int/meetings/en/details.jsp?meeting_id=64550.

47. On 11, 12 and 26 Octber 2022, UPOV organized a seminar on the role of plant breeding and plant variety protection in enabling agriculture to mitigate and adapt to climate change. Over 450 participants registered for the Seminar. A video of the seminar is available at https://www.upov.int/meetings/en/details.jsp?meeting_id=71391.

48. The ongoing UPOV distance learning courses DL-205 "Introduction to the UPOV System of Plant Variety Protection under the UPOV Convention", DL-305 "Examination of applications for plant breeders' rights", DL-305A "Administration of Plant Breeders' Rights" and DL-305B "DUS Examination", in English, French, German and Spanish, are as follows:

Study period: 8 March to 12 April 2023

The categories of participants for the UPOV distance learning courses are the following:
Category 1: Government officials of members of the Union endorsed by the relevant representative to the UPOV Council (no fee).
Category 2: Officials of observer States/intergovernmental organizations endorsed by the relevant representative to the UPOV Council (One non-fee paying student per State/ intergovernmental organization; Additional students: CHF1 000 per student)
Category 3: Others (Fee: CHF1 000)

Registration of participants in categories 1 and 2 must be accompanied by an endorsement from the representative to the UPOV Council of the UPOV member or observer, as appropriate, formally nominating the participant. More detailed information concerning the UPOV distance learning courses' content and on-line registration is provided on the UPOV website (see http://www.upov.int/resource/en/training.html).

For further information about UPOV, please contact the Office of the Union:
E-mail: upov.mail@upov.int Website: www.upov.int
Tel: (+41-22) 338 9153 Fax: (+41-22) 733 0336

MEMBERS OF THE INTERNATIONAL UNION FOR THE PROTECTION OF NEW VARIETIES OF PLANTS (UPOV) AS AT 31 JANUARY 2023

African Intellectual Property Organization[2, 4]
Albania[2]
Argentina[1]
Australia[2]
Austria[2]
Azerbaijan[2]
Belarus[2]
Belgium[2]
Bolivia (Plurinational State of)[1]
Bosnia and Herzegovina[2]
Brazil[1]
Bulgaria[2]
Canada[2]
Chile[1]
China[1]
Colombia[1]
Costa Rica[2]
Croatia[2]
Czech Republic[2]
Denmark[2]
Dominican Republic[2]
Ecuador[1]
Egypt[2]
Estonia[2]
European Union[2, 3]
Finland[2]
France[2]
Georgia[2]
Germany[2]
Ghana[2]
Hungary[2]
Iceland[2]
Ireland[2]
Israel[2]
Italy[1]
Japan[2]
Jordan[2]
Kenya[2]
Kyrgyzstan[2]
Latvia[2]
Lithuania[2]
Mexico[1]
Montenegro[2]
Morocco[2]
Netherlands[2]
New Zealand[1]
Nicaragua[1]
North Macedonia[2]
Norway[1]
Oman[2]
Panama[2]
Paraguay[1]
Peru[2]
Poland[2]
Portugal[1]
Republic of Korea[2]
Republic of Moldova[2]
Romania[2]
Russian Federation[2]
Saint Vincent and the Grenadines[2]
Serbia[2]
Singapore[2]
Slovakia[2]
Slovenia[2]
South Africa[1]
Spain[2]
Panama[2]
Sweden[2]
Switzerland[2]
Trinidad and Tobago[1]
Tunisia[2]
Turkey[2]
Ukraine[2]
United Kingdom[2]
United Republic of Tanzania[2]
United States of America[2]
Uruguay[1]
Uzbekistan[2]
Viet Nam[2]

[1] 1978 Act is the latest Act by which 17 States are bound.

[2] 1991 Act is the latest Act by which 59 States and 2 organizations are bound.

[3] Operates a plant breeders' rights system which covers the territory of its 27 member States *(Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden)*.

[4] Operates a plant breeders' rights system which covers the territory of its 17 member States *(Benin, Burkina Faso, Cameroon, Central African Republic, Chad, Comoros, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Guinea, Guinea Bissau, Mali, Mauritania, Niger, Senegal, Togo).*

States and intergovernmental organizations which have initiated the procedure for acceding to the UPOV Convention

Afghanistan, Armenia, Brunei Darussalam, Guatemala, Honduras, India, Iran (Islamic Republic of), Jamaica, Kazakhstan, Malaysia, Mauritius, Mongolia, Myanmar, Nigeria, Philippines, Tajikistan, United Arab Emirates, Venezuela (Bolivarian Republic of), Zimbabwe, as well as the African Regional Intellectual Property Organization (ARIPO).

States and intergovernmental organizations which have been in contact with the Office of the Union for assistance in the development of laws based on the UPOV Convention

Algeria, Antigua and Barbuda, Bahrain, Barbados, Cambodia, Cuba, Cyprus, El Salvador, Indonesia, Iraq, Lao People's Democratic Republic, Libya, Liechtenstein, Malawi, Mozambique, Namibia, Pakistan, Saudi Arabia, Sudan, Timor-Leste, Thailand, Tonga, Turkmenistan, Zambia, as well as the Southern African Development Community (SADC).

ANNEX 4

REPORT FROM THE CGIAR

I. INTRODUCTION

1. This report has been prepared by CGIAR in response to an invitation from the Secretariat of the FAO Commission on Genetic Resources for Food and Agriculture. It is structured to correspond, in general, to the agenda items 3-7 of the Eleventh Session of the Intergovernmental Technical Working Group on Plant Genetic Resources (ITWG-PGRFA). Some sections of this report were previously included in the CGIAR submission to the Ninth Session of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty), in September 2022; where possible, we have updated statistics (for example, genebank holdings) in those sections.

A. The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture (Agenda item 3)

2. Scientists from various CGIAR Centers were involved in the preparation of draft chapters and thematic background papers for the Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture (3rd SOW-PGRFA).

B. Status of implementation of the Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture (Agenda item 4)

In situ *conservation and on-farm management*

3. In this section we provide examples of activities in which CGIAR Centers were involved supporting *in situ* conservation and on farm management of PGRFA.

4. The Alliance of Bioversity and CIAT, in cooperation with the Plant Genetic Resources Center of the Southern African Development Community (SPGRC) coordinated the project 'Bridging agriculture and environment: Southern Africa crop wild relative regional network', supported by the Darwin Initiative. The project carried out national crop wild relatives (CWR) inventories and identified CWR hotspots at national and regional levels. It established genetic reserves in Malawi, Tanzania and Zambia. It provided training on techniques for *in situ* conservation of CWR and helped the partner countries prepare National Strategic Actions Plans. The project developed a white paper for the creation of a Regional Network for the conservation and use of CWR in the Southern African Development Community (SADC). This proposal was approved at the Joint Meeting of the SADC ministers responsible for agriculture, food security and fisheries and aquaculture. Two hundred seventy-one priority areas for *in situ* and *ex situ* CWR conservation in 13 SADC countries were identified to form part of the regional network.

5. From 2016 until 2021, CIAT, CIP and IITA, together with CIRAD, joined forces under the CGIAR Research Program Roots, Tubers and Bananas (RTB) to develop a Crop *In situ* Conservation Knowledge Base which is currently fully operational and available for any user on the website http://rtb.crop-diversity.org/. The aim of this website is to document and share knowledge about the species, landraces and genetic diversity of priority RTB crops (such as bananas, cassava, potatoes, sweetpotatoes and yams). This data can then be openly consulted, allowing for better conservation, management, and use of these resources, including for crop improvement.

6. For many years, Bioversity International has pioneered the implementation of a specific type of payments for ecosystem services, payments for agrobiodiversity conservation services or PACS, in Bolivia, Ecuador, Ethiopia, India, Malawi, Nepal, Peru and Zambia. PACS is composed of several elements that make the approach effective, including prioritization, setting conservation targets, facilitating access to threatened seed varieties, exploring value chain development for conserved varieties, and motivating and rewarding farmers for undertaking *in situ* on-farm conservation services of threatened genetic resources. In 2014, the Peruvian Ministry of the Environment decided to expand Bioversity International's small-scale applications of PACS in quinoa to several Andean locations,

first for quinoa and amaranth and then for potato. Since 2019, the Ministry has been scaling up the use of PACS in four Andean regions through the Global Environment Facility project "Sustainable Management of Agrobiodiversity and Vulnerable Ecosystems Recuperation in Peruvian Andean Regions Through Globally Important Agricultural Heritage Systems Approach". PACS interventions have been realized across 190 community groups, involving 1,630 farmers (42 percent female) involved in cultivation of tentative crops of importance for food security and climate change, including maize, potato and quinoa. Participating farmers are compensated through in-kind rewards identified by the farmer groups themselves, training, and social recognition.

7. The International Potato Center (CIP) has been developing a series of initiatives to facilitate the systematic monitoring of on-farm conserved landrace populations. First, a series of key hotspots have been identified, and CIP and partners are systematically documenting the landrace diversity in each site into baselines (e.g., CIP, 2021). These geo- and time-tagged baselines include spatial, genetic, morphological, nutritional, agronomic, red listing and ethnobotanical information about each landrace. Second, the multilevel semi-standardized methods used for generating the baselines and systematic field-level monitoring are gradually being published as part of an on-farm conservation toolbox. Each tool is described in a series of didactical flyers (e.g., CIP, 2022). Third, significant advances have been made towards involving youth in landrace monitoring through citizen science. The digital tool used is called VarScout, and the landrace observations are stored on a website called WikiPapa (see: https://wikipapa.org/). The combination of a well-established network of hotspots, robust monitoring tools and a decision support platform make it possible to conduct timeline comparisons and actively monitor the conservation status of landraces on-farm.

8. Since 2014, CIP and partners have been supporting a custodian farmers network which involves more than 100 communities from 9 regions of Peru's highlands. The Association of Potato Guardians puts farmers' rights into practice in a highly tangible way, and provides households with monetary incentives for the ecosystem services they provide (see: https://www.aguapan.org/). The association collectively conserves hundreds of landraces, many of which are also unique for the CIP genebank. AGUAPAN's benefit-sharing scheme is supported by the private sector, specifically breeding and seed companies. The association has invested in women's leadership, capacity building, the creation of a fund for medical emergencies, and a collective brand to promote a high value niche market for mixtures (see: AGUAPAN, 2020).

Ex situ *conservation*

9. Eleven Centers signed agreements with the Governing Body of the Plant Treaty in 2006, in accordance with Article 15 of the Plant Treaty. Currently, these 11 Centers conserve and make available, using the standard material transfer agreement (SMTA), a total of 712,498 accessions of crop, tree and forage germplasm. In addition, these Centers maintain approximately 17,000 accessions that are not available under the Plant Treaty's multilateral system since they are maintained under black-box or other legal conditions that don't allow for their distribution with the SMTA. Details concerning the Centers, crop collections and numbers of accessions available for distribution under the SMTA are included in Table 1.

Table 1: PGRFA conserved and made available by CGIAR Centers' genebanks pursuant to their Article 15 agreements with the Governing Body.[76]

CENTER	CROP	ACCESSIONS AVAILABLE WITH SMTA
AFRICARICE	Rice	19 696
BIOVERSITY	Banana	1 690
CIAT	Beans	37 934
	Cassava	5 965
	Forages	22 662
CIMMYT	Maize	28 694
	Wheat	123 219
CIP	Andean roots and tubers	1 178
	Potato	7 362
	Sweet potato	6 149
ICARDA	Barley	31 851
	Chickpea	15 229
	Faba bean	9 594
	Forages	25 360
	Grasspea	4 301
	Lentil	14 342
	Pea	4 591
	Wheat	43 350
ICRAF	Fruit trees	8 246
	Multipurpose trees	6 744
ICRISAT	Chickpea	20 258
	Groundnut	15 237
	Pearl millet	24 355
	Pigeon pea	13 534
	Small millets	11 683
	Sorghum	42 750
IITA	Banana	392
	Cassava	3 184
	Cowpea	17 069
	Maize	1 561
	Misc legumes	6 868
	Yam	5 809
ILRI	Forages	3 914
IRRI	Rice	127 727
	Total	712 498

[76] Global Crop Diversity Trust/CGIAR On-line Reporting Tool, covering period up to 31 December 2022.

10. Over the course of 12 years, from 2010 to 2021 inclusive, the CGIAR Centers' genebanks acquired over 123 000 samples of distinct PGRFA to include in their Article 15 collections. Approximately 65 percent of those materials (i.e., 80 000 distinct PGRFA) came from providers in 142 different countries. The remaining 35 percent came from the Centers' own breeding programs. Eighty-four percent of the materials received from countries came from developing countries or countries with economies in transition. Approximately 18 percent of these materials came from new collecting expeditions; the other 82 percent was material that was already in *ex situ* conditions prior to being sent to the Centers (Figure 1).

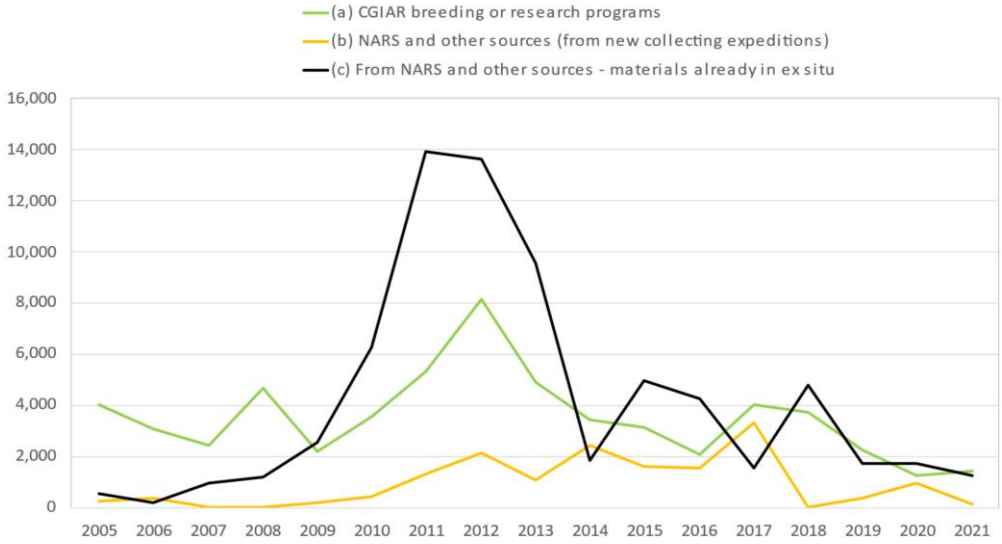


Figure 1: Numbers of distinct PGRFA acquired by CGIAR Centers' genebanks 2005-2021 from CGIAR research programs (black), from *ex situ* collections maintained by national agricultural research organizations (yellow) and from new collecting expeditions conducted by national agricultural research organizations (green)[77].

11. The materials provided by countries were of 25 crops approximately: Rice, banana, beans, cassava, wheat, barley, grasspea, pea, lentils, chickpea, faba bean, maize, potato, sweet potato, Andean tubers, finger millet, pearl millet, small millets, sorghum, pigeon pea, yam, cocoyam, cowpea, and Bambara groundnut; and also of various species of forages and trees.

12. All of the materials from providers in countries were either received under the standard material transfer agreement (SMTA) or under other agreements whereby the providers gave the Centers permission to subsequently distribute the material concerned with the SMTA.

13. Approximately one-third of the PGRFA acquired by the genebanks from providers in countries between 2010 and 2019 were associated with a project coordinated by the Global Crop Diversity Trust from 2007 to 2012 called "Securing the Biological Basis of Agriculture", funded by the Bill and Melinda Gates Foundation and the Grains Research and Development Corporation. Activities with 84 national partners in 54 countries resulted in the regeneration of approximately 73 000 threatened accessions, of which more than half were duplicated in CGIAR Centers' genebanks with permission to make them available through the multilateral system.

14. As of 2019, another 2 256 samples of 1,508 unique accessions collected from 25 countries were sent to CGIAR Centers' genebanks (ICARDA, ICRISAT, IRRI, IITA, CIP) by the Millennium Seed Bank (MSB), associated with the project called "Adapting Agriculture to Climate Change: Collecting, Protecting and Preparing Crop Wild Relatives" coordinated by the Global Crop Diversity Trust from 2011 to 2021. This project, with funding from the Norwegian government, provided

[77] Adapted from Halewood, Jamora, López et al. 2020.

financial and technical support for project partners to target and collect wild species related to crops, to create a safety back-up, and make collected material available through the multilateral system.

15. At the end of 2021, the CGIAR Genebank Platform coordinated new collecting missions in Chad, Mauritania, the Niger, Sudan, South Sudan, Togo, and Papua New Guinea. The expeditions were undertaken by NARS partners in collaboration with Bioversity, ICRISAT, IITA and ICARDA and resulted in the collecting of approximately 4 000 distinct samples of more than 30 species from over 200 sites, from which the Centers and national partners had never previously collected samples. Some of the materials collected were of crop species (such as breadfruit and traditional vegetables) that are not mandate species for CGIAR. All collected materials are being introduced as new accessions into national genebanks and CGIAR Centers' genebanks (or other relevant international genebanks for crops not maintained by the CGIAR Centers' genebanks). In all cases, they will be made available by the organizations hosting the collections using the Plant Treaty's SMTA. As part of the collecting projects, NARS scientist extension workers and farmers were trained in collecting, documenting and conserving plant genetic resources. At the same time, nearly 500 accessions were restored from CGIAR Centers' genebanks to Chad, Niger and Sudan. In addition, the Genebank Platform and the CGIAR Centers supplied equipment to national genebanks.

16. A recent updated report indicates that 781 accessions were acquired by CGIAR Centers in 2022, including crops of rice, banana, maize, legume spp, cowpea and potato from Cook Islands, Guinea, Mali, Peru, South Sudan and Togo.

17. There is considerable fluctuation, from year to year, in the ratio of materials the CGIAR Centers' genebanks send to recipients within the CGIAR (mainly breeders) and to recipients outside the CGIAR, as can be seen in Figure 2. Since 2017, the Centers' genebanks have been distributing proportionately more materials to recipients outside the CGIAR.

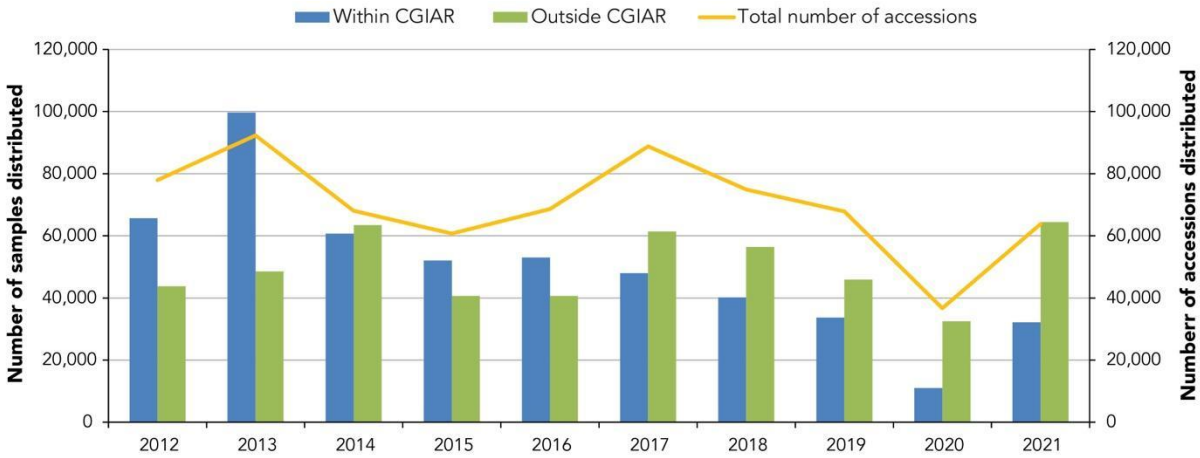


Figure 2: Samples and accessions distributed annually by CGIAR genebanks from 2012 to 2021. Source: CGIAR Genebank Platform, Annual Report 2021.

18. The CGIAR Centers have distributed over 6 million PGRFA samples under SMTAs during the 15 years they have been operating under the Plant Treaty framework. The majority of the PGRFA distributed were improved materials from the Centers' breeding programs. While it varies from year to year, 20 to 25 percent of the materials distributed are from the genebanks. Table 2 provides details of materials distributed (from both genebanks and breeding programs) by each CGIAR Center.

Table 2: CGIAR Centers' transfers of PGRFA with SMTAs, 2007 to 2021/22[78].

Center	SMTAs	Samples	From	To
AfricaRice	598	53 351	2007-03-05	2022-01-29
Bioversity	554	8 595	2007-01-24	2021-11-18
CIAT	3 077	298 291	2007-01-05	2022-02-24
CIMMYT	26 644	3 211 789	2007-03-16	2021-12-21
CIP	788	22 503	2007-01-19	2022-05-05
ICARDA	11 531	992 246	2007-02-13	2021-12-21
ICRAF	358	1 719	2011-09-03	2022-03-03
ICRISAT	6 048	297 367	2006-12-07	2021-11-26
IITA	1 172	48 891	2007-03-07	2022-02-09
ILRI	944	13 712	2007-02-22	2022-02-14
IRRI	9 317	764 594	2007-01-04	2022-02-09

19. Eighty percent of the materials referred to in Table 2 were sent to recipients in developing countries. Twenty percent were sent to recipients in developed countries. More details concerning regional distributions of PGRFA by CGIAR Centers are provided in Figure 3.

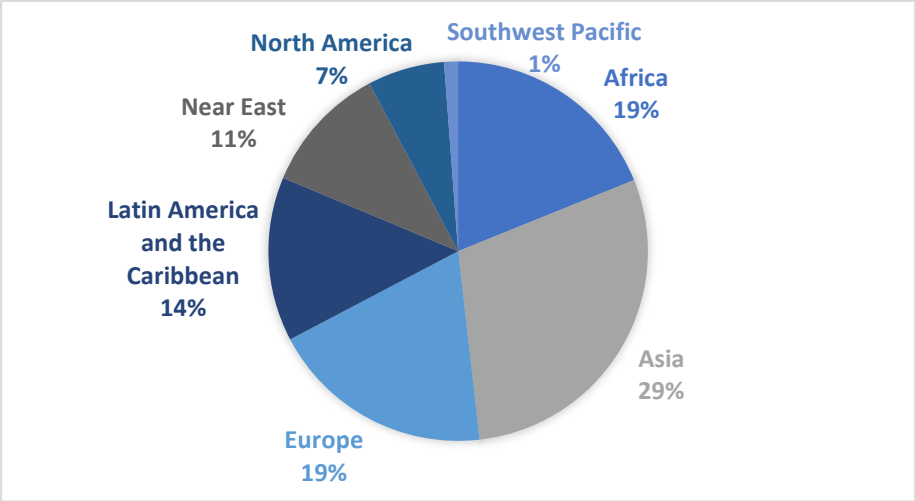


Figure 3: Regions of recipients of germplasm samples from CGIAR Centers' genebanks and breeding programs 2007-2021 inclusive.

20. Figure 4 provides percentages for each type of recipients of samples from the CGIAR Centers' genebanks for years 2019-2021, with the largest groups being advanced research institutes and universities, and NARS and national genebanks. Transfers to the commercial sector represented 13 percent, 15 and 7 percent of CGIAR Centers' genebank transfers in 2019, 2020 and 2021 respectively.

[78] Plant Treaty Secretariat. Data obtained from Easy-SMTA.

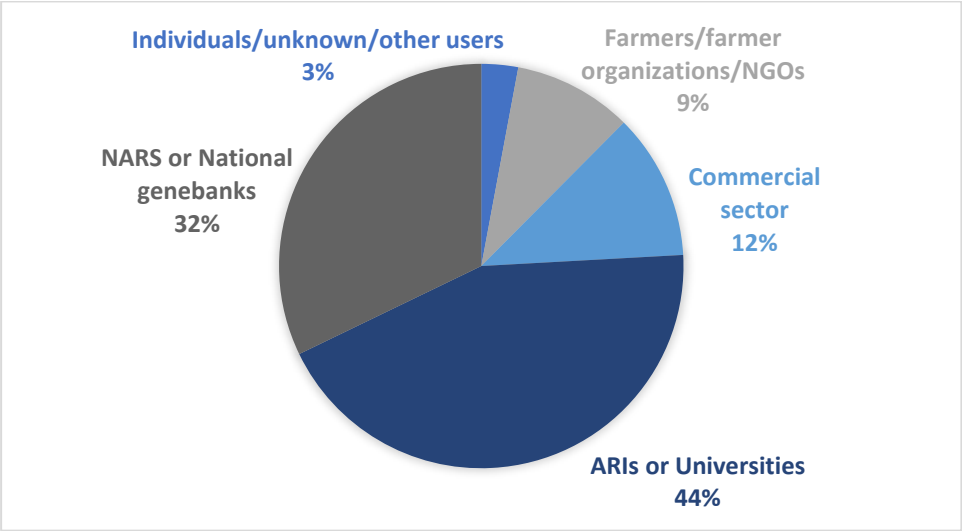
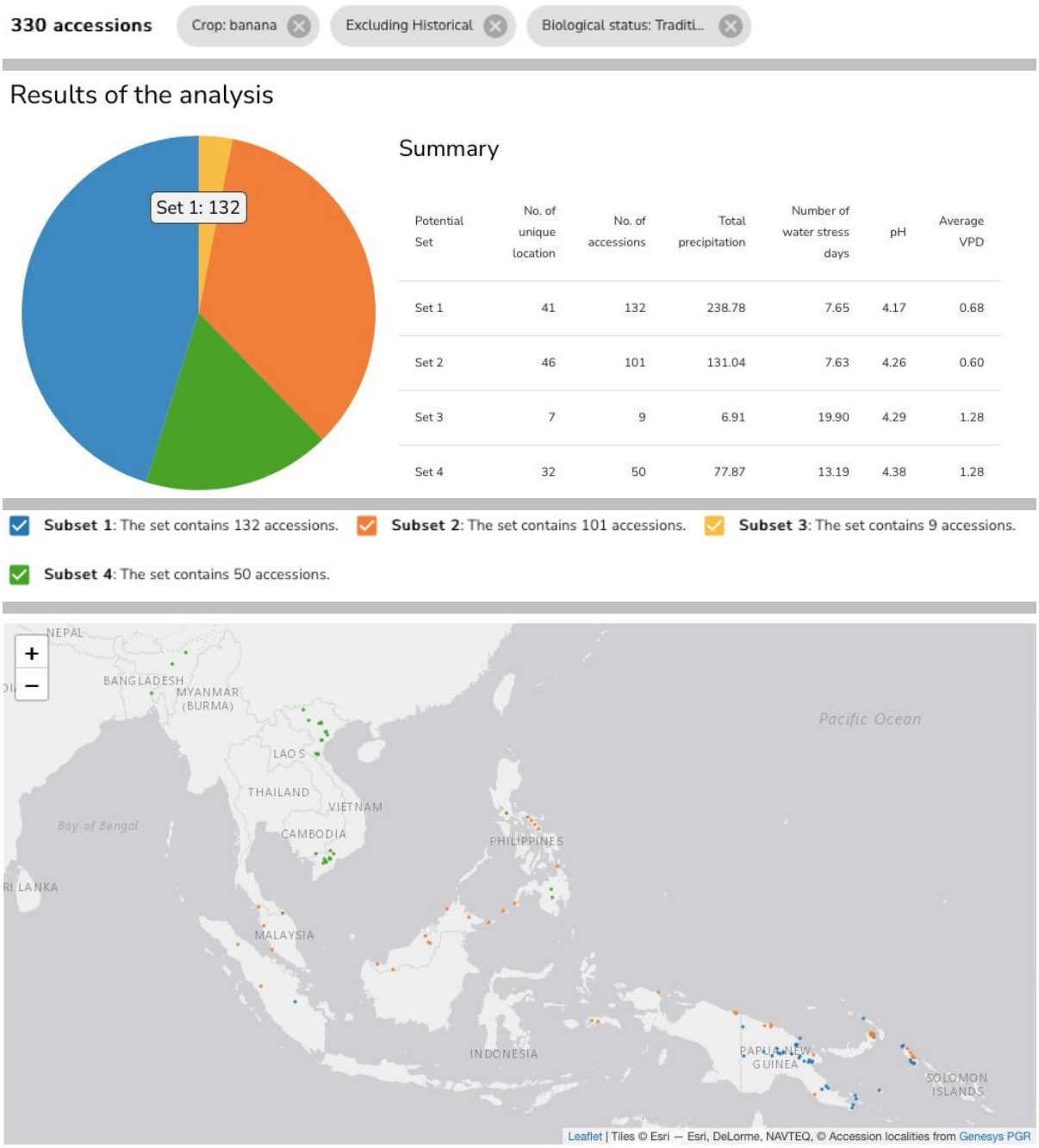


Figure 4: Types of recipients of germplasm samples distributed by CGIAR Centers' genebanks 2019-2021 inclusive.

21. CGIAR scientists have released a generic sub-setting tool that helps potential PGRFA users mine passport, climate, and soil data to identify groups (sets) of accessions that best suit their needs. In the example provided below (Figure 5), a user with interest in soil fertility and drought has selected the relevant indicators, mined all existing banana landrace collections and identified four potential subsets. Subsets 3 (in yellow, located in Tanzania – not shown on the map) and 4 (in green – in Vietnam), contain landrace accessions that were collected from relatively dry sites.



Potential Set	No. of unique location	No. of accessions	Total precipitation	Number of water stress days	pH	Average VPD
Set 1	41	132	238.78	7.65	4.17	0.68
Set 2	46	101	131.04	7.63	4.26	0.60
Set 3	7	9	6.91	19.90	4.29	1.28
Set 4	32	50	77.87	13.19	4.38	1.28

Figure 5: Subsets of banana landraces included in Genesys that were collected in places with selected climatic characteristics (total precipitation; number of water stress days, average vapor-pressure deficit-VPD) and soil characteristics (pH).

22. The tool is available to any user who creates an account on the Genesys website: https://www.genesys-pgr.org/.

23. CGIAR Centers have undertaken a series of activities, coordinated by the Global Crop Diversity Trust under the Conservation Module of the CGIAR Genebank Platform, to measure the representation of crop genetic diversity conserved ex situ, identify gaps in collections and guide and prioritize collecting expeditions. Three complementary approaches have been used and combined to identify the gaps.

24. First, diversity trees have been constructed for the gene pools of 22 crops. Each gene pool may include several crops, for example the wheat tree includes durum wheat and bread wheat. Diversity trees are available on Genesys at https://genesys-pgr.p.gitlab.croptrust.org/diversity-tree-editor/#.

25. The cowpea diversity tree is reproduced in Figure 6. The trees are developed using published literature and expert knowledge to quantify the distribution of diversity in each crop gene pool, leading to quantitative estimates of gaps by comparison with the actual composition of collections.

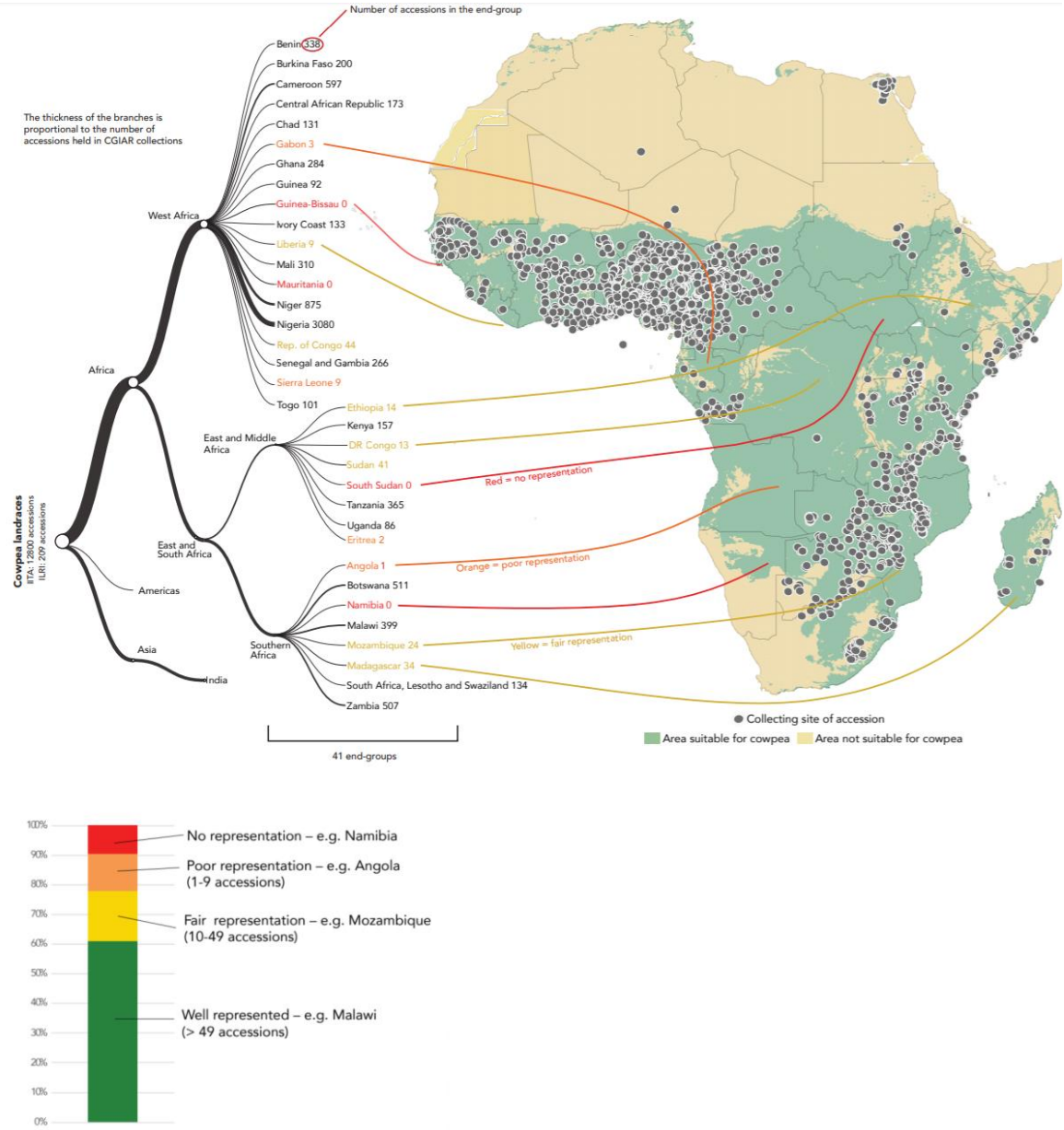


Figure 6: Cowpea diversity tree. Source: Giovannini, P. 2019. *Cowpea landrace diversity in the CGIAR collections: Finding and filling the gaps*. Poster presented at the side event entitled *Tools and Metrics for Global Priority Setting: Diversity Trees*, during the 8th meeting of the Governing Body of the Plant Treaty.

26. Second, spatial analyses have been undertaken using a method developed by CIAT to assess the eco-geographic gaps and coverage of current CGIAR crop collections. The method, which works best for collections with a high percentage of available information on the latitude-longitude of origin of accessions, builds models that help predict the geographic distribution of landraces (using spatial, climate, soil, and socio-economic data) and then compares these distributions with the locations where landraces have been collected.[79] Figure 7 shows maps of total predicted diversity for crop wild

[79] This method has been described in detail in Ramírez-Villegas et al. 2020 (Ramirez-Villegas, J., Khoury, C.K., Achicanoy, H.A., Mendez, A.C., Diaz, M.V., Sosa, C.C., Debouck, D.G., Kehel, Z., Guarino, L. 2020. A gap analysis modelling framework to prioritize collecting for ex situ conservation of crop landraces. *Biodiversity Research.* DOI: 10.1111/ddi.13046) and the results are available in the Landrace Gap Analysis dashboard: https://surveylandraces.shinyapps.io/LGA_dashboard/. All spatial analyses were published in a multi-crop peer-reviewed study: Ramirez-Villegas, J., Khoury, C.K., Achicanoy, H.A. *et al.* State of ex situ conservation of landrace groups of 25 major crops. *Nat. Plants* **8**, 491–499 (2022)

relatives and landraces globally (top map) and total diversity in need of further collecting (i.e., gaps, bottom map).

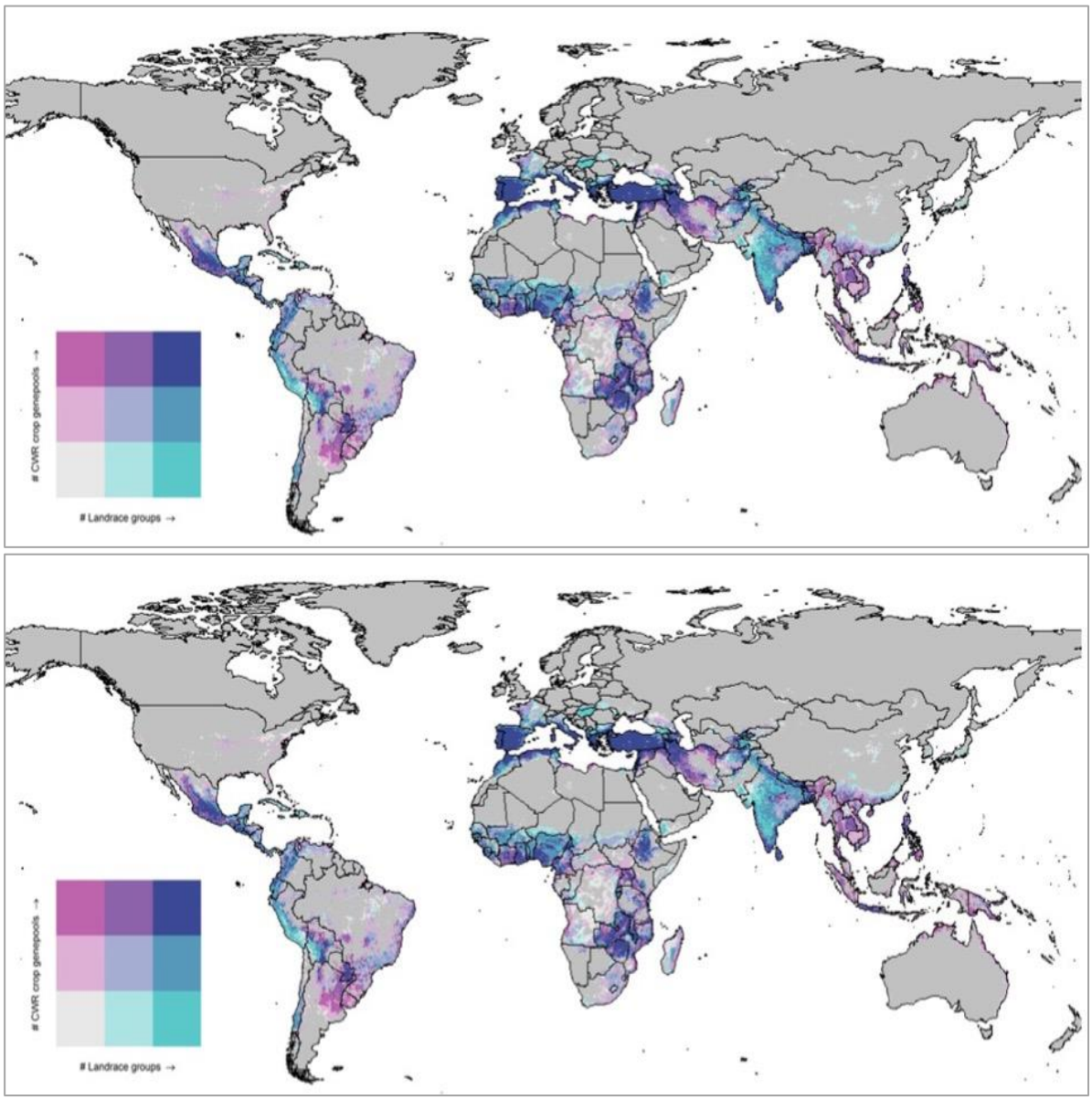


Figure 7: Total predicted diversity for crop wild relatives and landraces globally (top map) and total diversity in need of further collecting (i.e., gaps, bottom map).

27. Third, a method for trait-based gap analyses has been developed by ICARDA. This approach focuses on analysis of distribution of adaptive priority traits in relation to the environment using machine learning algorithms to make predictions. It works best where landraces have been associated with an environment where they have evolved long enough for their traits to become adaptive. This method presupposes well-characterized collections.

28. So far, at least one gap analysis method has been applied to the following crops: alfalfa, Bambara groundnut, banana/plantain, barley, beans, breadfruit, cassava, chickpea, cowpea, faba bean, finger millet, grasspea, groundnut, lentil, maize, pea, pearl millet, pigeonpea, potato, rice, sorghum, sweet potato, taro, wheat and yam; and all three methods have been applied to barley, cassava, chickpea, lentil, maize, potato, rice, sorghum and wheat, with the trait analyses focusing on selected important traits for each crop.

29. The results of these analyses have been incorporated in the updated conservation strategies for several crops. Many of the approximately 4 000 unique PGRFA collected by the CGIAR Centers and

national agricultural research organizations in late 2021, described in the section about acquisitions above, were targeted as a result of these gap analyses.

30. In 2020 and 2021, Bioversity International, CIAT, CIP and IITA (CGIAR Centers, which maintain collections of clonal crops and are currently implementing cryopreservation), and the Global Crop Diversity Trust, initiated the development of a Global Plant Cryopreservation Initiative (GPCI) to respond to a feasibility study commissioned by Bioversity International, and led by the Global Crop Diversity Trust in 2017.[80] The GPCI was presented at the meeting *Cryopreservation: A long-term strategy for hard-to-conserve PGRFA collections in a post-COVID world*, on 25 June 2021. Building on the success of cryopreservation in potato and banana, where more than 80 percent of the global in-trust collections have been safeguarded in cryobanks under strict quality guidelines, the GPCI will establish regional "Center of Cryopreservation Excellence" hubs, starting in Europe (Belgium), Latin America (Peru) and Africa (Nigeria). with the objectives to:

- Provide safety back up;
- Create regional and global communities of practice around cryopreservation;
- Expand cryopreservation to other crops, beyond potato and banana; and
- Become centers of excellence for capacity building and training.

31. The hubs will work with partners worldwide to cryopreserve germplasm collections in line with the Plant Treaty.

32. Since 2020, CGIAR scientists have provided inputs for the following global crop conservation strategies, under the coordination of the Global Crop Diversity Trust: Global strategy for the *ex situ* conservation of temperate forages; Global strategy for the conservation and use of yam genetic resources; Global strategy for the conservation and use of genetic resources of selected millets; Global strategy for the conservation of potato; Global strategy for the conservation and use of sorghum (*Sorghum bicolor (L.*) Moench) genetic resources; Global strategy for the conservation and use of pea (*Pisum sativum L.*) genetic resources; Global strategy for the conservation and use of *Vigna*.

33. In 2022, scientists from CGIAR Centers participated in the meeting 'Towards Mainstreaming Global Crop Conservation Strategies', organized by the Global Crop Diversity Trust in November 2022, and contributed to an opinion paper of the same title.[81]

Sustainable Use

34. From 2017 until 2021, breeding work in the CGIAR took place in the framework of the following CGIAR research programs: Maize, Wheat, Rice, Grain Legumes and Dryland Cereals, Roots, Tubers and Bananas, and Livestock (for forages). Some of the breeding programs' focus was dictated by the emergence and spread of new pests and diseases. Heat and drought continued to gain importance in CGIAR breeding programs for sub-Saharan Africa and South Asia. Most breeding programs integrated nutritional aspects in their work, and some of them increased their focus on traits that facilitate crop production at a market scale.

35. CGIAR scientists successfully worked with marker-assisted recurrent selection. Advancing further, through the Genomic Selection method, CGIAR scientists used genetic information of new, improved lines to predict their performance for key attributes. CGIAR scientists adapted these methodologies to resource constrained breeding programs focusing on small holder farmers in Africa, Asia and Latin America. The CGIAR breeders have demonstrated successful use of Genomic Selection in these regions, considerably reducing the operational cost of first year field evaluation testing phase, enabling evaluation of a larger number of new lines.

[80] Acker, J.P., Adkins, S., Alves, A., Horna, D. and Toll, J. (2017) Feasibility study for a safety back-up cryopreservation facility. Independent expert report: July 2017. Rome (Italy): Bioversity International. 100p. Available at https://cgspace.cgiar.org/bitstream/handle/10568/91009/Feasibility_Acker_2017pdf.pdf?sequence=1

[81] Dulloo E and Khoury CK. 2023. Towards Mainstreaming Global Crop Conservation Strategies. Global Crop Diversity Trust. Bonn, Germany. https://doi.org/10.5281/zenodo.7525946

36. The following paragraphs provide examples of CGIAR research programmes' work at various stages of the breeding process. We are not attempting to provide an exhaustive overview. Instead, we limit ourselves to providing one or two examples of work for each crop.

37. Since 2012, the CGIAR Research Program on Wheat has maintained the Global Network of Precision Wheat Phenotyping Platforms (PWPP). To date, more than ten platforms are fully operational. They cover a wide range of geographies and target traits, from wheat blast in Bolivia and Bangladesh to rust pathogens in Turkey, and head blight in China. For example, the phenotyping platform in Njoro, Kenya, supports breeders to identify and develop new lines which are resistant to stem rust race Ug99. Over the last decade, up to 50 000 wheat lines per year from up to 25 countries were assessed, and over 100 wheat cultivars with Ug99 resistance were released.

38. As part of the project AGENT, ICARDA is screening 500 wheat and 500 barley genebank accessions for response to major fungal diseases: yellow rust and spot blotch.

39. In 2021, IRRI scientists evaluated a set of 220 Aus rice genotypes for root architecture in field trials and in greenhouses. Through this evaluation, IRRI identified that nodal root diameter has an important role in deep root growth.[82]

40. CIMMYT carried out a genome-wide association study (GWAS) to characterize grain Zn concentrations in a set of 330 breeding bread wheat lines across a range of environments in India and Mexico, as part of a HarvestPlus breeding program. GWAS analysis revealed 39 marker-trait associations for grain Zn. Two larger effect QTL regions were found on chromosomes 2 and 7. Candidate genes were associated with the QTL. The linked markers and associated candidate genes identified are being validated in new biparental mapping populations for marker-assisted breeding.

41. IRRI and partners developed a platinum standard pan-genome resource that represents the population structure of Asian rice. In 2021, IRRI developed a novel SNP chip to distinguish different subtypes of rice, and 12,000 genebank accessions were genotyped and their correct groupings were identified. Using GWAS approach, rice researchers at IRRI identified novel set of genetic factors that were associated with pre-harvest sprouting in japonica rice.

42. In 2017-2021, ICRISAT, IITA and CIAT made advances in genomic sequencing and development of markers for selected traits in legume species. At ICRISAT, 195 accessions of wild Cicer, seven 14 of wild Cajanus and 38 of wild Arachis were sequenced and used for genetic/genome diversity and to identify haplotypes, candidate genes. Diagnostic molecular markers were developed for a number of priority traits in pearl millet, sorghum, chickpea, pigeonpea, finger millet, soybean and cowpea. In chickpea, a global genetic variation map based on the sequencing of 3 366 genomes was reported and a pan-genome of 592 Mb was assembled to describe genomic diversity across cultivated and wild progenitors. In groundnut, SNP markers alleles were used to identify alleles conferring high oleic content. For common bean, improved markers were developed by CIAT in collaboration with USDA for bean golden yellow mosaic virus.

43. In finger millet, a 10 SNP panel for blast resistance was developed for routine use in ICRISAT breeding program. Quality control panels for germplasm identity and purity were developed for all ICRISAT mandate crops for parental identification.

44. To identify the most genetically diverse set of *O. glaberrima* collection for future use in breeding and gene discovery, the entire *O. glaberrima* collection conserved at the AfricaRice genebank was genotyped and a core collection of 350 accessions that captured 97 percent of the molecular variation was developed. This core collection consisted of 76 trait donors for multiple traits, including tolerance to abiotic stresses (early-morning flowering and peak spikelet opening time that are associated with heat, anaerobic germination ability, stagnant flooding, drought, and iron toxicity), and biotic stresses (resistance to African gall midge, bacterial leaf blight, and Rice Yellow Mottle

[82] Liao, Q., Chebotarov, D. Islam, M.S. et al. Aus rice root architecture variation contributing to grain yield under drought suggests a key role of nodal root diameter class. *Plant, Cell and Environment*. 2022 March; 45 (3)

Virus). This mini-core represents the different maturity groups (78 early, 194 intermediate, 65 late maturity) and originated from 19 countries and 8 rice growing ecologies.

45. Currently, the entire collection is being evaluated for quality and nutritional traits, and the core collection for agronomic, nutritional, climate resilient and biotic traits.

46. The genebank also holds also *O. sativa* accessions. From these O. sativa accessions, 5 738 were selected to genotype with DArTseq-based SNP markers. 4 242 (74 percent) of the genotyped accessions originated from African countries. Based on neighbor-joining tree, principal component and model-based population structure analyses, the accessions were divided into four genotypic groups representing the two O. sativa subspecies, Japonica (787 accessions) and Indica. Indica further sub-divided into "traditional cultivars/landraces" (1 879 accessions) or "advanced breeding lines/improved cultivars" (3,027 accessions), and a fourth small group of admixed accessions was identified. Subclusters identifying a specific agro-ecology (upland, lowland, mangrove swamp, hydromorphic or floating) and originating country, were noted. To form the "AfricaRice O. sativa Core Collection" (AROSCC), 600 genotyped accessions were selected. This subset captures >95percent of the SNP polymorphisms in the entire collection. The AROSCC includes 400 Indica (AROSCC-indica) and 200 Japonica (AROSCC-Japonica) accessions. The most prevalent germplasm type in both the AROSCC-Indica and AROSCC-Japonica accessions were the more variable traditional cultivars and landraces, which included 218 and 134 accessions of the total accessions, respectively. The African continent was most heavily represented in both the AROSCC-Indica and -Japonica accessions with 306 and 148 African accessions, respectively. The AROSCC is a well characterized and important resource to support pre-breeding and rice improvement programs around the world.

47. AfricaRice scientists are sequencing accessions of the *O. glaberrima* collection and *O. barthii* to develop genomic resources for climate-resilient rice. The data will be available on GIGWA and GERMINATE (genebanks genomic sharing information with users).

48. AfricaRice is performing market-intelligent studies to understand the demand for rice quality traits through price and quality segmentation of market samples from African markets (https://hdl.handle.net/10568/114655; https://hdl.handle.net/10568/119735). These studies have been completed in eight African countries. In all countries, the market was dominated by moderate-quality rice, except in Nigeria, where low-quality parboiled rice is dominant. Preferences for white rice is country specific, although Benin and Ghana clustered together, as did Côte d'Ivoire and Nigeria, and clustering in six main nodes. The attribute of primary interest for parboiled rice was length-to-width ratio (LWR), with slender grains (LWR ≥ 3) being preferred in all eight countries, yet clustering in four nodes. Second-placed quality characteristics for parboiled rice varied by country, though with some clustering mostly by parboiling quality.

49. AfricaRice is screening rice germplasm for low glycemic (GI) properties following different processing regimes (https://hdl.handle.net/10568/119734). Non-parboiled polish samples recorded higher GI than all parboiled samples. Three varieties ORYLUX 6, NERICA 11 and TOG6813 recorded the lowest GI following parboiling and milling.

50. AfricaRice in collaboration with Giessen University, is screening different rice germplasm for protein, iron, zinc and phytate contents. Two thousand eighty accessions have already been screened for protein, while 400 have been screened for Fe, Zn and phytate. Agglomerative Hierarchical Clustering for protein content reveals four clusters, with one having high protein content, ranging from 20.90 – 28.25 percent dry matter. Similar clustering for Fe, Zn and phytate reveals three distinct classes, with one class being important as it recorded both high Fe (25.61 mg/kg) and Zn (32.96 mg/kg) contents in grains. The concentration of phytate in the different classes was high (18.5 g/kg). ICARDA performed interspecific crosses of barley with *H. spontaneum* which have allowed to develop populations and elite lines with resistance to major foliar diseases, with higher beta-glucans, Iron and Zinc contents and with some having good performance in grain and straw.

51. Scientists from ICRISAT, IITA, and CIRAD/CERAAS (Center d'étude régional pour l'amélioration de l'adaptation à la sécheresse) used crop wild relatives in the following crops: chickpea (for Botrytis grey mould (BGM) resistance); groundnut (for resistance to rust and late leaf

spot); pearl millet (for heat tolerance at flowering stage, and tolerance to blast); pigeonpea (for resistance to pod borer); finger millet (for tolerance to blast disease) and cowpea (for drought tolerance at seedling stage, and heat tolerance). ICRISAT and IITA used (and will continue to use) promising wild genetic materials as donors of novel genes for introgression and development of pre-breeding populations. Introgressed lines were evaluated and screened for their reaction to a range of biotic and abiotic pressures, including heat, drought and blast in the case of pearl millet, and pod borer infestation in the case of pigeonpea.

52. Between 2016-2021, ICARDA made advances in the development of grass pea resistance to parasitic Broomrape weeds (*Orobanche* spp.) using wild *Lathyrus* species. In 2016-2018, ICARDA screened 285 accessions representing 13 *Lathyrus* species for their resistance to *Orobanche crenata* and *O. foetida*. In 2019-2021, F1, F2 and F3 fertile plants were obtained from crosses between *Lathyrus sativus* and *L. articulatus, L. cicera, L. heirosolymitanus, L. inconspicuous, L. marmoratus and L. ochrus.* They represent a valuable source of *Orobanche* resistance for grass pea breeding programs.

53. CIP scientists are sequencing accessions of wild relatives of potato and breeding lines to build genomic resources for climate smart potatoes. Data will be made public through the Potato Genome Diversity Portal (https://potatogenomeportal.org/website).

54. To identify and validate sources of genetic resistance to fall armyworm in Africa, CIMMYT screened over 3,500 hybrids in 2018 and 2019. In 2020, a promising set of hybrids were tested in screenhouses, on station, and on-farm, in Kenya and Tanzania, leading to identification of three tolerant hybrids that will be nominated for varietal release in eastern and southern Africa.

55. Great strides were made in developing maize germplasm with resistance to maize lethal necrosis disease (MLN) in 2017-2020, using both innovative technologies and novel maize genetic materials from around the world. Scientists from the CGIAR Research Program on Maize worked with Corteva Agriscience to identify one of the genes that confers strong resistance against MLN. With fine-mapping, scientists narrowed their search to fewer than eight genes (from a total of ~40,000 in the maize genome). A promising candidate among these eight genes is being validated via gene editing in MLN-susceptible parental lines to determine whether it confers resistance to MLN.

56. Early maturing is one of the traits sought by the pigeonpea and cowpea breeding programs of ICRISAT and IITA, to adapt production to water deficiencies in South Asia and sub-Saharan Africa. High-yielding introgression lines of pigeonpea with resistance for fusarium wilt, sterility mosaic and phytophthora blight were identified and are in advanced stages of evaluation in national programs.

57. ICRISAT's sorghum breeders used genotypes with high transpiration efficiency under high vapor pressure deficit for developing drought-tolerant sorghum hybrids with high biomass yields. These new hybrid lines are currently being tested.

58. Rice researchers at IRRI made major progress towards understanding and improving both grain quality and grain yield simultaneously in rice breeding lines. OSPTR gene was found to be important to get good yield without a penalty on quality.

59. CIP has been optimizing and validating generic high throughput sequencing (HTS)-based virus indexing for potato and sweetpotato, and provided training to CIAT and IITA for cassava and other clonally propagated crops. Bioversity has been conducting the same for banana. Results show that with the developed procedures, HTS are generally equivalent in their ability to identify infected plants, however HTS provides more detailed information enabling identification of new viruses, and can generate results faster than the standard procedures, at a similar cost. Simultaneously, CIP has developed a Laboratory Information Management System (LIMS) for capturing, recording and tracking pest/disease detection assays results, that is compatible with genebank and breeding database systems. CIP also provided support to CIMMYT by sharing the source code of this LIMS, to adapt it to their needs. CIP's beta-version of the LIMS is open to all CG centers for feedback and/or use.

Building sustainable institutional and human capacities

60. The following paragraphs provide examples of Centers' activities in 2020-2022 to increase capacities of national plant researchers, breeders and farmers for the conservation of PGRFA and their use in plant germplasm evaluation and breeding.

61. In 2021, CIMMYT and national agricultural research organizations established Regional Collaborative Maize Breeding and Testing Networks in sub-Saharan Africa to improve national partners' breeding efficiencies using modern breeding tools and approaches. The networks serve as platforms for fostering greater efficiency and communication across sub-Saharan Africa and within the individual countries, sharing best practices and protocols, and accelerating variety development and turnover.

62. The Wheat Improvement Course was stablished in 1968 by CIMMYT to train wheat breeders to face challenges in wheat production, and has been run regularly since then. Early career scientists from public and private sector organizations review core concepts in genetics, conventional breeding, statistics, and the most recent cutting-edge technologies. In 2022, CIMMYT, with Cornell University, launched the Advanced Wheat Improvement Course, which explores technologies such as genomic selection, selection indices, GWAS analysis and speed breeding.

63. ICARDA also organizes an annual course on wheat improvement. This three-week training combines theoretical and practical sessions on wheat breeding strategies, marker assisted selection, doubled haploid, speed breeding, quality analysis, integrated pest management approaches, genetic resource conservation, and biometrics.

64. ICRISAT's Center of Excellence in Genomic and Systemic Biology offers training and short courses to provide scientists/researchers updated information on the application of novel genomics technology in crop research and breeding. The Center has organized 15 training courses, training 485 scientists from national agricultural research centers, universities and private entities in Asia and sub-Saharan Africa.

65. The Genebank Initiative includes a work package entitled 'Strengthening the Global System (WP4)' which promotes mutually supportive roles for CGIAR and national partner organizations to conserve PGRFA, and make those resources available under the frameworks of the Plant Treaty, the International Plant Protection Convention (IPPC) and other applicable international norms. Among other things, this new work package supports national partners' in the following areas of activity: core genebank operations; development of regional cryopreservation hubs as described above; compliance with phytosanitary standards and regulations; analyzing gaps within and across international and national genebank collections, identifying 'hot spots' for new collecting, and developing and implementing policies and operating procedures to operate under the framework of the Plant Treaty. As part of its work in these areas, the CGIAR Genebank Initiative is supporting development of online curricula. The Genebank Initiative is coordinating closely with the Global Crop Diversity Trust and the Plant Treaty secretariat to ensure that we are supporting capacity building in a mutually supportive, complementary way.

66. In 2022, WP 4 supported the following regional and subregional workshops: 'Virtual Workshop on Access and Benefit-Sharing in southern and eastern Africa', 21-22 February 2022; 'Workshop on Cryopreservation for Latin American Organizations', Lima, Peru, 25-27 August, 2022; 'Joint meeting of the SADC Plant Treaty and Nagoya Protocol Focal Points', 31 August-1 September, 2022, organized in collaboration with the African Union and Plant Treaty; 'Data Collection and Management Applied to Plant Genetic Resources Management', Bouake, Côte d'Ivoire, 22-26 August, 2022 (see details in box below); 'On-line training course on SNPs to Genome-Wide Association Studies (GWAS) for NARS researchers and students from West and Central Africa and East Africa', 29-30 August, 2022, hosted by AfricaRice; 'High level meeting on Material Transfer Agreements for PGRFA exchanged through Open-Source Seed Systems (OSS) for Kenya, Tanzania and Uganda', 14 September 2022; 'Capacity building workshop on gap analysis and other management tools for national genebanks', organized by AfricaRice, IITA and ILRI and hosted by AfricaRice in Yamoussoukro, Côte d'Ivoire, 23-28 October, 2022; 'Third workshop of the Community of Practice for Latin America and the Caribbean on the use of genomic and digital tools for the conservation and use of Genetic Resources for Food and Agriculture', Texcoco, Mexico, 14-18 November, 2022;

'Mainstreaming access and benefit- sharing in Agricultural Research and Development: a workshop for researchers, practitioners and policy makers in selected African countries and organizations', Addis Ababa, 21-24 November 2022; 'CWANA Workshop on Conservation and Use of Plant Genetic Resources', Zahle, Lebanon, 5-16 December, 2022.

Highlights of Work Package 4 capacity building activities coordinated by CIP and AfricaRice
AfricaRice Genebank hosted an in-person workshop on Data Collection and Management Applied to Plant Genetic Resources Management (CoP PGR Data Management) from August 22-26, 2022 in Bouake, Côte d'Ivoire. During five days, a total of 21 participants had an opportunity to learn and practice several techniques and methods routinely applied in the AfricaRice genebank. These training sessions included: (i) sampling labelling using barcoding equipment approach; (ii) field and lab data collection during using tablet and appropriate software (fieldbook & XSanpet app); (iii) viability testing of seeds, and data collecting and interpretation of results; (iv) drying, packing and conservation of seeds in long-term and medium-term storage rooms (LTS & MTS); and (v) data management using Grin Global Community Edition (GG CE) and Genesys online database. At the end, the participants each received a certificate of attendance and all were happy to have gained more experience in plant genetic resources management. In 2022, CIP organized a regional workshop with the participation of 14 countries, international specialists, CIAT, GCDT and IT-PGRFA. The two-day workshop allowed the group to deeply discuss the current situation of cryopreservation in Latin America, the priorities of each country, and current capabilities to start implementing the safety duplication of clonal crops in cryo at CIP. At the end of 2022, GIZ/BMZ approved CIP's Genebank proposal to construct the new cryobank for the Latin American cryohub. The project will begin in 2023.

67. In total, in 2022, the CGIAR Genebank Initiative organized thematic or regional workshops for more than 400 NARS scientists, of which 40 percent were women. Partners were trained in a range of genebank operations including cryopreservation and cryobanking, seed phenotyping using multispectral imaging, use of genotypic platforms, geographical gap analysis, sample tracing, management and analysis of genotypic data, seed dormancy breaking, sub-setting, accession selection, phytosanitary diagnostics, international plant genetic resources policy and compliance, access and benefit-sharing, etc.

C. Application of the Genebank Standards for Plant Genetic Resources for Food and Agriculture (Agenda item 4.1)

Guidance Note for CGIAR Centers' Genebanks for Improving Accession Management

68. In 2020, the CGIAR Genebank Platform, working with the genebank managers, in close collaboration with the Secretariats of the Plant Treaty and the FAO Commission on Genetic Resources for Food and Agriculture developed a 'Guidance note for CGIAR Genebanks on improving accession management'. The note was reviewed by the Director Generals of the 'Article 15 Centers' in January 2020 and approved by the CGIAR Executive Management Team in April 2022.

69. The Guidance Note is fully aligned with the Genebank Standards for PGRFA and promotes harmonization across the Centers with respect to certain aspects of their management of international collections, including the vocabulary, form and scheduling of their joint communications concerning the management of those collections, within the context of existing applicable policies. The note does not present a new policy *per se*; rather, it reflects and promotes best practices that Centers have developed over time in managing the international collections under the frameworks of, first, their 1994 In Trust Agreements with FAO and, later, their Article 15 Agreements with the Governing Body of the Plant Treaty.

70. The note describes four classes of PGRFA curation, which all Centers will use to describe their collections, including when they share information with the Governing Body of the Plant Treaty,

the UNFAO CGRFA and other stakeholders. The four curation classes are: Fully curated, Partially curated, Archived, and Historical. Each class represents a different level of activity provided by the Centers in the curation of the materials concerned. The Guidance note is available at this link: https://hdl.handle.net/10568/126835

71. In 2021, a draft of a decision guide was circulated to CGIAR genebanks for discussion. The aim of the decision guide is to further assist CGIAR genebank managers in the decision-making process for designating accessions to a particular curation class.

D. The role of plant genetic resources for food and agriculture in mitigating climate change (Agenda item 5)

72. CGIAR Centers appreciate plans to expand the scope of the *Voluntary Guidelines to Support the Integration of Genetic Diversity into National Climate Change Adaptation Planning,* to include climate change mitigation planning. In the following paragraphs we provide examples of Centers' efforts to use PGRFA for climate change mitigation.

Development of plants with deeper, more extensive root systems

73. Atmospheric carbon is sequestered (through a process starting with photosynthesis) into root structures. Roots exudate carbon into below-ground storage. Crop plants with improved root architectures can sequester carbon (and other nutrients, plus water) more effectively. They are thus not only more prepared to cope with drought and poor soils, but they also can contribute to climate change mitigation.

74. In 2019-2022, scientists from CIMMYT were involved in genome-wide association studies focusing on genomic regions controlling root system architecture in winter wheat[83] and durum wheat.[84] These studies led to the identification of genomic regions for functional gene discovery of root traits, an important step towards marker-assisted selection for developing wheat varieties with more extensive root systems.

75. IRRI and CIAT have conducted research and breeding for root improvement over the last two decades, with a focus on understanding root architecture and factors that influence it, and identifying appropriate root traits that enhance rice grain yield and at the same time contribute to carbon sequestration under different conditions.[85] For instance, in the period 2010-18, IRRI evaluated over 400 lines from its genebanks for root traits such as dry weight, crown roots, root length density and root anatomy, as part of drought tolerance research.[86] [87]

76. Selection and crossing of varieties for their root traits have been common in legume breeding for drought tolerance within CGIAR. CIAT breeders crossed, selected and tested common bean varieties that have longer roots than most bean varieties. Through the Pan-Africa Bean Research Alliance (PABRA), these new common beans were tested in Malawi and other Eastern and Southern Africa countries, where they have performed in particularly severe episodes of drought. Recent field

[83] Li L, Peng Z, Mao X, Wang J, Chang X, Reynolds M, Jing R. Genome-wide association study reveals genomic regions controlling root and shoot traits at late growth stages in wheat. Ann Bot. 2019 Nov 27;124(6):993-1006. doi: 10.1093/aob/mcz041

[84] Alemu, A., Feyissa, T., Maccaferri, M. *et al.* Genome-wide association analysis unveils novel QTLs for seminal root system architecture traits in Ethiopian durum wheat. *BMC Genomics* **22**, 20 (2021).

[85] Sandhu N, Subedi SR, Yadaw RB, Chaudhary B, Prasai H, Iftekharuddaula K, Thanak T, Thun V, Battan KR, Ram M, Venkateshwarlu C, Lopena V, Pablico P, Maturan PC, Cruz MTS, Raman KA, Collard B and Kumar A (2017) Root Traits Enhancing Rice Grain Yield under Alternate Wetting and Drying Condition. Front. Plant Sci. 8:1879. doi: 10.3389/fpls.2017.01879

[86] Liao, Q., Chebotarov, D. Islam, M.S. *et al*. Aus rice root architecture variation contributing to grain yield under drought suggests a key role of nodal root diameter class. Plant, Cell and Environment. 2022 March; 45 (3)

[87] Siangliw Jonaliza L., Thunnom Burin, Natividad Mignon A., Quintana Marinell R., Chebotarov Dmytro, McNally Kenneth L., Lynch Jonathan P., Brown Kathleen M., Henry Amelia. 2022. Response of Southeast Asian rice root architecture and anatomy phenotypes to drought stress. Frontiers in Plant Science, 13. DOI=10.3389/fpls.2022.1008954

evaluations of root traits of selected chickpea genotypes[88] as well as involvement in the project "Chickpea Root" have allowed ICRISAT scientists to better understand chickpea root development under different conditions and identify best combination of root traits for breeding.

Development of plants with biological nitrification inhibition

77. The manufacture and use of nitrogen fertilizers for crops is responsible for nearly 80 percent of global emissions of nitrous oxide (N_2O), a potent greenhouse gas. This gas is released to the atmosphere through microbial nitrification and denitrification of nitrogen fertilizer. Biological nitrification inhibition (BNI) is the process by which phytochemicals that inhibit nitrification are produced in roots of certain plants and secreted into the rhizosphere, thereby suppressing soil nitrification.

78. CIAT work on the BNI capacity of the *Brachiaria* forages goes back to the 2010s.[89] More recently, in partnership with Japan and Norway, CIAT tested the nitrification reduction capacity of 119 germplasm accessions of Guineagrass (*Megathyrsus maximus*), an important tropical forage crop for livestock production. The results showed reductions on nitrification activity ranging between 30 and 70 percent, as well as a reduction in N2O emissions compared to accessions of high nitrification rates.

79. CIMMYT and the Japan International Research Center for Agricultural Sciences identified a chromosome region that controls BNI production in wheat grass *Leymus racemosus* (Lam.) Tzvelev. Its introduction into wheat cultivars resulted in doubling BNI in these cultivars, evidenced by suppression of soil nitrifier activity, reduced nitrification potential, and N_2O emissions.

Evaluatin of perennial grains

80. Perennial crops have greater carbon storage capacities than annual crops; their management also releases less soil carbon loss from the soil to the air. Furthermore, they require fewer agricultural inputs than annual crops.

81. CGIAR Centers have been involved in projects testing perennial rice in West Africa,[90] and intermediate wheatgrass (*Thinopyrum intermedium*) in Turkey.[91]

Breeding varieties that facilitate adoption of low emission agronomic practices

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[88] Ramamoorthy P, Lakshmanan K, Upadhyaya HD, Vadez V, Varshney RK. Root traits confer grain yield advantages under terminal drought in chickpea (Cicer arietinum L.). Field Crops Res. 2017 Feb 1;201:146-161. doi: 10.1016/j.fcr.2016.11.004.

[89] Ryan C. Byrnes, Jonathan Nùñez, Laura Arenas, Idupulapati Rao, Catalina Trujillo, Carolina Alvarez, Jacobo Arango, Frank Rasche, Ngonidzashe Chirinda. Biological nitrification inhibition by Brachiaria grasses mitigates soil nitrous oxide emissions from bovine urine patches. Soil Biology and Biochemistry, Volume 107, 2017.

[90] In 2019-2021, AfricaRice and the Department of Agriculture of Yunnan Province (China) partnered to lead the testing of perennial rice variety PR23 in various countries of West Africa. PR23 was developed by a team working at the Yunnan University in Kunming with collaborators including a former IRRI scientist (Zhang, S.; Huang, G.; Zhang, Y.; Lv, X.; Wan, K.; Liang, J.; Feng, Y.; Dao J.; Wu, S.; Zhang, L.; Yang, X.; Lian, X.; Huang, L.; Shao L.; Zhang., J.; Qin. S.; Tao, D.; Crews, T.E.; Sacks, E.J.; Lyu, J.; Wade, L.J.; Hu, F. Sustained productivity and agronomic potential of perennial rice. *Nature Sustainability* **2023**, 6, *28–38*. https://doi.org/10.1038/s41893-022-00997-3) building on previous work carried out by the Yunnan Academy of Agricultural Sciences, Kasetsart University in Bangkok and IRRI.

[91] Wheat researchers from CIMMYT-Turkey were involved in a network of 21 experiments across nine countries on four continents and spanning both hemispheres, to evaluate the relative performance of early generation perennial cereal material derived from wheat, rye, and barley and to inform future breeding strategies. In particular, CIMMYT-Turkey contributed to the evaluation of the intermediate wheatgrass Kernza in selected sites in Turkey. The study showed that the existing experimental material is all relatively short-lived (≤3 years), with environments that are milder in summer and winter generally conferring greater longevity. A recommendation arising from the study was for the development of perennial cereal genotypes adapted to specific target environments rather than a generic product for one global market. Hayes, R.C.; Wang, S.; Newell, M.T.; Turner, K.; Larsen, J.; Gazza, L.; Anderson, J.A.; Bell, L.W.; Cattani, D.J.; Frels, K.; Galassi, E.; Morgounov, A.I.; Revell, C.K.; Thapa, D.B.; Sacks, E.J.; Sameri, M.; Wade, L.J.; Westerbergh, A.; Shamanin, V.; Amanov, A.; Li, G.D. The Performance of Early-Generation Perennial Winter Cereals at 21 Sites across Four Continents. *Sustainability* **2018**, *10*, 1124. https://doi.org/10.3390/su10041124

82. Compared to the conventional puddled transplanted rice method prevalent in Asia, direct seeding rice (DSR) delivers faster planting and maturing, conserves scarce resources like water and labor, is more conducive to mechanization, and reduces emissions of greenhouse gases that contribute to climate change, particularly methane.

83. In 2017, IRRI convened the Direct Seeded Rice Consortium, a public-private multi-stakeholder platform which has, among other aims, the objective to identify and develop rice varieties suited for DSR. Several studies have demonstrated that elongation of the mesocotyl (the tissue between the insertion point of the radicle and the coleoptile -the organ that encloses the first few leaves of the seedling) is a crucial ability for DSR. The mesocotyl pushed buds out of deep water or soil after rice germination. In DSR, germplasm with a long mesocotyl have a faster emergence rate, a higher survival rate, and a more uniform emergence than germplasm with short mesocotyl. The ability of mesocotyl elongation shows high diversity among wild rice, weedy rice, and cultivated rice, but few cultivated rice varieties grown via transplanting seedling system have long mesocotyl. Identifying rice germplasm that has the ability of mesocotyl elongation, as well as the genes and mechanisms that control this ability, are essential for breeding new rice varieties suitable for direct seeding. One of IRRI's prominent works in this direction is the study of mesocotyl elongations in more than 1,000 genebank accessions, which was conducted in 2018-20.[92]

E. Access and benefit-sharing for plant genetic resources for food and agriculture (Agenda item 6)

CGIAR contributions to international negotiations on access and benefit-sharing

84. After five years of fraught negotiations, the Conference of the Parties (COP) to the CBD finally adopted the Global Biodiversity Framework (GBF) at its 15th meeting in Montreal, Canada, in December 2022. CGIAR proactively engaged in those negotiations, submitting policy briefs, meeting with delegates, hosting side events, participating in informal, off the record meetings of key stakeholders, etc. In relation to access and benefit-sharing we pursued two primary goals. The first goal was that the GBF should recognize, and promote the Plant Treaty and its multilateral system of access and benefit-sharing. This is important to CGIAR given that international PGRFA collections hosted by CGIAR Centers, and hundreds of national collections of PGRFA around the world, are managed under the Plant Treaty's rules concerning access and benefit-sharing. They should be 'counted' as contributing to the GBF's targets and goal related to access and benefit-sharing. The second goal was to ensure that new norms of benefit-sharing from the commercial use of digital sequence information (DSI) should be multilateral in nature, with minimal or no interruption to the open availability and use of DSI for agricultural research, but at the same time generate monetary and non-monetary benefits to be shared with developing countries, underscoring the importance of capacity building to ensure that users in developing countries are able to take advantage of DSI. In December 2022, COP 15 decided to create a "multilateral mechanism for benefit-sharing from the use of digital sequence information on genetic resources, including a global fund". It also created an open-ended working group to negotiate, over a two-year period, how the mechanism will function. CGIAR will continue to participate in that process.

85. At its Ninth Session, , in September 2022, the Governing Body of the Plant Treaty decided to launch a process that will consider options for monetary benefit-sharing under the multilateral system of access and benefit-sharing, ways to lower transaction costs for users, and the expansion of the list of crops and forages included in the multilateral system. The CGIAR celebrates this outcome; one which it has supported since the negotiations were suspended in 2019. CGIAR appreciates that it has been expressly included in the terms of reference for the working group as one of the stakeholders that should be included in those negotiations.

CGIAR compliance with access and benefit-sharing obligations for PGR

[92] Sang He, Hongyan Liu, Junhui Zhan, Yun Meng, Yamei Wang, Feng Wang, Guoyou Ye. 2022. Genomic prediction using composite training sets is an effective method for exploiting germplasm conserved in rice gene banks. The Crop Journal, Volume 10, Issue 4. https://doi.org/10.1016/j.cj.2021.11.011

86. Most of the CGIAR Research Centers' activities related to the conservation, research and development and distribution of plant genetic resources are governed by the multilateral system of ABS of the Plant Treaty. However, there are some situations where the CGIAR Centers will need to comply with regional, national and sub-national mechanisms that implement Article 15 of the Convention on Biological Diversity (on access and benefit-sharing) and/or the Nagoya Protocol on access and benefit-sharing, for example, when accessing plant genetic resources that are not available through the Plant Treaty's multilateral system. In 2028, CGIAR developed guidelines for Centers' compliance with the Nagoya Protocol. They are available in English, French and Spanish at this link: https://www.cgiar.org/how-we-work/accountability/policies/

87. In 2021, the Genebank Platform of CGIAR launched the online course 'Genetic Resource Policies for CGIAR Scientists', provided through the UK's Open University on-line Learning Platform (https://www.open.edu/openlearncreate/). The course focuses on access and benefit-sharing for plant genetic resources. There have been three sessions of the course so far, and a new edition is scheduled for March-May 2023. The course includes readings, videos, animations, self-test questions and practical exercises working through scenarios. The course is spread over eight weeks (with learners expected to dedicate approximately 8 hours a week). Each week concludes with a live session with students. Experts from inside and outside the CGIAR participate as resource people in these sessions. One member of the CGRFA Secretariat participated as resource people in the two sessions of the course that took place in 2022. So far, more than one hundred CGIAR staff have taken the course, including genebank managers and staff, plant breeders, pathologists, information managers, seed system specialists, and legal and intellectual property specialists. Currently, the policy team of the CGIAR Genebank Initiative is working with the Open University for the development of a similar course for scientists working agricultural research organizations more generally, and not limited to CGIAR scientists.

88. The CGIAR Genebank Initiative also hosts a 'Genetic Resources Policy Helpdesk' which is open to all CGIAR scientists to obtain feedback and advice for dealing with ABS-related challenges that arise in the course of their daily work.

CGIAR support for the development and implementation of ABS policies that promote agricultural research and development

89. Under Work Package 4: 'Strengthening the Global System', the Genebank Initiative launched projects with partners from Uruguay, Guyana, Togo, Nigeria, Mauritius, and Zimbabwe, to develop policy measures to implement the Plant Treaty's multilateral system of access and benefit-sharing, identify and publish information about PGRFA that is available under the multilateral system, and adopt standard operating procedures related to acquisition and distribution of PGRFA, including the use of SMTA, in relevant research organizations. The projects also include training on use of a sub-setting tool to identify potentially useful materials in the CGIAR genebanks, training in collection gap analysis, and improved accession information management. A few of the projects also include support for evaluation of materials received from the CGIAR and national genebanks and sharing related information on-line.

90. Under the same Work Package, the Genebank Initiative worked with SPGRC, and Secretariats of CGRFA, Plant Treaty, and CBD to organize a regional workshop in February 2022 on ABS systems in support of the recently adopted regional crop wild relative strategy. The participants developed a draft resolution for possible endorsement by the SADC regarding mutually supportive implementation of the Plant Treaty and the Nagoya Protocol on ABS.

91. Together with the African Union Commission and the International Livestock Research Institute (ILRI), in November 2022, the Genebank Initiative organized a workshop entitled 'Mainstreaming access and benefit-sharing in agricultural Research and Development: a workshop for researchers, practitioners and policy makers in selected African countries and organizations'. The workshop brought together approximately 35 participants from national and international research organizations, regional and continental intergovernmental organizations, national ministries of environment and agriculture, private sector and farmers' associations. The main objectives were to raise awareness about the role of ABS in reaching pan-African objectives of sustainable agricultural

development, food security and climate change adaptation, and to advance on the consideration of ABS issues within concrete initiatives, including the African Seed and Biotechnology Program, the African Network of Animal Germplasm Biobanks and the Africa BioGenome Project.

F. "Digital sequence information" and plant genetic resources for food and agriculture (Agenda item 7)

92. As mentioned above, CGIAR engaged proactively in the CBD negotiations on DSI. As part of this work, CGIAR submitted a paper entitled 'Digital sequence information is changing the way genetic resources are used in agricultural research and development: implications for new benefit-sharing norms' to the 15th Session of the Conference of the Parties to the Convention on Biological Diversity (COP15). This paper includes inputs from 27 scientists and research leaders across the CGIAR; it analyses the ways CGIAR Centers use DSI in their efforts to conserve and sustainably utilize the world's most important crop and livestock genetic diversity. The paper then reflects on which benefit-sharing options would provide effective policy support for the continued use of DSI in agricultural research and development in the future. The paper is available at https://hdl.handle.net/10568/125749; we hope delegates to the ITWG-PGRFA, and the CGRFA, will access and read the paper.

93. CGIAR also convened a side event at COP15 for CGIAR scientists and a representative of the Plant Treaty secretariat to present, and reflected upon, the main messages from the paper.

94. Over the course of 2023-2024, CGIAR will monitor and contribute to negotiations under the CBD regarding the operation of the "multilateral mechanism for benefit-sharing from the use of digital sequence information on genetic resources, including a global fund" that COP 15 decided to create in December 2022.

ANNEX 5

REPORT FROM THE SECRETARIAT OF THE INTERNATIONAL TREATY ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

I. INTRODUCTION

1. The Secretariat of the International Treaty on Plant Genetic Resources for Food and Agriculture (International Treaty) has prepared this report in response to the invitation to provide the Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture (ITWG) with updates on activities regarding plant genetic resources for food and agriculture (PGRFA).

2. This report illustrates the major outcomes of the Ninth Session of the Governing Body of the International Treaty, which was held in September 2022, and outlines the general planning of implementing activities in 2023. The Tenth Session of the Governing Body will take place in November 2023.

II. OUTCOMES OF THE NINTH SESSION OF THE GOVERNING BODY

3. The Ninth Session of the Governing Body adopted seventeen Resolutions. The summary below presents the Working Group with the deliberations of the Governing Body on thematic areas which are of direct relevance to the on-going consideration of PGRFA by Members of the Commission on Genetic Resources for Food and Agriculture (Commission).

A. Cooperation with the Commission

4. In line with established practice, the Governing Body adopted a separate Resolution on the matter, namely Resolution 11/2022.[93] The Governing Body welcomed the ongoing close cooperation with Commission and and the joint activities undertaken by the Secretariats. It agreed to keep the matter of the functional division of tasks and activities between the Governing Body and the Commission under review.

5. The Governing Body invited Contracting Parties that still have not done so, to cooperate with the Commission in the preparation of The Third Report on the State of the World's Plant Genetic Resources for Food and Agriculture (Third SoW-PGRFA) in order to facilitate the updating of the Second Global Plan of Action for Plant Genetic Resources for Food and Agriculture (Second GPA);

6. In regard of joint activities, the Governing Body requested its Secretary to continue strengthening collaboration and coordination with the Secretary of the Commission to promote coherence in the development and implementation of the respective programmes of work of the two bodies, and in particular with regard to: a) the preparation of the Third SoW-PGRFA, the review and possible update of the Second GPA, and the revision of the reporting system of the World Information and Early Warning System on Plant Genetic Resources for Food and Agriculture (WIEWS); b) the organization of symposia on in situ conservation and on-farm management of PGRFA; c) the effects of seed policies, laws and regulations; d) the implementation and monitoring of the Second GPA, including technical instruments that facilitate its implementation, such as the Genebank Standards for Plant Genetic Resources for Food and Agriculture and work on sustainable use of PGRFA; e) access and benefit-sharing (ABS) and digital sequence information / genetic sequence data (DSI/GSD) on PGRFA; f) joint efforts to advocate for the consideration of the objectives and relevant work and policies of the Commission and the Governing Body of the International Treaty in global strategies and frameworks, such as the FAO Strategy on Mainstreaming Biodiversity across Agricultural Sectors and the Post-2020 Global Biodiversity Framework (GBF), as well as to update FAO Members on progress in the implementation of their respective mandates and work programmes, for example through briefings for Permanent Representations; and g) the Global Information System (GLIS) and WIEWS, and relevant targets and indicators.

7. The Governing Body further encouraged building complementarity and collaboration in relation to the development and implementation of national strategies of PGRFA and national

[93] https://www.fao.org/3/nk247en/nk247en.pdf

planning process relevant to PGRFA such as those related to climate change adaptation and mitigation.

B. Conservation and Sustainable Use

8. The Governing Body received a concept note of a joint programme for the sustainable use of PGRFA in the context of agricultural biodiversity as well as a background study on the bottlenecks and challenges to the implementation of articles 5 and 6 of the International Treaty. In Resolution 6/2022, the Governing Body decided to reconvene the Ad Hoc Committee on Sustainable Use to provide inputs for finalizing the concept note and to develop suggestions on future strategies to address the bottlenecks identified in the study.[94]

9. The Governing Body also requested the Secretary to continue analyzing and monitoring the gaps and needs identified in the study and called upon Contracting Parties to share information on the difficulties and challenges encountered in implementation as well as possible new initiatives, activities, and approaches that could be undertaken to address them. Regional consultations may be organized subject to the availability of financial resources.

C. Farmers' Rights

10. The Governing Body, through Resolution 7/2022, welcomed the updated Inventory of National Measures, Best Practices and Lessons Learned on the Realization of Farmers' Rights and its online version on the website of the International Treaty, recognizing that it will continue to be reviewed periodically and updated, as necessary.[95]

11. The Governing Body took note of the Options for Encouraging, Guiding and Promoting the Realization of Farmers' Rights as set out in Article 9 of the International Treaty (the Options), requested the Secretary to publish the Options and invited Contracting Parties and other stakeholders to consider using the Options, in accordance with their needs and priorities as appropriate and subject to national legislation, in encouraging, guiding and promoting the realization of Farmers' Rights.

12. The Governing Body requested the Secretary to make an assessment on the state of implementation of article 9 of the International Treaty and to present criteria and an outline of the assessment at its Tenth Session and the full report at its Eleventh Session. Subject to the availability of financial resources, a global symposium to share experiences and discuss possible future work on Farmers' Rights will be organized with the Government of India.

13. The Governing Body also requested the Secretary to include the possible impact of DSI/GSD on Farmers' Rights into the assessment of DSI/GSD as foreseen in its Multi-Year Programme of Work (MYPoW).

14. Contracting Parties have been invited to promote sustainable biodiverse production systems and facilitate participatory approaches such as community seed banks, community biodiversity registries, participatory plant breeding and seed fairs, including by considering to provide legal recognition of such approaches as tools for realizing Farmers' Rights.

D. Digital Sequence Information

15. For the first time, the Governing Body approved a specific Resolution on DSI/GSD, Resolution 16/2022.[96] It requested its Secretary to continue following the discussions in other fora and to continue coordinating with the Secretariats of the Convention on Biological Diversity (CBD) and the Commission in any related activities, in order to ensure coherence and avoid duplication of work. In taking note of the pre-COP 15 relevant deliberations on DSI for the GBF, the Governing Body encouraged Parties to the CBD in their consideration of a solution for fair and equitable benefit-sharing from the use of DSI on genetic resources, to bear in mind the need for implementation of the International Treaty and of the CBD and its Nagoya Protocol to be mutually supportive.

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[94] https://www.fao.org/3/nk241en/nk241en.pdf
[95] https://www.fao.org/3/nk242en/nk242en.pdf
[96] https://www.fao.org/3/nk641en/nk641en.pdf

16. The Governing Body invited Contracting Parties and stakeholders to provide information about their capacity building needs for accessing and using DSI/GSD and to share their experiences in this regard. It called on Contracting Parties and other donors with the capacity to do so to promote the provision of financial resources and technical assistance to reduce the existing gap on capacity regarding DSI/GSD between developed and developing countries.

E. Multilateral System of Access and Benefit-Sharing

17. The Governing Body adopted two Resolutions on the Multilateral System. In Resolution 2/2022, the Governing Body provided guidance on implementation of the System. It urged the Contracting Parties that have not yet done so, to identify, at accession level, the material that forms part of the Multilateral System.[97] It emphasized the importance of collections that are adequately characterized and evaluated and appealed to donors to support characterization of collections conserved in national genebanks of developing countries and countries with economies in transition.

18. The Governing Body requested its Secretary, in cooperation with the Commission, to update the report on the global availability of material in the Multilateral System and transfer of germplasm, including a systematic analysis of reasons why there are Contracting Parties that have not placed any material in the Multilateral System. It called for the report to include information on the status of collections of vegetatively propagated material available, and information on the use of the Standard Material Transfer Agreement (SMTA) for both foreign and domestic transfers of material, and the identification of difficulties and capacity development needs related to national implementation.

19. Through Resolution 3/2022, the Governing Body resumed the process of enhancement of the System, through the Open-Ended Working Group and in order to: a) increase the benefits that arise from the Multilateral System for all Contracting Parties and users, both monetary and non-monetary; b) increase user-based income to the Benefit-Sharing Fund in a sustainable and predictable long-term manner; c) expand the crops and plant genetic diversity available through the Multilateral System; d) improve the availability of PGRFA in the Multilateral System; e) make the Multilateral System more dynamic given that there are developments and emerging issues in science, innovation, plant breeding and global policy environment; f) create legal certainty, administrative simplicity and transparency for everyone participating in the Multilateral System.[98]

20. The Governing Body decided that the process should build upon previous progress and achievements both in terms of structure and content and integrate new ideas, if relevant, and address, in a balanced manner, all three blocks of the package of measures developed previously, namely: a revised SMTA; the expansion of Annex I; the implementation measures through a Resolution of the Governing Body. The Governing Body also requested that the process be structured so to accord early attention to the key issues such as DSI/GSD.

F. Global Information System

21. In Resolution 5/2022, the Governing Body took note of the publication of the Descriptors for Crop Wild Relatives Conserved in Situ and new lists of characterization and evaluation descriptors for tropical fruit trees, and invited the Secretary to facilitate the development of further descriptor lists.[99] In noting the limited availability of national databases of crop wild relatives (CWR) conserved in situ, the Governing Body invited their development with a view to facilitating further research and use, and requested the Secretary to support Contracting Parties in documentation and availability of information, and public awareness about the value and role of CWR in plant breeding.

22. The Governing Body took note of the ongoing collaboration with Genesys, WIEWS, GRIN-Global, the European Search Catalogue for Plant Genetic Resources and the SPGRC Documentation and Information System, and requests the Secretary to continue enhancing cooperation with relevant institutions.

[97] https://www.fao.org/3/nk237en/nk237en.pdf
[98] https://www.fao.org/3/nk238en/nk238en.pdf
[99] https://www.fao.org/3/nk240en/nk240en.pdf

23. The Governing Body adopted the revised GLIS Programme of Work and decided to reconvene the Scientific Advisory Committee (SAC) with the same terms of reference of the previous biennium, including the consideration of scientific and technical issues of relevance to DSI/GSD and national legislation. It Invited the SAC to advise the Secretary on exploring collaboration and linkages with the CBD Clearing House Mechanism and to provide the Governing Body at its Tenth Session with advice on ways to increase the declaration of the country of origin/provenance.

G. Cooperation with the Convention on Biological Diversity

24. Through Resolution 13/2022, the Governing Body requested its Secretary to continue monitoring and participating in the relevant processes related to the CBD and its Nagoya Protocol, in order to promote practical, harmonious and appropriate interfaces among them, both nationally and internationally.[100] It emphasized the importance of maintaining cooperation, complementarity and coherence as well as avoiding duplication between the International Treaty and the CBD, and with other biodiversity-related conventions, in the development and implementation of the GBF.

25. The Governing Body Invited Contracting Parties to ensure that there is effective liaison between the respective national focal points of the CBD and the International Treaty, to ensure that considerations relevant to the International Treaty are integrated in the GBF, and that the contributions of PGRFA are fully integrated and supported within National Biodiversity Strategy and Action Plans. The Governing Body decided that, at its Tenth Session, it will consider the GBF and follow-up actions to support the implementation of the framework and integrate those into its MYPoW.

26. The Governing Body requested the Secretary to cooperate with the Executive Secretary of the CBD by providing information on developments and practical implementation experiences within the International Treaty, including to inform future discussions on Article 10 of the Nagoya Protocol. It welcomed the on-going collaboration between the Secretariats of the International Treaty and the CBD in the monitoring process on the achievement of SDG Target 15.6 “Promote fair and equitable sharing of the benefits arising from the utilization of genetic resources and promote appropriate access to such resources, as internationally agreed”.

27. The Governing Body welcomed the engagement of the Secretariat of the International Treaty in capacity development activities on harmonious and mutually supportive implementation and requests the Secretary to continue engaging in such activities.

H. Contribution by FAO to implementation of the International Treaty

28. In Resolution 9/2022, the Governing Body invited FAO to integrate the International Treaty activities into the implementation of relevant initiatives and strategies, such as the International Platform for Digital Food and Agriculture, the Strategy on Mainstreaming Biodiversity across Agricultural Sectors and its 2021–23 Action Plan, the Science and Innovation Strategy, and the Strategy on Climate Change 2022–2031 and upcoming associated Action Plans with a view to improving the ability of the International Treaty to contribute to addressing complex social, economic and environmental challenges of agrifood systems in a globally equitable, inclusive and sustainable manner.[101]

29. The Governing Body further invited FAO to continue its active support to the activities of the International Treaty as a key international instrument required for the fulfilment of SDGs 2 and 15, and to build awareness of the importance of the implementation of, and compliance with, the International Treaty at the highest national levels.

I. Multi-Year Programme of Work

30. In line with Resolution 15/2022 adopted by the Ninth Session of the Governing Body, the Multi-Year Programme of Work of the Governing Body of the International Treaty on Plant Genetic

[100] https://www.fao.org/3/nk249en/nk249en.pdf
[101] https://www.fao.org/3/nk244en/nk244en.pdf

Resources for Food and Agriculture (MYPoW) was finalized under the guidance of the Bureau of the Tenth Session.[102]

31. According to the MYPoW, a presentation of the of Third State of the World's PGRFA has been scheduled for the Tenth Session of the Governing Body of the International Treaty.

III. FOLLOW-UP TO THE NINTH SESSION OF THE GOVERNING BODY

Outcomes of CBD COP 15

32. CBD COP 15 resulted in the adoption of the Kunming-Montreal Global Biodiversity Framework. COP 15 took a number of important decisions regarding DSI and introduced a goal within the GBF recognizing that the monetary and non-monetary benefits from the utilization of genetic resources need to be increased. The analysis of the outcomes of the CBD COP 15 is one of the items included in the Governing Body's MYPoW for its Tenth Session. The Bureau of the Tenth Session is conducting a comprehensive analysis of all the COP 15 outcomes and the implications for the objectives and the work of the International Treaty.

Subsidiary bodies and other meetings

33. The Tenth Session of the Governing Body will take place in November 2023. The Secretariat has published the calendar of meetings of subsidiary bodies.[103]

34. Regarding the meeting of the Open-ended Working Group to Enhance the Functioning of the Multilateral System, the Co-Chairs of the Working Group are planning a number of regional, interregional and stakeholder consultations in the first semester of 2023.

35. The Secretary initiated consultations with the Government of India to identify the date and venue for the organisation of the International Symposium on Farmers Rights to be hosted by the Government of India.

Fifth cycle of the Benefit-Sharing Fund

36. The fifth cycle of the Benefit-sharing Fund (BSF-5) was launched in May 2022 and, in the first quarter of 2023, is progressing towards the elaboration of full project proposals for selected applicants. The call bridges the divide between on-farm, *in situ* and *ex situ* conservation, and aims at creating a network of initiatives led by farming communities that are actively managing plant genetic diversity in centers of origin of crops, areas of food insecurity or affected by climate change. Knowledge, information and germplasm generated through the Benefit-sharing Fund will feed back into the Treaty enabling mechanisms. BSF-5 will develop a knowledge-sharing mechanism to improve farmers' access to plant genetic material and its related-data.

IV. CONCLUSION

37. In accordance with the request of the Governing Body at its Ninth Session, the Secretariat of the International Treaty will continue working closely with the Secretariat of the Commission on a range of issues of common interest and objectives, including issues of relevance to the ITWG. The Secretariat of the International Treaty will also bring to the attention of the Governing Body, at its next Session, any relevant discussions at this meeting of the ITWG as well as the relevant outcomes of the Nineteenth Regular Session of the Commission.

[102] https://www.fao.org/plant-treaty/overview/mypow/en/
[103] https://www.fao.org/plant-treaty/meetings/en/