

## The Role of CGIAR in the Global System of PGRFA Conservation and Use

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### Introduction

This short paper is dedicated to celebrating the 80<sup>th</sup> birthday of Dr RS Paroda, who has been champion of the genetic resources' conservation in India and a strong supporter of the CGIAR genebanks, especially the ICRISAT genebank that is named after him. This team wishes him many more years to his healthy life. This paper provides a high-level overview of the globally coordinated system for plant genetic resources for food and agriculture (PGRFA) conservation and sustainable use under the framework of the United National Food and Agriculture Organization (UN FAO). The paper also considers the role that CGIAR Centers, particularly their genebanks, have historically played within that system, and how recent reforms to the CGIAR system could influence the role it plays. Finally, the paper ends with a few recommendations for further development of the global system.

### The Evolving Global System for PGRFA

For decades, under the auspice of the United Nations Food and Agricultural Organization, the international community has repeatedly committed itself to supporting a globally coordinated system for the conservation and sustainable use of plant genetic resources for food and agriculture. Over time, there has been a gradual accretion of international policies, standards, tools, and guidelines adopted by UN FAO, and by other organizations, that have formed a part of that global system. Some of the most important developments in this regard were creation of the FAO Commission on Plant Genetic Resources and adoption of the International Undertaking on Plant Genetic Resources for Food and Agriculture in 1983; and the adoption of the International Treaty on Plant Genetic Resources for Food and Agriculture (Plant Treaty) in

2001; adoption of the genebank standards, and revised genebank standards in 1994 and 2014 respectively.<sup>1</sup> These instruments create a platform for countries, international organizations, crop and genetic resources networks, and farmer, civil society and private sector organizations to compare notes, coordinate activities, hash-out contentious issues, develop best practices and standards, and ultimately collectively contribute to: increasing the scope of plant genetic resources that are safely conserved, exchanged, and sustainably used; increasing the quantity and quality of information about those PGRFA that is globally, publicly available, and increasing the equitable sharing benefits derived from the use of PGRFA.

Since the earliest efforts under FAO to promote a global system, the focus has tended to be on three fundamental components: i) an internationally linked system of *ex situ* PGRFA collections; ii) creation of a global information system comprising information about those collections and iii) creation of a fund to support strengthening of the capacity of developing countries to play an active role in conserving and using and benefitting from the PGRFA in the global system. There has been comparatively little energy and resources dedicated to *in situ* conservation and local level management of plant genetic diversity as part of the global system. Recent efforts to recognize and promote Farmers Rights are starting to address these lacunae, at least partially. Indeed, the 9<sup>th</sup> session of the Governing Body of the Plant Treaty to be held in India in September 2022 will consider (and we hope) adopt a document entitled *Options for encouraging, guiding,*

<sup>1</sup> Indeed, there are many relevant policies, guidelines and standards adopted by the UN CGRFA and Governing Body of the Plant Treaty to list here.

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and promoting the realization of Farmers' Rights, and develop a program to support implementation of those options within countries over the next biennia.

There has also been comparatively little international attention or resources dedicated – at the level of the Plant Treaty's Governing Body, or the UN FAO CGRFA or FAO, more generally under the rubric of global system, on supporting plant breeding *per se*. This may be due to a perception that plant breeding is already being effectively addressed and practiced by national, international, public, and private sector organizations (or the hope that it will be), or it could simply be a reflection of the fact that supporting national, or sub-regionally organized plant breeding programs has been beyond the resource constraints of the UN FAO.

### The Role of CGIAR within the Global System

The international community has gone to considerable lengths to ensure that the CGIAR Centers and the collections they host are part of the global system. This is important given that these collections are among the most genetically diverse, and most used, in the world. In 1994, with the approval of the UN FAO Commission on Plant Genetic Resources, FAO entered into legal agreements with CGIAR Centers hosting *ex situ* collections (the FAO-CGIAR In Trust Agreements) to confirm the legal status of those collections as being held in trust by the CGIAR Centers on behalf of the international community, making them available without restriction for conservation and agricultural research and development. The Plant Treaty includes an invitation to CGIAR Centers (in Article 15) to enter into agreements with the Governing Body of the Plant Treaty to agree to manage those collections under the Plant Treaty framework, making materials available under the terms and conditions of the multilateral system of access and benefit sharing. In 2006, the Centers concluded such Article 15 agreements and have been managing their collections and taking policy advice from the Governing Body ever since. The Centers' genebanks act like global PGRFA pumps, acquiring and conserving materials from all over the world, and then redistributing it to the recipients all around the world along with associated information. In this sense, the Centers' operations reflect, and perpetuate, the interdependence of all countries in the world on PGRFA. Those Centers currently conserve, and make available, using the standard material transfer agreement (SMTA), a total of 722,525 accessions of

crop, tree, and forage germplasm, as set out in Tables 1 and 2, below.

**Table 1. PGRFA conserved and made available by CGIAR Centers' genebanks pursuant to their Article 15 agreements with the Governing Body of the Plant Treaty**

Center	Crop	Accessions available with SMTA
AfricaRice	Rice	19,696
Bioversity	Banana	1,682
CIAT	Beans	37,934
	Cassava	5,965
	Forages	22,662
CIMMYT	Maize	28,694
	Wheat	135,021
CIP	Andean roots and tubers	1,178
	Potato	7,367
	sweet potato	6,143
ICARDA	Barley	31,843
	Chickpea	15,230
	faba bean	9,594
	Forages	25,358
	Grasspea	4,301
	Lentil	14,295
	Pea	4,593
	Wheat	41,967
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	17,051
	Maize	1,561
	misc legumes	6,747
	Yam	5,929
ILRI	Forages	3,918
IRRI	Rice	127,413
	Total	722,525

Source: Global Crop Diversity Trust/CGIAR On-line Reporting Tool, covering period up to December 31, 2021.

**Table 2. CGIAR Centers' transfers of PGRFA with SMTAs, 2007 to 2021/22. PUD stands for PGRFA under Development**

Center	SMTAs	Samples	PUD	From	To
AfricaRice	598	53,351	30,714	2007-03-05	2022-01-29
Bioversity	554	8,595	831	2007-01-24	2021-11-18
CIAT	3,077	298,291	36,646	2007-01-05	2022-02-24
CIMMYT	26,644	3,211,789	-	2007-03-16	2021-12-21
CIP	788	22,503	12,221	2007-01-19	2022-05-05
ICARDA	11,531	992,246	873,178	2007-02-13	2021-12-21
ICRAF	358	1,719	-	2011-09-03	2022-03-03
ICRISAT	6,048	297,367	100,532	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	441,382	2007-01-04	2022-02-09

Source: Global Crop Diversity Trust/CGIAR On-line Reporting Tool, covering period up to December 31, 2021

The CGIAR centers also host very important crop and forage improvement programs focusing on a wide range of species/genera, including maize, wheat, rice, pigeon pea, cowpea, sorghum, finger millet, pearl millet, barnyard millet, proso millet, kodo millet, little millet, potato, cassava, banana, chickpea, lentils, barley, ground nut, yam, potato, sweet potato, lathyrus, grass pea, etc.

In the 16 years, since signing their Article 15 agreements with the Plant Treaty's governing body, the CGIAR Centers have distributed over 6 million

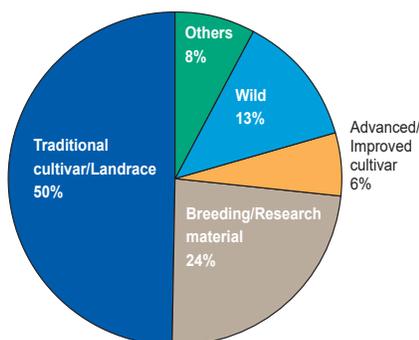
PGRFA samples to recipients around the world under the Plant Treaty's framework (Table 2). The majority of the PGRFA frequently requested and distributed between 2017 and 2019 were traditional landraces/cultivars (50%), followed by breeding materials (24%), and wild relatives (13%) (Fig. 1). Eighty percent of the materials were sent to recipients in developing countries. As far as regional distributions are concerned, the largest percentage of materials from CGIAR centers (29%) were sent to recipients in Asia; 19% distribute to

### Box 1. ICRISAT genebank case study

The germplasm supplied by CGIAR centers has played a critical role in supporting NARS crop breeding programs and agriculture. To cite an example, the germplasm supplied by ICRISAT Genebank, 114 germplasm accessions have been directly released as 153 cultivars in 52 countries. Some of the germplasms released as cultivars have significant economic impact. For example, ICP 8863, a pigeonpea landrace resistant to fusarium wilt was released in 1986 as Maruthi for cultivation in Karnataka state of India. The value of benefits from ICP 8863 was estimated at US\$ 75 million by 1996 with 73% internal rate of return. The Crop Trust Impact story of direct germplasm release of ICP 8863 <https://www.genebanks.org/news-activities/news/maruthi/>.

Enhancing use of germplasm in crop improvement is an important research area where ICRISAT genebank has played seminal role. Having recognized that less than 1% germplasm has been used in most crop improvement programs, and development of core collections (10% of entire collection) was not helpful where number accession was large, Upadhyaya and Ortiz, 2001 (*Theor. Appl. Genet.* **102**: 1292–98) postulated concept of mini core (10% of core or 1% of entire collection) and proposed development process, to produce resources recognized globally as an "International Public Good" (IPG). New diverse sources of genetic variation have been identified from mini core collections of various crops for multiple traits including biotic and abiotic stresses, agronomic and nutritional traits for use in crop improvement programs (Upadhyaya et al., 2013 – *Crop Sci.* **53**: 2506–2517; Upadhyaya et al., 2014 – *Crop Sci.* **54**: 679-693; Upadhyaya et al., 2019 – *Agriculture* **9**, 121). These multiple trait diverse sources would be extremely useful in developing high yielding climate resilient and nutrition rich crop cultivars with a broad genetic base and having greater genetic gains.

(a) All Centres



(b) By Center

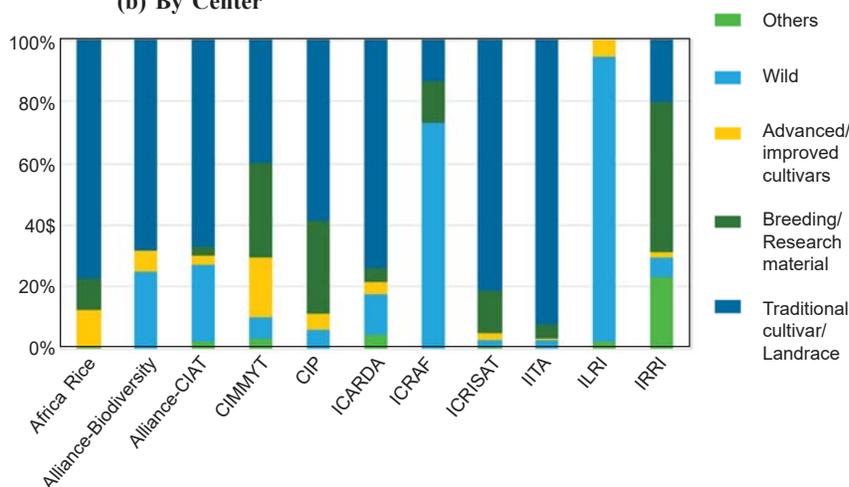


Fig. 1. Types of germplasm distributed by CGIAR genebanks to all centers (a) and by the centers (b), 2017–2019 (Michael *et al.*, 2020 - *Plants*, 9, 1296).

recipients in Africa; 19% to recipients in Europe, 14% to recipients in Latin America and the Caribbean; 11% in the Near East and 7% in North America. Transfers from CGIAR Centers account for 89% of all reported transfers under the Plant Treaty's multilateral system of access and benefit sharing. The germplasm distributed through genebanks has been evaluated and released as varieties after direct selection from the germplasm (Box 1) as well as used as parents for crossing or sources for important traits/genes.

The CGIAR works through partnerships, primarily with national research and development organizations in developing countries. As such, technology transfer, capacity strengthening, information sharing, – all important forms of non-monetary benefit sharing associated with PGRFA – are built into CGIAR Centers' modus operandi and reflected in their day-to-day operations. In recent years, Centers have been asked to report to the CGIAR System Office on how they have been promoting Farmers' Rights in particular in the context of their day-to-day R&D activities. Highlights are included in the Centers' biennial reports to the Plant Treaty, and in the annual CGIAR Intellectual Asset Management reports.

### Recent CGIAR Reforms

The CGIAR is currently in a system-wide reform, including the development of a 'One CGIAR' governance arrangement, aiming to increase efficiency and effectiveness in response to evolving global challenges (Fig. 2). As part of those reforms, CGIAR adopted

'CGIAR 2030 Research and Innovation Strategy: Transforming food, land, and water systems in a climate crisis'. Under the new governance structure, most research and development initiatives working directly with genetic resources for food and agriculture (including the work of genebanks, breeding programs and seed systems R&D) take place under 'Genetic Innovation'. This arrangement is conceived to getting faster reflections/ feedback/ participation from leaders who collaborate across research groups, and from top CGIAR leadership on important evolving issues, including CGIAR genetic resources management policies. *In situ* conservation and dynamic *in situ/ex situ* PGRFA conservation are still not explicitly integrated into the work of the Genebank Initiative. Some such work is included in the Initiative entitled Nature Positive Solutions, but one could argue that more targeted support - including strong involvement of NARS would be useful and justified.

The 'OneCGIAR' reform process has involved considerable realignment and integration of the governance and operational structure of the CGIAR System overall, but the CGIAR Centers will maintain their legal status as independent legal entities in their own right, and that their Article 15 agreements with the Governing Body of the Plant Treaty will remain in place. CGIAR considers the 'in trust' plant genetic resources maintained by the CGIAR genebanks to be of inestimable value for the international community. CGIAR remains committed to supporting the continued management of collections hosted by International Agricultural Research

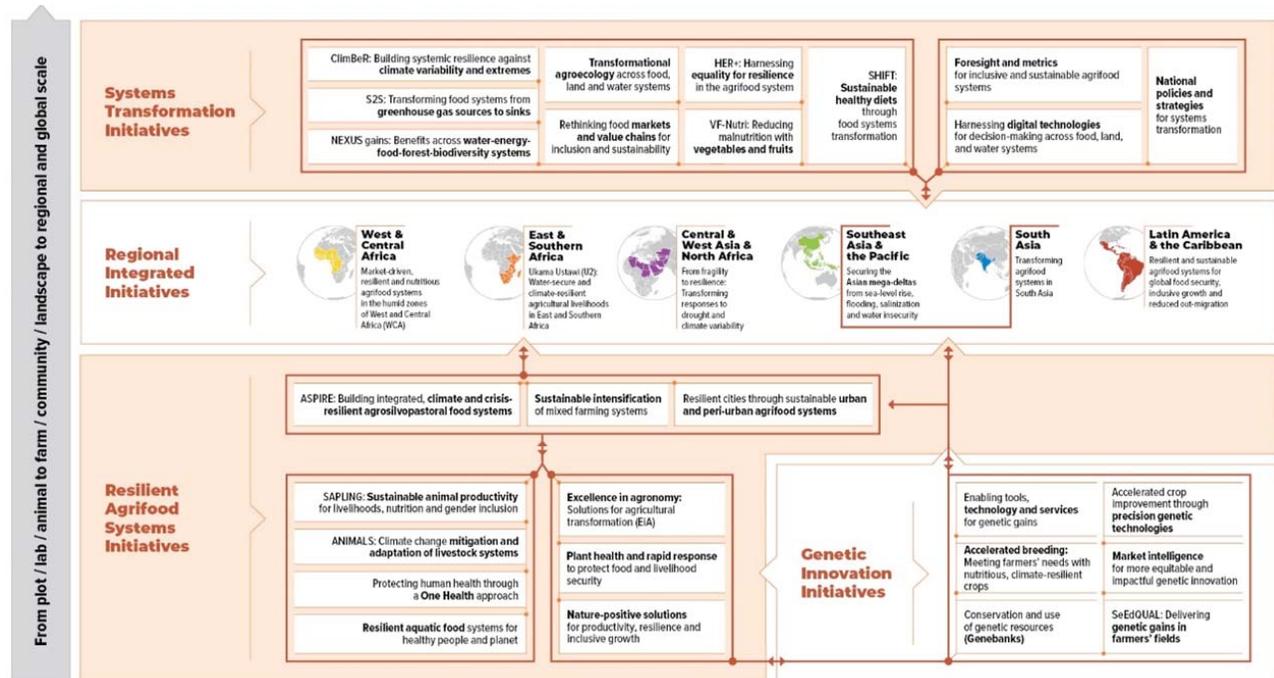


Fig. 2. One CGIAR Research Initiatives

Centers (IARCs), including within ‘OneCGIAR’ under the framework of the Plant Treaty.

Although CIFOR-ICRAF and ICRISAT have not adopted for ‘OneCGIAR’ unified governance arrangements at this time, they remain CGIAR Centers that hold Article 15 agreements with the Plant Treaty’s Governing Body. ICRISAT and ICRAF will continue to ensure their genebanks are operated and maintained as per international standards. ICRISAT and ICRAF will continue to conserve the germplasm for the international community, under the auspices of the UN FAO and the Plant Treaty, as per the agreements signed in 1994 and 2006, and will continue to deliver their missions to international agriculture, food systems and landscape stewardship.

One of the consequences of opting out is that these Centres do not have access to the same financial support from the OneCGIAR Trust fund as Centers that have joined the OneCGIAR governance arrangement. Funding from the Crop Trust, however, is not affected by the OneCGIAR reform. Alternative sources of funding are actively being sought as well as additional funds from the Global Crop Diversity Trust (Crop Trust). The long-term grants already in place with nine CGIAR Centre genebanks continue to provide funding for genebank operations. In addition, as genebanks

reach performance targets they become eligible for a larger Long Term Partnership Agreement (LPA), which provides enough funding to cover all essential genebank operations. ICRISAT is among a number of international genebanks that are approaching eligibility for an LPA. ICRISAT, CIFOR-ICRAF and the CGIAR senior leadership are also engaged in discussions to work out the conditions for future cooperation, coordination, and mutual supportiveness. ICRISAT and CIFOR-ICRAF continue to be international institutions and CGIAR Centers. Their long-standing Article 15 agreements with the Plant Treaty’s governing body are not affected.

### Going Forward in the Context of an Expanding, more Efficient, Global System

Moving forward in the further evolution of the global system, it will be important for all article 15 organizations and other international institutions hosting PGRFA under the Plant Treaty framework to work more closely together, developing stronger network ties, to enhance their collective contributions. These organizations include CGIAR Centers inside and outside the new OneCGIAR governance arrangement, International Center for Biosaline Agriculture, FAO Mutant Germplasm Repository, International Coconut Genebank for the South Pacific, International Coconut Genebank for African and the Indian Ocean, International

Cocoa Genebank – Centro Agronomico Tropical de Investigacion u Ensenanza (CATIE), Centre for Pacific Crops and Trees (CePACT), World Vegetable Center, and SADC Plant Genetic Resources Center (SPGRC).

Efficient functioning of the global system will also depend on stronger linkages and better-defined sharing of responsibilities for all actors including national and international collection holders, and organizations involved in promoting *in situ* conservation and sustainable use. As part of that effort, we flag the following important initiatives:

- Coordinated analysis of gaps in globally accessible national and international collections
- Work on the West and Central African regional hub (possibly other hubs)
- Global Plant Cryopreservation Initiative
- Participation in the Crop Trust’s Global Genebank Partnership,
- Capacity building for a much wider range of actors to both conserve, access and to use PGRFA and related information for addressing pressing local to global challenges including climate change, and nutrition deficits
- Promote development and operationalizing a more supportive policy environment through enhancement of the Plant Treaty’s multilateral system of access and benefit sharing, and mutually supportive implementation of the Plant Treaty, Nagoya Protocol, IPPC, etc
- Contribute to international discussions/negotiations with respect to setting targets for, and monitoring, biodiversity conservation, generating and sharing benefits (and monitoring that sharing) through the use of digital sequence information
- Developing pangenebank (IARC and NARS genebanks) unified collections using high throughput genomics approaches