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October 2012

	منظمة الأغذية والزراعة للأمم المتحدة	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

COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Item 8 of the Provisional Agenda

INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Sixth Session

Rome, 14 - 16 November 2012

REPORT FROM THE CGIAR CONSORTIUM OF INTERNATIONAL AGRICULTURAL RESEARCH CENTRES TO THE INTERGOVERNMENTAL TECHNICAL WORKING GROUP ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

Table of Contents

I. INTRODUCTION

1. This document presents a report on the activities undertaken by the Centers[1] of the CGIAR[2] Consortium in relation to plant genetic resources for food and agriculture (PGRFA). The CGIAR Consortium Office has prepared the document on behalf of the Centers, drawing on inputs from individual Centers. It presents an overview of activities conducted in 2011 updating the document presented at the last session of the Intergovernmental Technical Working Group on Plant Genetic Resources[3].

2. Over the reporting period, the CGIAR Centers have undertaken a significant range of activities in areas important to the Commission on Genetic Resources for Food and Agriculture. Major contributions have been made in relation to assuring the sustainability of the genebanks managed by the Centers. These collections support crop improvement programs of the Centers and of partners. The work of the Centers continues to take forward the implementation of the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (GPA), as well as supporting the aims of the program of work on agricultural biodiversity of the Convention on Biological Diversity (CBD), in which FAO plays a key role.

3. For over 16 years the CGIAR System-wide Genetic Resources Program (SGRP) has served as a key mechanism for cross-sectorial genetic resources work in the CGIAR Centers. It has facilitated collaboration among the Centers and with national and international organizations, to enhance the CGIAR's contribution to global efforts to conserve genetic resources for use in agriculture, forestry and fisheries. This has included fulfilling representation and public awareness functions, and contributing to international agendas on the Centers' behalf.

4. Through the reform, all System-wide programs came to a closure, including the SGRP. The CGIAR Consortium is in the right position to present the consolidated views of the CGIAR Centers in international technical and policy fora. The following sections provide an update on plant genetic resources activities undertaken in 2011 in CGIAR Consortium Centers.

II. MANAGEMENT OF *EX SITU* PLANT COLLECTIONS

5. The management of the *ex situ* collections lies at the heart of the CGIAR's Centers' work on plant genetic resources for food and agriculture. These collections currently hold about 750,000 accessions. The emphasis is on main food crops, but the total number of species is large (more than 3,000) and they include forage, range and agro-forestry species and crop wild relatives. The CGIAR genebanks hold about 10% of global crop genetic resources accessions (about 7.4 million accessions conserved in about 1750 crop genebanks worldwide[4]), but their importance is much more relevant as they are responsible for a high proportion of the global exchange of crop genetic resources.

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[1] AfricaRice (formerly Africa Rice Center/WARDA); Bioversity International (formerly International Plant Genetic Resources Institute IPGRI; including the International Network for the Improvement of Banana and Plantain INIBAP, hereafter referred to as Bioversity); Centro Internacional de Agricultura Tropical (CIAT); Centro Internacional de Mejoramiento de Maíz y Trigo (CIMMYT), Centro Internacional de la Papa (CIP); Center for International Forestry Research (CIFOR); International Center for Agricultural Research in the Dry Areas (ICARDA); International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); International Food Policy Research Institute (IFPRI, including the International Service for National Agricultural Research ISNAR programme); International Institute of Tropical Agriculture (IITA); International Livestock Research Institute (ILRI); International Rice Research Institute (IRRI); International Water Management Institute (IWMI); World Agroforestry Centre (ICRAF); WorldFish Center (WorldFish)

[2] 'CGIAR' is no longer an acronym that stands for the 'Consultative Group on International Agricultural Research', but a name. Consequently, 'CGIAR' should never be spelled out or translated (CGIAR Branding Guidelines and Toolkit, http://library.cgiar.org/bitstream/handle/10947/2699/CGIAR_Branding_Guidelines_and_Toolkit.pdf?sequence=1

[3] CGRFA/WG-PGR-5/11/Inf.8

[4] FAO 2010. The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture. UN FAO, Rome Italy.

6. The Global Crop Diversity Trust (hereafter the Trust), established in 2004 under international law as an offspring of the CGIAR, largely to give stability and permanence to funding of CGIAR collections, has been partnering with the CGIAR Centers for several years to achieve the common goal of effective management and sustainable funding. In 2010 the Trust and the CGIAR Consortium commissioned and participated in a study to document the cost to the CGIAR Centers of maintaining and distributing germplasm. The nature of these activities does not fit easily in project funding. In the past they have been almost entirely financed by unrestricted funding support, a funding category not anymore available in the reformed CGIAR, as the CGIAR Research Programs are the main vehicles for funding the research and support activities. For this reason in 2011, the Consortium and the Trust worked together to develop a proposal to finance the 2011 costs for the core activities (multiplication/regeneration, characterization, documentation, distribution and management) of the genebanks at the CGIAR Centers and subsequently they developed a comprehensive 5-year program (Genebank CRP) for the management, as well as the secure and sustainable funding, of the collections of plant genetic resources held by 11 members of the CGIAR Consortium[5].

A. Conservation, distribution, and characterization

7. The Trust has agreements to support specific collections at Bioversity, CIAT, CIMMYT, CIP, ICARDA, ICRISAT, IITA, ILRI, and IRRI for the long term. The Trust has a routine monitoring of performance for specific aspects of the conservation and use of the collections as well as the global outreach of the Centers. In 2011 the funds from the Trust complemented that provided by the CGIAR Fund. AfricaRice was not included in the long term grants from the Trust, but it was included in the 2011 stability funding of the CGIAR Fund.

8. Centers differ in the achieved proportion of their collections identified for secure long term conservation (55% to 100%) with adequate safety duplication at an off-site facility (0% to 100%) and stored in Svalbard seed vault (50% to 100%). All Centers reported progress in this area, with increased percentage of samples duplicated.

9. *Ex situ* conservation approaches for vegetative propagated collections differed for Centers and crops. IITA has focused on conservation of live plants of cassava while CIAT, for the same crop, has focused on *in vitro*. Bioversity is storing its banana collection *in vitro* and by cryopreservation. IITA maintained a total of 4,042 accessions of yam (including about 200 new acquisitions in 2011) and 2,658 accessions of cassava as live plants. FAO and Bioversity contributed in collaboration with CIP, ICARDA, and ILRI and other international experts to the development of the genebank standards for plants with non-orthodox seeds and clonally propagated. The effort, lead by FAO upon request of the CGRFA, addresses the conservation in field genebanks as well as *in vitro* and cryopreservation. During 2011 Bioversity developed the draft standards for conservation in field genebank, organized an international expert consultation held at its headquarters in Rome in January 2012, and collaborated in the development of the final draft of the standards after the expert consultations.

10. Progresses are reported by all Centers in the area of high risk pathogens, viruses and pests. Four Centers have attained the target of 100% free of pathogens that would impact conservation and distribution of the collections. This is still a main focus for many of the Center genebanks.

11. The number of samples distributed varied highly between Centers and between collections. Most of the collections met >85% of the requests for germplasm.

[5] In Trust for the International Community – Plan and partnership for Managing and Sustaining CGIAR-held Collections. CRP Research Support. April 2012.

Table 1. Number of samples distributed and number of countries distributed to.

Center	Samples distributed outside the Center with SMTA	Number of Countries distributed to
AfricaRice	24,964	35
Bioversity	509	27
CIAT	5,956	35
CIMMYT/Maize	13,056	30
CIMMYT/Wheat	1,988	28
CIP	2,290	n.a.[a]
ICARDA	6,772	25
ICRAF	346	2
ICRISAT	7,290	17
IITA	2,503	n.a.
ILRI	694	13
IRRI	10,107	34

[a] not available

12. ICRISAT has restored germplasm to nine countries when their national collections were lost due to natural disasters or due to lack of proper facilities.

13. In addition there are large numbers of breeding material distributed as germplasm under development using SMTA.

14. Under the leadership of the respective national programs, new collection missions were organized by AfricaRice in Benin (330 rice accessions), and by ICARDA in Cyprus (448 accessions of wild cereals and forage and pasture legumes) and Tajikistan (378 accessions of cereals and legumes, including crop wild relatives, and forage and pasture legumes. In collaboration with IRRI and AfricaRice, rice collecting missions are being conducted by the national genetic resources systems of Kenya, Tanzania and Uganda. After many years without field expeditions CIP has recently participated in two collection missions to increase holdings of the underutilized and highly promising yam bean (*Pachyrhizus tuberosus*), and in two collection trips in the central Peruvian Amazon together with Peru's national program (INIA) resulting in the addition of more than a dozen new accessions.

15. Other genebanks acquired new accessions from partners: IITA received 189 yam new accessions from Benin and 78 and 21 cassava accessions from Guinea and Angola, respectively; Bioversity acquired 85 new *Musa* accessions. ICARDA received 720 new accessions from partners which benefited from the Trust regeneration grants.

16. Descriptors are the basis of major information platforms such as GENESYS, EURISCO, and the FAO World Information and Early Warning System. Bioversity in collaboration with other CGIAR Centers and other international partners has lead in the development of descriptors and derived standards. Some of the major outputs are:

- An updated version of the FAO/Bioversity List of Multi-Crop Passport Descriptors V.2 [MCPD V.2][6] was released in 2012. The MCPD is widely used as the international standard to facilitate germplasm passport information exchange. The new version resulted from consultation with more than 300 scientists from 187 institutions in 87 countries and represents the backbone of GENESYS.
- Methodology for the assessment of the characterization and evaluation descriptors for 22 crops included in Annex I of the International Treaty on Plant Genetic Resources for Food and Agriculture (Treaty). The strategic sets of data standards are designed to facilitate access to and utilization of plant genetic resources information. Passport, characterization and evaluation descriptors are included on the GENESYS portal, to facilitate access to information and promote the utilization of germplasm accessions.[7]

17. Bioversity is currently developing descriptors for underutilized species (with FAO and PROINPA for quinoa; with the University of Valencia and of Ecuador for tree tomato; and with EMBRAPA for *Butia odorata* native palm) promoting the expanded use of local and locally adapted crops as stated in Art. 6 of the treaty.

18. Molecular characterization of collections have continued in several Centers, for example at ICRISAT the molecular characterization of composite sets of germplasm, has helped in understanding genetic diversity and population structures in sorghum, pearl millet, finger millet, foxtail millet, chickpea, pigeonpea, and groundnut (11,500 germplasm accessions of the seven crops were genotyped with 19 to 50 SSR markers).

B. Informatics activities

SINGER

19. The System-wide Information Network for Genetic Resources (SINGER) is a project that dates back to 1994, with the aim to publish on the web all data on the CGIAR collections that is of public interest in a form that is easily accessible. SINGER website (http://singer.cgiar.org/) with the seed request gateway was released in 2008 as a product of the Global Public Goods Project, Phase 2 (GPG2), and is still maintained by Bioversity. However, the SINGER community is moving toward one-stop integration with the emerging GENESYS global database and portal.

20. All passport data provided by the 12 SINGER member genebanks, 11 CGIAR Centers and the World Vegetable Center (ex-AVRDC), were formatted and updated in August 2011 by Bioversity in the SINGER database, and published in GENESYS in 2012. The total number of crop germplasm accessions reported in SINGER as of 18 September 2012 is 751,717.

21. All CGIAR genebanks have provided updates or links to their own genebank information systems and some as in the case of Bioversity, have linked each sample passport, for Bioversity-supported missions, to the scanned original notes taken by the collectors and to the reports in the collecting mission reports repository[8]. IRRI, with AfricaRice and Lao PDR, has contributed further collecting forms and reports from other missions to the central repository maintained by Bioversity, and it also provides direct links through the International Rice Information System[9]

22. A summary report and analysis of the germplasm exchanges performed by CGIAR genebanks was provided in April 2011 to the Governing Body of the Treaty and is available on the Treaty site. The distribution data were also extracted and analyzed to provide baseline information to the CGIAR Research Program on Climate Change, Agriculture and Food Security.

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[6] http://www.bioversityinternational.org/index.php?id=19&user_bioversitypublications_pi1%5bshowUid%5d=6901

[7] http://www.bioversityinternational.org/nc/publications/publication/issue/key_characterization_and_evaluation_descriptors.html

[8] http://www.central-repository.cgiar.org/

[9] For example, http://webtools.cropinfo.org/WCIMS/germplasm2/id/1228046

GENESYS

23. SINGER has provided invaluable experience and a model to move towards an approach to information management to underpin a global system of plant genetic resources conservation and use. The Trust and the Secretariat of the Treaty have supported a project to develop relevant informatics tools. A key tool is GENESYS, a global informatics portal to provide access to information on around 2.4 million accessions held in hundreds of genebanks around the world. GENESYS takes the purpose and functionality of SINGER to the next level by incorporating data from genebanks outside the CGIAR and, as well as passport data, including environmental, characterization and evaluation data for each accession. GENESYS will promote the use of accessions by allowing users to make queries across all categories of data and place orders online. Bioversity with financial support from the Trust and the Treaty developed the GENESYS 1.0 portal[10] that was released on 13 May 2011. Breeders can cross-search for characterization, evaluation and environmental (19 climatic parameters) information for 18 crops. Much of this information, especially the evaluation and environmental data, is particularly relevant in identifying accessions that can address present plant breeding objectives such as food security and climate change.

24. The foundation for GENESYS comprises aggregated data from SINGER, EURISCO[11] and the Germplasm Resources Information Network (GRIN)[12] of the United States Department of Agriculture (USDA). The evolution of SINGER into GENESYS, looking beyond the CGIAR Centers to the wider community of partners, is in line with and supportive of the larger vision of the CGIAR reform. Moreover, by providing an informatics portal that is global in scope, GENESYS is well positioned as a potential basis for the global information system envisaged by Article 17 of the Treaty.

25. At its release, GENESYS 1.0 contained the 2.33 million accession records previously available in SINGER, EURISCO and GRIN information systems. In addition it contains more than 11 million records of characterization and evaluation data and other 11 million records of climatic data for 27% of geo-referenced accessions. About 33% of the characterization and evaluation data was provided by GRIN with the remainder being provided by four CGIAR Centers (ICARDA, IRRI, CIMMYT, and IITA). As of 3 September 2012, GENESYS contains information on 2,348,398 accessions.

26. GENESYS has to continuously evolve, adapt and change to address needs of users, policy makers and data providers. It has to take input from development of data standards, actively monitor user requirements and respond to their needs. GENESYS is now part of the Genebank CRP. An external review of the first phase has been conducted, and the Trust has put in place a planning process to implement the phase 2 of GENESYS.

GRIN-GLOBAL

27. GRIN-Global[13] is an emerging global standard of software technology which genebanks can apply to their information and genebank management requirements. Not only does it offer genebanks the ability to better manage their core passport and other data, but it also offers significant flexibility for adding data fields, using global data standards, managing all in-house activities including inventory control. It also supplies a generic web portal through which genebanks can offer users internet access to their collection and an online ordering system compliant with the Treaty's Multilateral System (MLS) and Standard Material Transfer Agreement (SMTA).

28. The USDA/ARS, Bioversity, and the Trust announced a full release of GRIN-Global System version 1.0 on 14 December 2011. Bioversity currently has staff in Europe, Africa and South America

[10] http://www.genesys-pgr.org/

[11] http://eurisco.ecpgr.org/static/index.html. EURISCO is a web-based catalogue that provides information about *ex situ* plant collections maintained in more than 40 countries in Europe. SINGER provided the technical infrastructure for EURISCO, as well as training national focal points in the tools and approaches needed to operate the system.

[12] http://www.ars-grin.gov/

[13] http://www.grin-global.org

contributing toward the on-site deployment of the system with selected NARES genebanks in collaboration with some CGIAR Centers. By 31 December 2011 some 35 genebanks had received basic and, in most cases, more extensive training in the use of GRIN-Global. Of the 70 individuals who completed a GRIN-Global evaluation survey (6 February 2012), 50 indicated they would install the GRIN-Global generic website which covered 31 different collections.

Crop Genebank Knowledge Base

29. The Crop Genebank Knowledge Base[14] is a web portal that was developed as part of the World Bank funded project "Collective Action for the Rehabilitation of Global Public Goods in the CGIAR Genetic Resources System, Phase 2 (GPG2)" by SGRP. The main goal was to contribute to more efficient and effective *ex situ* conservation and use of crop genetic resources through facilitating easy access to the knowledge and best practices for genebank management of selected crops and to several aspects of general genebank management. The best practices and relevant information for banana, barley, cassava, chickpea, forage grasses and legumes, maize, rice and wheat were initially collated and written by genebank experts of CGIAR Centers and of national genebanks worldwide. Procedures and learning resources were compiled by CGIAR Centers and management strategies were contributed by different groups carrying out parallel activities in GPG2. The site was launched in 2010 and is a widely used web site (more than 50 000 unique visitors in 2011). Bioversity is currently maintaining it, advanced the Spanish translation of the web site in collaboration with CIMMYT and CIP, and developed and added in 2011 the best practices for radish conservation in collaboration with 8 genebanks conserving radish. Several sections were updated by the lead CGIAR Centers. In 2012, Bioversity added a new section on plant collecting, which contains the update of the technical guidelines on collecting plant genetic diversity, which had been developed by Bioversity, FAO, IUCN and UNEP and published in 1995 by CABI.

C. Reporting to the Governing Body of the Treaty

30. A report on the experiences of the CGIAR Centers with the implementation of the agreements with the Governing Body of the Treaty was compiled by Bioversity, with contributions from 11 Centers, and submitted to the Fourth Session of the Governing Body of the Treaty (14-18 March 2011) held in Bali, Indonesia. The report contains information on the PGRFA acquired and distributed by Centers' genebanks and breeding programs. The Centers convened a side event to present the data, and provide information about the research programs within which many of the materials were distributed, focusing on partnerships and crop improvement objectives. Details about the side event and the text of interventions made by the Centers' representatives during plenary sessions of the Governing Body are available at http://www.sgrp.cgiar.org/?q=node/1066.

31. The reports submitted by the CGIAR to the Governing Body of the Treaty have been accepted as valuable contributions to the discussion and decisions of the Governing Body. However, it has been noted that these reports do not replace the obligations of Providers of germplasm under SMTAs to report to the Governing Body as described in Article 5e of the SMTA. To meet these contractual obligations, the CGIAR Centers have to report independently as independent Providers, and have submitted reports manually in the format required. IRRI has been working with the Treaty Secretariat to facilitate the reporting process.

III. *IN SITU* AND ON-FARM CONSERVATION AND USE OF CROP GENETIC RESOURCES

32. In 1997, CIP undertook a repatriation program to distribute native potato varieties back to their communities of origin. The varieties were collected from Andean farming communities 20 to 40 years ago and were conserved at CIP's *ex situ* genebank. In an effort to restore cultivars and diversity lost due to frost, drought, crop pests and diseases, human migration, social unrest and poverty, CIP distributes high quality planting material that is disease-free, thus increasing yields.

[14] http://cropgenebank.sgrp.cgiar.org

33. Since then scientists, farmers and local partners have repatriated over 5,000 samples of more than 1,250 accessions of native potato to 51 Andean farm communities and six local institutions. During 2011, 402 accessions of native potatoes and 92 accessions of Andean roots and tubers (mashua, oca and olluco) were delivered to the communities in an effort to introduce clean bio-diverse material. These repatriation programs highlight the complementary between *in situ* and *ex situ* activities.

34. Bioversity is managing a research portfolio of nine projects addressing different crops and aspects of on farm conservation of crop and crop wild relative genetic resources in different parts of the world. One research area addresses the identification and mainstreaming of best practices to conserve native fruits and their wild relatives in orchards and home gardens focusing on temperate fruits in five countries of Central Asia and tropical fruits in four countries of South and Southeast Asia. For tropical fruits the concept of a Community-based Biodiversity Management (CBM) approach has been employed to support on-farm conservation, with CBM allowing communities to take control of the maintenance and use of their genetic resources. This method is also employed by NGOs in countries of Asia, Africa and Latin America. In another area, a framework and a methodology were developed to assess the success of on farm conservation projects and applied these tools to a set of six projects focused on the on-farm conservation of native Andean crops in South America. The concepts and methods for payments for ecosystem services were adapted and applied to the conservation of agricultural biodiversity on farm in three countries (Andes and Asia), as well as exploring their implications for collective action and social equity at the community level. Associated decision-support tools for prioritizing genetic resources conservation interventions have also been undertaken for case study crops (maize and cacao) in Latin America and is currently on-going for root, tuber and banana crops. Approaches and methods for the conservation and use of crop genetic diversity to control pests and diseases on farm have been researched and evaluated for a group of crops in different countries of Asia, Africa and Latin America. Another area of research explores how on-farm conservation of local agricultural biodiversity can be use to reinforce the resilience of poor rural communities against food insecurity, poverty and climate change in selected countries of Africa, Asia and Latin America. In this respect the use of landraces, both from genebanks and the field, as a tool to adapt to climate change has been developed and tested. Monitoring the impact of on-farm conservation interventions and participatory plant breeding on local crop diversity is another important area of research that builds upon past work in Asia. An important component of the research portfolio includes research on traditional seed systems, which include projects on methods to enhance these systems to reduce risk of crop failure in Sahelian West Africa, as well as with regard to the role of gender in agricultural biodiversity conservation and use (Asia and Oceania). A tool was developed to support the estimation of the income that may be expected to flow into the Treaty Benefit Sharing Fund over the coming decades under a range of scenarios. Efforts are being made to develop national strategies for *in situ* and on farm conservation of important native species for climate change and food security (e.g. buckwheat in China).

35. ICARDA continues to promote *in situ* and on farm conservation of dryland agro-biodiversity through several activities including those of the Diversification and Sustainable Intensification of Production Systems, and Integrated Water and Land Management Programs and through the technical backstopping and training to several projects in Yemen, Tunisia, Iraq, Palestine, Afghanistan, and Syria. Promoting landrace participatory improvement and community-based seed production and supply systems is continuing in Tunisia, Palestine and Yemen. In Yemen, more than 65 Seed Producers Groups were fully involved in improvement and seed multiplication of landraces of 11 crops planted in 5 governorates.

36. ICRAF is managing on farm conservation stands of several tree species in Cameroon, Indonesia, Peru and Malawi in partnership with the local communities. The inventory of accessions maintained was updated in 2011 and currently 471 accessions are maintained. Management practices are being reviewed in 2012.

37. Several publications have been produced by different Centers, including a comprehensive review of the benefits generated by on-farm conservation and ways to support it, results from the

evaluation of payments for agricultural biodiversity conservation services incentive schemes and a manual for CWR *in situ* conservation.

A. Consortium approach to *in situ* agro-biodiversity research

38. The report of the Consortium Board-Commissioned Genetic Resources Scoping Study highlighted the strategic position of genetic resources in the CGIAR in both their research and service roles. The Study identified cross cutting issues and gaps in the in the current portfolio of CGIAR Research Programs (CRPs), and provided recommendations impacting the maintenance of genetic resources, associated research activities and services provided by the CGIAR Centers. The key issue addressed by the panel relates to how best the new research structure of the CGIAR will accommodate on-going genetic resources research and services activities, in addition to the genetic resources components already included in current CRP proposals.

39. The Consortium Board decided on the most relevant cross cutting issues and gaps that needed attention, some have been already addressed (i.e. the Genebank CRP). One area which is still not fully addressed is agro-biodiversity research, in particular *in situ* management of agro-biodiversity, its ecosystem services and crop wild relatives.

40. The Fund Council at its meeting in Seattle, March 7-8, 2012, requested the Consortium to develop a system-wide approach to *in situ* agricultural biodiversity (hereafter refer to as agro-biodiversity) conservation and management that would address key research questions for the CGIAR. The Consortium Board decided that such agro-biodiversity research should be mainstreamed within the existing CRP portfolio, in the same manner as it previously decided to mainstream gender research in all CRPs.

41. As a first step the Consortium Office convened a Workshop in Montpellier, July 24-26, 2012 to discuss and identify the key research questions that the CGIAR, as a public and global international agricultural research system, must address. At the moment of writing this report an articulated *in situ* agro-biodiversity strategy is under preparation.

IV. SUPPORTING AND ENHANCING PARTNERS CAPACITY IN PLANT GENETIC RESOURCES

42. Supporting and enhancing partners' capacities in plant genetic resources have been always vital activity for CGIAR genebanks. Capacity building activities including training courses on different aspects of plant genetic resources conservation and utilization, supervision of graduate students, and backstopping on specific needs of national genebanks.

43. Table 2 gives a summary of number of individuals trained at different Centers and number of institutions that received technical backstopping during 2011.

Table 2. Number of individuals trained and number of institutions that received technical backstopping by Center.

Center	Number of trainees	Number of Institutions receiving backstopping
Bioversity	5	16
CIAT	80	3
CIMMYT	113	0
ICARDA	131	0
ICRISAT	18	0
IITA	12	12

ILRI	10	82
IRRI	200	9

44. ILRI has a well established seed unit within the genebank that supplies large number of seed samples to small local enterprises, NGOs, government organizations, and farmers. The unit also provides recommendations on forage species to use in different environments, and advices on how to plant and grow those species. That explains the high number of backstopping interventions.

V. Participation in international policy-making processes

A. The International Treaty

45. As indicated in section II c above, the Centers compiled a report, based on PGRFA acquisition and distribution data from 11 Centers' breeding programs and genebanks, concerning their experiences working under the Treaty's framework.

46. Bioversity is one of the founding organizations of the FAO/Treaty Secretariat/Biodiversity Joint Capacity Building Programme for Developing Countries on the Implementation of the Treaty and its MLS, which has been recognized and welcomed by the Governing Body of the Treaty. Under the umbrella of the Joint Program, with support from the government of the Netherlands, since early 2012, Bioversity is coordinating parallel research and capacity building activities related to the implementation of the multilateral system in Nepal, Bhutan, Rwanda, Uganda, Côte d'Ivoire, Burkina Faso, Costa Rica, and Guatemala. The terms of reference for the research being conducted, with a wide range of national partners (with technical inputs from a specialized 'platform for university researchers' is available at http://www.bioversityinternational.org/fileadmin/bioversity/publications/pdfs/1536_Report_GRPI2_ITPGRFA_workshop_May_2012.pdf?cache=1346435118. Bioversity is also involved in supporting national implementation activities in India and Malaysia. Further details about these activities can be found at http://grpi2.wordpress.com/about/grpi-2/.

47. IRRI has worked with the Treaty Secretariat to design and test the Secretariat's new online system to generate, accept and report on SMTAs, now available at https://mls.planttreaty.org/itt/.

B. CBD and Nagoya Protocol

48. As part of its work supporting implementation of the Treaty's multilateral system discussed above, Bioversity and its partners are identifying policy options regarding how the Treaty and the Nagoya Protocol interact/interface at organizational and national levels. Bioversity and IRRI participated in the final (ninth) meeting of Ad Hoc Open-ended Working Group on Access and Benefit-sharing in July 2010, which developed a final draft text of the Protocol before its adoption in Nagoya, hosting a side event on GRFA and the planned Protocol.

49. Bioversity was invited to make a presentation to the plenary session of the 'Third Capacity Building Workshop on Access and Benefit-sharing' organized by the CBD Secretariat, (New Delhi, June 2-6, 2012, New Delhi) as part of the effort of the Conference of the Parties of the CBD to identify the best mechanisms to support implementation of the Nagoya Protocol. (See http://www.cbd.int/doc/meetings/abs/wcbabs-03/official/wcbabs-03-icnp-02-inf-09-en.pdf) The Bioversity representative focused primarily on lessons learned from its work supporting implementation of the Treaty's multilateral system and the need to coordinate implementation of the Treaty with the Nagoya Protocol. Bioversity has also participated in teleconferences jointly organized by the CBD and Treaty Secretariats to explore possibilities to coordinate capacity building and research activities in this regard.

50. Bioversity attended the CBD First Meeting of the Open-ended Ad Hoc Intergovernmental Committee for the Nagoya Protocol on ABS (ICNP-1) 6 - 10 June 2011, Montreal, Canada.

C. Inter-session meeting of technical committees set up by the Governing Body of the Treaty

51. Bioversity was invited to send an expert to the 3rd meeting of the Ad Hoc Technical Advisory Committee on the Standard Transfer Agreement and the Multilateral System, New Delhi, 26-28 June, 2012. The committee considered technical contributions from Bioversity, along with other experts, when developing its opinions regarding the distributions under of materials for non-food and non-food purposes, and to farmers for direct use.

52. Bioversity participated as an observer in the meeting of the Governing Body-created Ad Hoc Working Group on Compliance (held immediately before the Governing Body meeting) in Bali, where it was asked to provide information about the conditions under which the Centers make non-annex 1 materials available.

VI. CENTERS/CGIAR RESEARCH PROGRAMS HIGHLIGHTS

53. The highlights are reported by Centers with some references made to the CGIAR Research Programs (CRP), as in 2011 only 2 CRPs were operational for the entire year and 3 for six months.

AfricaRice

54. The Center's genebank is fully involved in the Global Rice Science Partnership CGIAR Research Program. The genetic resources component is designed to improve the conservation, characterization, and use of the world's rice gene pool for varietal development by joining the resources of organizations across the globe. Under GRiSP, efforts are being combined among AfricaRice, IRRI and National partners from 3 East Africa countries (Kenya, Tanzania and Uganda) in a project for new rice germplasm collection.

55. In an effort towards having better rice adaptation to the new emerging diseases and possible interactions with abiotic stresses that might result due to climate change, the AfricaRice genebank has formed a reference set of African rice germplasm (*Oryza glaberrima, O. barthii*) from accessions identified in previous evaluation trials. This is being used by AfricaRice and its partners in setting up methodologies and new resources for genotyping and phenotyping of African rice species and their pathogens for developing strategic disease resistance breeding programs (MENERGEP).

Bioversity International

56. The *Musa* Genotyping Centre was established and hosted by the Institute of Experimental of Botany (IEB), Czech Republic under the auspices of Bioversity. This Centre will assure that the molecular characterization of ITC accessions and provide SSR genotyping service to help the Musa Research Community. A centralized database of molecular profiles keeps growing with every new sample, resulting in stepwise improvement in the grouping. For more information please consult: http://aobpla.oxfordjournals.org/content/2011/plr024.full.pdf+html

57. Bioversity's Seeds4Needs program builds on the idea that adaptation options to climate change already exist in genebanks and farmers' fields, but the challenge is to identify and disseminate them in the right environments and conditions and in ways that satisfies the needs of farmers. The seeds4needs concept has been developed to test innovative methodologies and tools for the identification of the required diversity with the desired adaptive traits from collection and farmers field. In 2011-present, the project has made use of modern GIS technologies to identify the most promising local genebank resources that could help farmers adapt to climate change in India, Papua New Guinea (PNG) and Ethiopia. The target crops in India is rice, in PNG are taro and sweet potatoes and in Ethiopia barley and durum wheat.

58. In Ethiopia, the first country to adopt this approach, more than 12,500 accessions of durum wheat and barley were screened using the GIS tool and the most promising 100 varieties of each crop were chosen to be tested on-farm. As a result, now farmers are still using some of the varieties selected and therefore these important genetic resources are conserved on farm. In India and PNG the project is at its earlier stage.

CIAT

59. After more than six years of growing-out at the Popayán station, a new bean species, *P. hygrophilus*, bloomed and set seeds, and its description was finalized and published. This finding is noteworthy from four perspectives. First, this species is the first one in the genus *Phaseolus* found in a very humid forest, and this may open new evaluation schemes towards fungal diseases affecting the pods (e.g. anthracnose), the leaves (e.g. ascochyta blight, white mold), or the root system (e.g. root rot). Second, the species was found in the field without any specimen seen in herbaria before the fieldwork. The study of 80 Herbaria so far has helped to establish a relatively strong database, but it is clear that not everything exists in herbaria. Third, among neotropical countries, Costa Rica is perhaps the country with the best inventories; yet the region of Los Santos – acknowledged as poorly sampled by a reviewer - harbours a new bean relative. Fourth, the species was found without any GIS help; GIS tools would predict a low probability of finding wild beans in humid environments, and thus collectors would not go. Wild beans still have the potential to amaze the best collectors and GIS specialists!

CIMMYT

60. The CIMMYT genebank is preparing for ISO 9001 certification. This is an important step towards enhancing the quality standards to internationally-recognized and verifiable levels. The four principal activities of the bank will be standardized: Introductions, Processing of seed, Conservation, and Distribution of Germplasm. This will also protect the integrity of the genebank in the event of personnel changes that may occur. We expect to complete this certification process during 2012.

61. One of the neglected areas of the CIMMYT-held wheat collection is the accessions of crop wild relatives. This is due, in part, to difficulties in the regeneration maintenance of these material, which often need artificial vernalization and lighting to break cold and photoperiod requirements; lack of Mediterranean (cool winter rainfall) conditions throughout Mexico, to replicate natural regenerative environments; and, concerns about the inadvertent induction of noxious weeds on CIMMYT research stations, and in Mexico. All of these factors can be controlled, by use of confinement facilities, and a proper inventory of the collection is underway, to allow regeneration of critical materials. All these accessions are in high demand. One a more positive side, two USDA wheat CWR collections, upon the retirement of the principle oversight scientists, is being made available to CIMMYT in 2012/13.

62. In 2011, the CIMMYT Wheat Germplasm Bank prepared over 90,000 seed packets, representing approximately 30,000 accessions, for use by Seeds of Discovery (SeeD) researchers. These activities were supported by the Sustainable Modernization of Traditional Agriculture (MasAgro) project, a multi-pronged, international agricultural research for development project funded by the Mexican government. One of the four main components of MasAgro is the Discovering the Genetic Diversity of Seed (SeeD) project. The SeeD project is using cutting-edge technologies to study and classify the genetic diversity in CIMMYT's and others' collections of maize and wheat germplasm, and the resulting information will be made available to breeders and researchers worldwide. The CIMMYT genebank is a principal partner in the SeeD project.

CIP

63. CIP's in-vitro genebank is the first potato genebank to have obtained and maintained International Standards Organization (ISO) 17025 accreditation for safe and secure germplasm movement. Recently, as part of a restructuring exercise and an effort to assure maximization of the quality of the conservation and distribution of healthy and well-identified accessions, CIP has established the genebank as a service unit within its new organizational structure. The research functions which include the evaluation or screening, biosystematics and in-situ conservation of potato and sweet potato genetic resources and the development of genebank technologies are now housed in a new and dedicated Genetic Resources Program. The system also has adapted an increasingly proactive approach to the promotion of advanced potato germplasm through the publication of yearly catalogues[15] and the establishment of an international nurseries system[16].

[15] http://www.cipotato.org/catalogue

[16] http://cipotato.org/genebank/germplasm-distribution/international-nurseries

64. The Genetic Resources Program, in collaboration with the Trust, Bioversity and CIAT is currently conduction a genetic gap analysis for wild potato, sweet potato and *Oxalis* species. A new initiative for the long term monitoring of potato landrace in-situ diversity is soon to be officially launched under the name of Chirapaq Ñan (rainbow route).

ICARDA

65. ICARDA is now using the Focused Identification of Germplasm Strategy (FIGS) to better target the selection of subsets for sought traits by requestors and 23 subsets were developed for heat, drought and salinity tolerance and for resistance to major diseases and insects. This approach has been used to respond adequately to requests asking for large numbers of accessions and also will in the future reduce the multiplication efforts. FIGS is a system to access useful adaptive traits from large germplasm collections. It is a methodology, which will greatly enhance the ability of researchers to find adaptive traits in large germplasm collections. FIGS is based on the premise that environment strongly influences gene flow, natural selection and thus spatial/geographic differentiation of organisms. In this context, accessions that co-evolved within a given environment will possess a suite of adaptive traits shaped by selection pressures unique to its environment. Thus information about an accession's collection site can be used to approach the utilization of genetic resource collections in a more rational way. FIGS in its current form, is used to create "best-bet" trait specific sub-sets of material for screening by placing accession level information, particularly agro-climatic site parameters, through a series of filters designed to increase the chances of encountering the adaptive trait of interest.

66. ICARDA holds around 1383 accessions of *Rhizobium* strains and has distributed around 32 samples to 3 collaborators during 2011 using appropriate Material Transfer Agreement. It also maintains in good order 13,500 herbarium samples of its mandated species with around 1800 mounted to be added into the database.

ICRAF

67. ICRAF research activities have been geared towards maximizing benefits of trees on farms. One example is the domestication of *Allanblackia* species. Under the Novella private-public partnerships ICRAF is leading the collection, evaluation and conservation of genetic resources of *Allanblackia* species across the species range. Live gene banks and mother blocks were established in Ghana, Tanzania and Cameroon. molecular and morphological characterizations indicate high genetic diversity within the species, suggesting high potential for genetic gain through selection. Hence, targeted selection based on fruit size and seed yield has been adopted in sampling. Vegetative propagules collected from selected trees are being conserved in mother blocks for mass propagation and subsequent distribution. Seedlings are used for the establishment of live genebanks for conservation purposes.

68. Other species with similar success stories in other regions include *Dacryoides edulis* in West Africa, *Faidherbia albida* in east and southern Africa, *Guazuma crinita* in Latin America, *Embilica officinalis* in South Asia and *Camellia reticulata* in South East Asia.

69. ICRAF developed high-resolution species distribution maps and guidelines for the selection of tree species in East Africa region for present and future climates. Using this information suitability maps are being developed that show species–site matching and are been used to predict areas where the species can be introduced in future.

ICRISAT

70. Drought is one of the major constraints for sorghum cultivation, particularly during grain filling, which causes premature leaf senescence, poor grain quality and yield losses. Hence, development of post-flowering drought tolerant cultivars is one of the major objectives of sorghum breeding programs. Different studies were carried out to evaluate sorghum germplasm accessions for drought tolerance.

71. A genotype-based sorghum reference set (384 accessions) was evaluated for post-flowering drought tolerance under irrigated and un-irrigated conditions during 2008-2009 and 2009-2010 post-

rainy seasons at ICRISAT Patancheru. Based upon two years evaluation, 100 promising lines were identified for assessing their drought tolerance and stover/grain yield potential. Analysis of variance showed significant differences among genotypes for all the traits. When compared with the best control cultivars, 4 accessions (IS 14556, 62(73)509, IS 12531, IS 9303) for stover yield, 5 accessions (IS 33173, SSM 215, IS 8882, IS 21124, IS 24786) for grain yield, and one accession (IS 929) both for stover and grain yield has been identified as promising accessions for use in breeding programs to develop drought tolerant cultivars.

IITA

72. Some mistakes and mismatches, due to accumulative errors and mislabelling over the years, were identified in the IITA yam collection. These errors were identified through:

- A preliminary study (unpublished), focused on the detection of somaclonal variations in the yam *in vitro* collection, which showed mismatches between accessions in the *in vitro* collection and the field one.
- A revision of the inventory system that revealed some mislabelling.
- Observation of obvious morphological differences between *in vitro* plantlets or field plants that were supposed to belong to the same accession.

73. For all these reasons, agro-morphological and molecular characterization was initiated in 2009 to identify the mismatches, the mislabelling errors and duplicates in the yam collection. In 2011, the bar coding of the entire yam field bank was completed and this is expected to help in the reduction of accession mismatches and mistakes in the management of the collections. The plan is to progressively re-introduce (already started in 2011) the *in vitro* collection from the well characterized and identified field material. The IITA online inventory system was revised in order to eliminate the mistakes. In total, 83 accessions were identified and removed from the system.

ILRI

74. Napier grass is the most widely used forage grass for cut and carry for smallholder dairy systems and has been a major focus of ILRI research since 2004. Ongoing research is focusing on identification of better adapted, high yield and disease tolerant accessions. In 2011, ILRI started a new project with Brazil to access additional germplasm to support activities on small holder dairy.

75. Diversity studies comparing Napier grass germplasm from the EMBRAPA-Brazil and ILRI collections were carried out to identify distinct genotypes that could be further introduced into the ILRI collection to search for germplasm with more tolerance to diseases and drought. This was part of the AFRICA-BRAZIL Agricultural Innovation Marketplace project and the AWARD fellowship. DNA samples were extracted from 111 Brazilian and 60 ILRI genotypes and analyzed using 20 single sequence repeats (SSRs) primers that had been successfully used for pearl millet and Napier in EMBRAPA and ILRI. Considerable genetic similarity was observed between accessions from the EMBRAPA and the ILRI collections. Seventeen accessions from the EMBRAPA collection were sufficiently different from the genotypes in ILRI and were identified as possible candidates for import. Some additional molecular fingerprinting is being done to confirm these preliminary results.

IRRI

76. IRRI is the lead centre in the Global Rice Science Partnership CGIAR Research Program (GRiSP), which includes some 900 partners in rice research and development from all sectors, including public and private sectors, ARIs and developing country NARES, extension systems and NGOs. Rice genetic resources are fully integrated into GRiSP, to maximize the efficiency and effectiveness of their conservation and use. Its structure directly supports many of the objectives of the GPA and of the Treaty. Within theme 1 of GRiSP ("Harnessing genetic diversity to chart new productivity, quality, and health horizons") there are components to enhance conservation of the global rice genepool, specifically with the context of the Global System for the rationale efficient and effective conservation and use of genetic resources, and to improve conservation methodologies, supporting priorities 5-7 and 13-18 of the second GPA. For example, new research results on seed

conservation biology are leading to new recommended standards for seed processing, drying, characterization technologies and dormancy removal for improved conservation.

77. A major component of GRiSP theme 1 involves characterizing and analyzing diversity among genebank accessions at the molecular level, addressing priorities 8-11 of the second GPA. In particular, one project is assessing high-density SNP diversity across 2,000 accessions; and a second seeks to sequence the whole genomes of 10,000 accessions – the most comprehensive basic analysis of crop diversity ever undertaken. This is in turn linked to gene discovery through a global rice phenotyping network, to help find the alleles needed for further crop improvement in rice. A major investment is underway to handle the enormous informatics requirements of the project. All these components of GRiSP theme 1 will lead to much more effective and efficient selection of accessions to deliver to and incorporate into rice improvement programs, supporting sustainable crop improvement in theme 2, leading through natural resource management, post-harvest technologies, and socio-economic and policy issues to alleviate poverty and enhance food security.