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COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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REPORT FROM THE CGIAR CONSORTIUM OF INTERNATIONAL AGRICULTURAL RESEARCH CENTRES TO THE COMMISSION ON GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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I. INTRODUCTION

1. On 18 October 2012, the Director General of FAO invited the CGIAR Consortium to provide focused information on its programmes, activities, and policies relevant to the prioritized themes of the Fourteenth Regular Session of the Commission on Genetic Resources for Food and Agriculture (Commission), including:

The State of the World's Biodiversity for Food and Agriculture

- Key issues and preparation of *The State of World's Biodiversity for Food and Agriculture*

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- Consideration of finalized roadmap or work programme on climate change and genetic resources for food and agriculture
- Review of all relevant international targets and indicators for biodiversity for food and agriculture
- Review of key issues on biodiversity and nutrition.

2. The CGIAR Consortium Office has prepared this document on behalf of the Centres, drawing on inputs from individual Centres. It presents an overview of activities conducted since the last session of the Commission and complementing reports submitted to the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (Treaty) and to the Commission's Intergovernmental Technical Working Groups. The contributions of Centres have been grouped according to the prioritised themes of the Commission's Fourteenth Regular Session.

II. *THE STATE OF THE WORLD'S BIODIVERSITY FOR FOOD AND AGRICULTURE*

Key issues and preparation of The State of World's Biodiversity for Food and Agriculture

3. Bioversity submitted a response in reply to the Commission's request for comments on the information document prepared for the Commission's Thirteenth Regular Session on the preparation of *The State of World's Biodiversity for Food and Agriculture* (SOWBFA).[1] The response recognised the importance of the preparation of the report and noted that Bioversity looked forward to contributing to its preparation. Bioversity recommended particular attention be paid to: (i) Status and trends of landraces, crop wild relatives (CWR) and neglected and underutilized species (NUS); (ii) Status of development of *in situ* and on-farm conservation tools and methodologies, and state of

[1] CGRFA-13/11/Inf.23.

efforts in facilitating the use of landraces, CWR and NUS. Related to these are the information systems that enhance the use of genetic resources, and the policies that establish the right environment for access, use and benefit sharing.

4. The International Potato Center (CIP) fingerprinted with 50 microsatellite SSR markers a reference collection of 742 potato accessions (all from CIP's genebank) belonging to all cultivated species and ploidy groups. 24% of the potato, 49% of the sweetpotato and 58% of the Andean Roots and Tuber Crop (ARTC) accessions in the genebank have been fingerprinted with AFLP/SSR, AFLP/SSR and AFLP markers respectively.

5. In 2011, the International Center for Agricultural Research in the Dry Areas (ICARDA) undertook an agro-biodiversity survey in 26 monitoring sites in Jordan, Lebanon and Syria and the results showed the continued degradation of natural habitats. Eco-geographic surveys and species diversity analysis of crop wild relatives of *Lathyrus*, *Medicago*, *Aegilops*, and wild *Triticum* showed the need to increase the number of targeted protected areas in Syria, Lebanon and Southern Turkey.

6. The ICARDA genebank holds more than 142,000 accessions in its active collection, of which 98% are safe-duplicated and 73% are also conserved in the Svalbard Global Seed Vault (SGSV) in Norway. Six collecting missions were organized based on a gap analysis in Jordan, Libya, Tajikistan, Cyprus and Greece in 2011-2012, which yielded 2,500 new accessions. In addition, more than 8,000 new accessions were received from partners who benefited from the Global Crop Diversity Trust regeneration grants. ICARDA is regenerating around 4,700 accessions each year and has the capacity to multiply in isolation around 600 accessions annually of cross-pollinated and self-incompatible species.

7. The genebank of the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Patancheru, India, holds in-trust over 120,000 accessions of sorghum, pearl millet, small millets, chickpea, pigeon pea and groundnut from 144 countries; seed samples of 97,800 accessions have been deposited in the SGSV. The collection has been evaluated to identify sources for stress tolerance and for agronomic/nutritional quality traits. The genebank has distributed over 1.4 million samples of germplasm to scientists in 146 countries and restored germplasm in countries upon request. The germplasm is securely conserved for present and future use. The genetic integrity is maintained by pollination control while regenerating cross-pollinated crops. ICRISAT contributed to this document by sharing its experience both with the implementation of Agreements in the context of the Treaty, such as the Standard Material Transfer Agreement (SMTA), and with respect to its participation in the World Information Sharing Mechanism on the Implementation of the Global Plan of Action for the Conservation and Sustainable Use of Plant Genetic Resources for Food and Agriculture. ICRISAT has been very active in planning and implementing concerted efforts to fill gaps in the genetic diversity of existing collections.

8. At the International Livestock Research Institute (ILRI) forage genetic resources work progressed towards characterization to increase the available information on the forages in the collection and to make this information more widely accessible to promote the use and regeneration of forage material and to ensure more of this material becomes available for dissemination. ILRI also continued to provide leadership in the development of a global system for forage diversity. ILRI worked towards improving the genebank standards procedures, collaborating with the Millennium Seed Bank at the Royal Botanic Gardens, Kewand refining the germination protocols for Crop Wild Relatives to help strengthen capacity for their conservation, especially in developing countries.

9. ILRI worked with EMBRAPA-Brazil towards mutual exchange of genetic resources of Napier grass to increase the diversity of their collection and to search for germplasm with better drought and disease tolerance.

10. In association with the Global Crop Diversity Trust, the International Rice Research Institute (IRRI) has been working both to ensure the safe conservation of threatened accessions of rice held by national genebanks that operate under very limited resources and to identify and fill gaps in collections.

III. ANIMAL GENETIC RESOURCES

Review of implementation of the Interlaken Outcomes

11. Livestock significantly contribute to ensuring global food security and sustainable development, while also playing an essential role in the livelihoods of hundreds of millions of people. Within the CGIAR Consortium, research on livestock genetic resources is mainly conducted by ICARDA and ILRI. In the CGIAR Research Program (CRP) Portfolio, the CRP on Livestock and Fish (lead by ILRI) aims to increase the productivity of small-scale livestock and fish systems in sustainable ways, making meat, milk and fish more available and affordable to poor consumers across the developing world.

12. During the reporting period, ICARDA and ILRI contributed to the implementation of the different strategic priority areas of the Global Plan of Action for Animal Genetic Resources (AnGR).

13. ICARDA and national agricultural research systems (NARS) partners conducted field surveys and published results related to phenotypic and molecular characterization of local sheep and goat populations and the characterization of their production systems in Ethiopia (five local goat breeds), Libya (country-wide survey of sheep and goat populations conducted in 2010 and 2011 and interrupted by the civil war), Iran (fibre quality of Tajik Angora goats and Raeini Cashmere goats), and Iraq (molecular characterization of Hamdani sheep).

14. FAO commissioned ICARDA and national partners to contribute to its global Domestic Animal Diversity Information System by providing characterizations of the environmental conditions in the distribution areas of 85 sheep and goat breeds in Egypt, Iran, Morocco, and Turkey. The study also developed GIS-based methods for rapid biophysical characterization of breed distribution areas and for identifying new areas where these breeds could potentially be introduced.

15. To support sustainable use and development of indigenous genotypes of sheep and goat breeds, ICARDA jointly with NARS and advanced research institutions (ARI) partners developed and tested breeding programs to be implemented by local communities and/or small-scale goat and sheep breeders. The development of such breeding programs included:

- Characterization of indigenous knowledge and breeding strategies of sheep farming communities of Ethiopia related to four local sheep breeds;
- Testing of methods for identifying breeding objectives and selection traits;
- Development of a web-based Data Recording and Management System (DREMS) for sheep and goats based on a precursor system provided by EMBRAPA; and
- Improving fibre quality and processing to access luxury fibre markets for Tajik Angora and Cashgora and Iranian Cashmere goats.

16. ILRI led the characterization of more than 20 different livestock breeds in Asia and Africa through its joint capacity building activities with the Swedish University of Agricultural Sciences (SLU). It also supported characterization work in most African and Asian countries, as part of the implementation of the Global Plan of Action for AnGR. The reports and outcomes of these activities are summarized in the document *Training of Trainers-An Innovative and Successful Model for Capacity Building in Animal Genetic Resources in Sub-Saharan Africa and Asia*.

17. To identify diversity hotspots, ILRI and NARS and ARI partners have mapped African and Asian livestock genetic diversity and identified the molecular diversity underlying some important traits, especially adaptation to diseases such as Trypanosomiasis and Haemonchosis. ILRI led the process to ensure that African diversity is represented in the next generation of high density cattle genotyping tools, important for future functional studies.

18. Through two projects funded by the Global Environmental Facility (GEF), ILRI is currently developing and facilitating the application of decision support tools to conserve and sustainably use genetic diversity of indigenous livestock and their wild relatives in four Asian countries. Through this work, ILRI also supports the implementation of a regional project aimed at the sustainable management of endemic ruminant livestock In Kenya and Ethiopia, ILRI developed, piloted and now

supports an Index Based Livestock Insurance (IBLI) Program, enabling the development of informed and sustainable pastoral livestock production programs and indirectly supporting AnGR diversity and biological diversity in fragile rangeland ecosystems.

19. ILRI recently established a bank of livestock tissues documented electronically and linked to livestock pathogens. The bank will be linked to a proposed AnGR bio-data bank and to facilities that conserve AnGR material. This bank of livestock tissues has an unprecedented potential for livestock related meta-genomic research. Once fully established, the facility and the data will be managed following the 'open source' principles.

20. ICARDA and ILRI conducted and facilitated several trainings and workshops on AnGR, and produced or contributed to the production of a series of guidelines and training resources.

21. ILRI attended the Seventh Session of the Intergovernmental Technical Working Group on Animal Genetic Resources for Food and Agriculture that was held in Rome, in October 2012.

IV. AQUATIC GENETIC RESOURCES

Review scoping policy analysis to identify gaps and opportunities related to aquatic genetic resources

22. The majority of activities carried out by WorldFish in fulfilment of its mission - "To reduce poverty and hunger by improving fisheries and aquaculture" –has relevance to the utilization and conservation of aquatic genetic resources (AqGR).

23. WorldFish participated in the development of guidelines towards the conservation of aquatic biodiversity in Africa (Nairobi Declaration, 2002) and in the ecological risk assessment of genetically improved fish (Dhaka Declaration, WorldFish 2003). In 2007, the Center developed its 'Policy on the transfer of Genetically Improved Farmed Tilapia (GIFT) from Asia to Africa" . Recent reviews discuss the socio-economic impacts of introducing a genetically improved fish strain (GIFT) and identify key issues and research priorities for the sustainable utilization and conservation of aquatic genetic resources.

24. WorldFish does not currently maintain *ex situ* AqGR collections, even if the development of cryo-preserved gamete collections has been identified as a potential future activity.

25. The Center promotes the conservation of farmed AqGR through its dissemination strategies and collaborative research efforts with national governments. These facilitate the development of well managed and designed National Breeding Programs that ensure genetic diversity loss is minimized within breeding nuclei, thus contributing to *in situ* conservation.

26. Improving the resilience and sustainability of small-scale fisheries is a research priority for WorldFish and also contributes to *in situ* conservation of AqGR. An increasing focus in our aquaculture research is directed towards understanding and minimizing the risks and impacts improved strains may have on indigenous, wild AqGR.

27. WorldFish actively builds capacity in genetic resource management and in maintaining genetic diversity in aquaculture, supporting local government and research institutes in Africa and Asia. In developing strategies and methodologies for disseminating genetically improved aquaculture strains, a strong emphasis is placed on ensuring sustainable genetic management practices are used and understood by target groups.

28. The FishBase, ReefBase and SeaLifeBase projects, developed and maintained by WorldFish and several partners, provide accessible databases and knowledge sharing portals for taxonomic, biological and ecological information on wild AqGR. Such databases may serve as future platforms to store and share population and strain level information on both wild and farmed AqGR.

V. FOREST GENETIC RESOURCES

Presentation of The State of the World's Forest Genetic Resources

29. Bioversity International (Bioversity) and the World Agroforestry Centre (ICRAF) have significantly supported and contributed to the preparation of *The State of the World's Forest Genetic Resources* (Report), to be presented to the Commission at its Fourteenth Regular Session in April 2013. In addition to taking responsibility for the preparation of four background thematic studies and participating in the preparation of each of them, Bioversity organized, facilitated and provided expert advice at a number of regional workshops in Africa, Asia, Latin America and North America. The regional workshop on the preparation of the Report in Africa, which was held from 27 to 29 April 2011 and was hosted by ICRAF, was attended by 33 African countries.

30. The four thematic studies prepared by Bioversity, which are intended to complement information drawn from country reports, are:

- *Indicators of forest genetic diversity, erosion and vulnerability* – this study summarizes the status of indicators of forest genetic resources (FGR) and presents a proposal for indicators spanning from the management unit to global scales and including indicators on the state, pressure, response, and benefit of FGR.
- *Role of Forest Genetic Resources in Adaptation to Biotic and Abiotic Factors in a Changing Climate* – this study reviews the importance of FGR as a source of evolutionary potential for adaptation to climate change and other changing ecological factors. Several case studies are presented and recommendations for policy-makers are given. The importance of management strategies for conserving the evolutionary potential of FGR is emphasized.
- *Forest Genetic Resources and restoration using native tree species* – this study analyses the role of FGR in current restoration practices, with contributions from many practitioners in different countries worldwide. A set of recommendations is presented on how to integrate genetic considerations into restoration projects at each point in the process, from the planning stage through to the monitoring of the project after its establishment.
- *Use and transfer of Forest Genetic Resources* – this background study was conducted by Bioversity to inform *The State of the World's Forest Genetic Resources*.

31. ICRAF also contributed to a number of thematic studies for the Report, including a study on the value of trees and tree genetic resources for the livelihoods of rural communities in the tropics.

32. Bioversity contributed to development of the guidelines and the template for collection of information at the national level for country reports. It also provided expertise at three series of regional meetings, first to test the data templates that had been developed and to contribute to training activities; second to provide advice to national focal points on how to collect and report their data; and finally Bioversity assisted in organizing, facilitating, providing expertise and writing regional summaries based on the information provided in country reports and information provided by national focal points and other sources.

33. A special edition of a forestry journal that will include a range of thematic studies that supported the preparation of *The State of the World's Forest Genetic Resources* will be co-edited by FAO, Bioversity and ICRAF.

34. ICRAF's work on tree genetic resources falls within its Global Research Priority on Quality Trees (see www.worldagroforestrycentre.org/research/grp1_agroforestry_germplasm, for more information on the programme and its activities). The Genetic Resources Unit (GRU) located within this programme is responsible for conserving and disseminating tree seed and for managing live field tree gene banks. In October 2012, the GRU published a new strategy for *ex situ* management of tree

genetic resources, and in late 2012, it received funding from the Global Crop Diversity Trust to support relevant activities.

35. Bioversity, the Center for International Forestry Research (CIFOR) and ICRAF published a review on the linkages between agroforestry and different conservation methods for maintaining tree genetic resources.

36. The three Centres also work together under the CGIAR Research Programme on Forests, Trees and Agroforestry. In this context, they organized a 'Tree Diversity Day', a side event at the 11th meeting of the Conference of the Parties to the Convention on Biological Diversity (CBD), which was held in October 2012, in Hyderabad, India. 'The Day' explored the importance of tree biodiversity at the 'nexus' of the three UN conventions dealing with biodiversity, climate change, and desertification, including the CBD, the United Nations Framework Convention on Climate Change (UNFCCC) and the United Nations Convention to Combat Desertification (UNCCD). At the same meeting, ICRAF organized a symposium entitled 'What's cooking on Farms? Tree diversity for health, fuel and nutrition', which highlighted the contribution of tree diversity to human well being through providing food and fodder, wood fuels for food preparation and medicines to treat diseases and promote health.

VI. MICRO-ORGANISMS AND INVERTEBRATES

Review of key issues on micro-organisms and invertebrates

37. ICARDA conserves around 1400 strains of *Rhizobium* spp. Forty-two samples were distributed in 2011 and2012. In collaboration with Moroccan institutions, 62 isolates of *Rhizobium sullae* were characterized using molecular markers and evaluated for various physiological traits such as resistance to salinity stress, water stress, high temperature stress, heavy metals, and various pH levels. The results revealed a considerable diversity for various physiological traits.

38. A significant collection of fungal, bacterial and viral species is conserved at IITA. This collection includes pathogens and beneficial agents. Climate change is a major issue facing the conservation and use of micro-organisms genetic resources for food and agriculture. IITA led and coordinated a Background Study Paper[2] at the request of the Secretariat of the FAO Commission on Genetic Resources for Food and Agriculture, as a contribution to the theme, Consideration of scoping study on climate change and genetic resources for food and agriculture, which the Commission considered at its Thirteenth Regular Session. Conservation of non-plant biodiversity is important with respect to integrated pest management. the IITA led System Wide Program on Integrated Pest Management produced a briefon this subject entitled 'The importance of non-plant biodiversity for crop pest management: Enabling conservation and access' to address the importance of biodiversity to agriculture from an angle often overlooked: that of the non-plant forms of life protecting crops in the field. The importance of these bacteria, insects, nematodes, fungi, spiders, mites, and viruses is often invisible, but it is being revealed in the devastating pest outbreaks that the world is seeing as balanced agro-ecosystems are disrupted.

39. The arthropod collection at IITA-Benin is the largest in the CGIAR and it is estimated to contain around 40-50% of insect biodiversity in West Africa. Climate change, transboundary pests and invasiveness are key considerations in the management of this collection. Diagnostic and surveillance activities linked to this collection are crucial to crop protection in the region. This collection has considerable potential as an international public good in terms of insect biodiversity, including accessibility and documentation.

VII. CROSS-SECTORIAL MATTERS

Consideration of the need for and modalities of access and benefit-sharing arrangements for genetic resources for food and agriculture

40. Bioversity is currently supporting parallel research and capacity-building activities in Nepal, Bhutan, Rwanda, Uganda, Cote D'Ivoire, Burkina Faso, Costa Rica, and Guatemala related to the

[2] Background Study Paper No.57.

implementation of the multilateral system of access and benefit-sharing of the Treaty. The terms of reference of the research that is being conducted with a wide range of national partners 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 as part of the same project. Further details on these activities, and the Netherlands-funded project through which they are supported, can be found at http://grpi2.wordpress.com/about/grpi-2/. All of these activities fall under the overall umbrella of the FAO/Treaty Secretariat/Biodiversity Joint Capacity Building Programme for Developing Countries on the Implementation of the Treaty and its multilateral system of access and benefit-sharing.

41. In January 2013, Bioversity hosted an expert workshop entitled: 'The International Treaty and the Nagoya Protocol: Supporting mutual supportiveness in the implementation of both instruments at the national level'. The meeting was organized by GIZ in coordination with the Secretariats of the Treaty and the CBD.

42. Bioversity is co-publishing, with Routledge, and with the contribution of other CGIAR Consortium Centres, a book series entitled 'Issues in Agricultural Biological Diversity.' Two recently published titles in the series address issues related to the implementation of the Treaty's multilateral system.

43. Bioversity has contributed background studies to support the Commission's investigation into access and benefit sharing options for genetic resources for food and agriculture.

44. CIP is active in cataloguing both *ex situ* and *in situ* species and landrace diversity in close collaboration with NARS partners and farmers. Catalogues provide information on hotspots, their total and relative diversity, and related collective knowledge in order to support custodian farmers' rights under the Treaty.

45. Bioversity was invited to the Third meeting of the Ad Hoc Technical Advisory Committee on the Standard Transfer Agreement and the Multilateral System, which was held in New Delhi, India from 26to 28 June, 2012. The Committee considered technical contributions from Bioversity, along with inputs from other experts, when developing its opinions on the distribution of materials both for non-food purposes and to farmers for direct use.

46. Bioversity participated as an observer in the Ad Hoc Working Group on Compliance meeting, which was held in Bali before the Fourth meeting of the Governing Body of the Treaty It was asked to provide information on the conditions under which the centres make non-annex 1 materials available.

47. Bioversity and IRRI participated as observers in the first session of the Commission's Ad Hoc Technical Working Group on Access and Benefit-Sharing for Genetic Resources for Food and Agriculture. Noting that the primary purpose of the CGIAR centres is to enhance the benefits for developing countries, we suggested that the impacts of the CGIAR should be included in the benefit-sharing related considerations. IRRI drew the attention of the Commission to post impact studies that quantify the magnitude of benefit-sharing (e.g. http://aciar.gov.au/publication/IAS074).

Consideration of finalized roadmap or work programme on climate change and genetic resources for food and agriculture

48. Work on plant genetic resources and climate change is mainly done under the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Bioversity is the main executor of the CCAFS research agenda in this area. Climate change adaptation research at Bioversity has focused on the role of agro-biodiversity (1) in adapting to current climates where climate change has already affected agriculture over the last decades; (2) in providing options for future climate change; and (3) in managing current climate risk, such as droughts and heat waves. The main research areas are:

- Local climate vulnerability assessment and adaptation planning;
- Climate-smart seed systems – delivering adapted materials to deal with climate change and risk;

- Diversification for climate risk management – introducing and revitalizing crops and varieties to create balanced portfolios;
- Policy change and institutionalization of adaptive agricultural innovation systems.

49. Progress has been made especially in the second research area, involving genebanks, seed producers and civil society organizations. Bioversity is experimenting with information and communication technologies and seed distribution to deliver diversity in a cost-effective and demand-driven way to farmers who work in relatively marginal and environmentally diverse areas. Bioversity is working with partners to use these new experiences and methods to transform seed systems, in order to increase their climate resilience.

50. CIP has shown, through participatory research, that cultivated potato genetic resources are moving upward in altitude. The expansion of the crop area is nowadays fastest growing at altitudes above 4,000 m above sea level, while landrace diversity is increasingly concentrated between 3,900-4,350 m. CIP is committed to long-term monitoring in selected hotspots to study the dynamics of conservation of diversity in light of climate change.

51. ICARDA is using the Focused Identification of Germplasm Strategy (FIGS) for selecting best-bet sets for heat, drought and salinity tolerance and for resistance to major diseases and insects, including adaptation to present and future climate. The evaluation of 23 subsets allowed the identification of new sources of resistance to new virulence of yellow rust and stem rusts, Sunn pest, Hessian fly and Russian wheat aphid in wheat. Strong pre-breeding activities are being developed in the case of wheat, chickpea and grass pea with the extensive use of wild relative species.

52. ICRAF is working on projects to secure future seed sources for agroforestry species in the face of climate change and to make farming systems more resilient against climate variability by integrating trees. A case study on mango is being undertaken to identify the current distribution of varieties and future changes according to climate modelling. New mango varieties from 'climate analogues' (i.e. locations that currently have the projected climate of the research location) will be introduced and evaluated with the aim to make planting material of most suitable varieties available to farmers. The diversity of local mango varieties will be screened for drought and salinity tolerance to select most promising varieties for rootstock trials.

53. ICRISAT is using mini-core and reference set approaches to identify trait-specific germplasm for use in crop improvement programs and in genomics of its mandate crops and small millets. Extensive multi-location evaluation of these sub-sets in 26 countries have resulted in the identification of diverse trait specific accessions for resistance to biotic and abiotic stresses and for quality and agronomic traits for use in developing high-yielding cultivars with a broad genetic base.

Review of all relevant international targets and indicators for biodiversity for food and agriculture

54. Several CGIAR centres have actively collaborated with FAO to prepare a revised set of indicators for monitoring the implementation of The Second Global Plan of Action for PGRFA and define higher-orders indicators, as requested by the Commission's Thirteenth Regular Session. Bioversity participated in a Technical Consultation to develop targets and indicators in April 2012. These targets and indicators were subsequently discussed and amended by the Sixth Session of the Intergovernmental Technical Working Group on PGRFA in November 2012 and will be submitted for review to the Commission's Fourteenth Regular Session.

55. Bioversity also actively contributed to the elaboration of targets and indicators, the so-called Aichi targets, for the CBD Strategic Plan on Biodiversity 2011-2020. To this end, Bioversity participated in the UNEP-WCMC facilitated Biodiversity Indicators Partnership (BIP). Bioversity worked with FAO and the Institute for Research and Development to develop indicators for *ex situ* collections in the form of an enrichment index. This index has been tested in several countries including Spain, Argentina and India by FAO. Furthermore, following the recommendation made at the Fifteenth meeting of the CBD's Subsidiary Body on Scientific, Technical and Technological Advice (Recommendation XV/1), Bioversity provided inputs to the Group on Earth Observation Biodiversity Observation Network (GEOBON) to develop Essential Bioversity Variables. These variables will be used as an input for the further development of indicators to meet the Aichi targets.

Review of key issues on biodiversity and nutrition

56. The potential of agriculture in general goes far beyond contributing to basic food and income needs. One of the four CGIAR system level outcomes is to improve nutrition and health. The CGIAR Research Program on Agriculture for Nutrition and Health aims to support agricultural researchers, value chain actors, program implementers, and policymakers in reshaping their actions to better contribute to nutrition and health outcomes and impacts by simultaneously tackling the challenges related to income, biodiversity and nutrition. Bioversity is one of the partners of this CGIAR Research Programme.

57. Nutrition research at Bioversity has focused on the role and impact of agricultural biodiversity on dietary diversity, dietary quality, nutrition and livelihoods. The research agenda was expanded with the development of the 2011-2021 Nutrition Strategy which emphasized the development of strong methodological and empirical evidence on how agricultural biodiversity contributes to dietary diversity, quality and nutrition outcomes with livelihood and ecosystem benefits. The Strategy focuses on food and nutrition system approaches to improving human nutrition and health. The major goal of the Strategy and subsequent programme is to promote the use of agricultural biodiversity within food production systems and provide nutritionally-rich food sources that contribute to dietary diversity and, potentially, better nutrition and health. Our major focus is on rural and peri-urban communities in the developing world. There are four objectives:

- To strengthen the evidence base for the role of biodiversity in nutrition and health and the means of incorporating agricultural biodiversity into food and nutrition systems;
- To ensure the production of more nutritious foods through value chains that reflect agricultural biodiverse practices and cultural preferences;
- To determine what agricultural biodiversity practices and delivery systems work in programmes to improve food and nutrition security;
- To mainstream the role of agricultural biodiversity into public health and nutrition policy and practice by sharing evidence and providing local solutions.

58. Specifically, the Nutrition Programme at Bioversity International has implemented several projects in different countries around the world in the last few years. Notably in Sub Saharan Africa the team has worked on assessing the contribution of agricultural biodiversity in increasing nutritional outcomes for target populations. Significant work has also been carried out on value chains and the constraints relating to the production, marketing, processing and distribution of plant and animal source foods. A new research agenda has been developed to inform policymakers and programmers of the importance of sustainable food systems and diets. The measurement and description of sustainable diets addresses very real concerns about a food system that has a minimal environmental impact, is accessible, culturally relevant, and will contribute to the wider focus on sustainable development. The diet transition seen in low, middle and high income countries needs to be understood and dietary diversity has the potential to address both over and undernutrition.

59. CIP, another partner in the programme, screened the collections of sweet potato and diploid potato for micronutrients (Iron and Zinc), carotenoid (ß-carotene or Vitamin A) and phenolic compounds. Superior genotypes were identified and are now being used in biofortification breeding.