



# The International Treaty

ON PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE



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## Item 15 of the Provisional Agenda

### FOURTH SESSION OF THE GOVERNING BODY

Bali, Indonesia, 14 – 18 March 2011

### **DRAFT UPDATED *GLOBAL PLAN OF ACTION FOR THE CONSERVATION AND SUSTAINABLE UTILIZATION OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE***

#### *Note from the Secretary*

The Governing Body of the International Treaty, at its Third Session, noted the need to ensure close collaboration between the Commission and the Governing with regard to the revision of the *Global Plan of Action* and invited the Commission, in this revision, to take into account specific issues of relevance to the Treaty and to adequately reflect the provisions of the Treaty in the updated *Global Plan of Action*. It also invited the Bureaus of the Commission and of the Governing Body to hold a joint meeting to review the draft updated *Global Plan of Action*. The Bureaus of the two bodies, at their third Joint Bureau Meeting, reviewed the draft updated *Global Plan of Action*. The draft updated *Global Plan of Action*, as presented to the Joint Bureau Meeting, is given in the *Appendix* to this document, for the information of the Governing Body.

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## I. INTRODUCTION

1. The rolling *Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (Global Plan of Action)* adopted in 1996 by the Fourth International Technical Conference on Plant Genetic Resources is a supporting component of the International Treaty on Plant Genetic Resources for Food and Agriculture (Treaty). The Funding Strategy, as adopted by the Governing Body, at its first session, considers the priority activity areas of the *Global Plan of Action* as initial priorities of the Strategy, for further development by the Governing Body.<sup>1</sup> The Commission on Genetic Resources for Food and Agriculture (Commission), at its Eleventh Regular Session, agreed to update the *Global Plan of Action*. It requested FAO to prepare the updated *Global Plan of Action* based primarily on *The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture (SoWPGR-2)*, and in particular, on the gaps and needs as identified in the SoWPGR-2, taking also into account further contributions from Governments, as well as inputs received from regional meetings and consultations.
2. The Governing Body, at its Third Session, noted the need to ensure close collaboration between the Commission and the Governing Body with regard to the *Global Plan of Action* and invited the Commission, in the revision of the *Global Plan of Action*, to take into account specific issues of relevance to the Treaty and to adequately reflect the provisions of the Treaty in the *Global Plan of Action*. It invited the Bureaus of the Commission and of the Governing Body to hold a joint meeting to review the draft updated *Global Plan of Action*.
3. In response to the Governing Body's invitation, the Commission, at its Twelfth Regular Session, requested its Secretary to coordinate with the Secretary of the International Treaty in the updating process, to ensure that specific issues of relevance to the International Treaty are taken into account. It also requested the Bureaus of the two bodies to coordinate the agendas of the Commission and the Governing Body for the purpose, *inter alia*, of reviewing the draft updated *Global Plan of Action*.
4. The Bureaus of the Treaty and the Commission, at their third meeting on 10 March 2011, reviewed the draft updated *Global Plan of Action*. The draft updated *Global Plan of Action*, as presented to the Joint Bureau Meeting, is given in the *Appendix* to this document, for information of the Governing Body.

## II. PREPARATION OF THE DRAFT UPDATED GLOBAL PLAN OF ACTION

5. The Commission, at its Twelfth Regular Session, in adopting the Strategic Plan 2010-2017 for the implementation of the Multi-Year Programme of Work, agreed a plan describing the process and timeframe for the update of the *Global Plan of Action*. The updated workplan is provided in *Table 1*.
6. Between May and December 2011, FAO convened regional consultations in all seven regions of FAO. In three cases the consultations could be combined with workshops on the implementation of the Treaty which were held back-to-back with the regional consultations. Representatives from a total of 129 countries and from 12 international and regional organizations attended the regional consultations and provided inputs during these regional consultations. The reports of the regional consultations are available on FAO's website.<sup>2</sup> The regional consultations were made possible through the support of the Governments of Australia, Italy and Spain.

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<sup>1</sup> IT/GB-1/06/Report, Appendix F, paragraph 4..

<sup>2</sup> [http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/gpa/gpa\\_update/en/](http://www.fao.org/agriculture/crops/core-themes/theme/seeds-pgr/gpa/gpa_update/en/)

**TABLE 1: WORK PLAN FOR THE UPDATING OF THE GLOBAL PLAN OF ACTION**  
(Status: 10 March 2011)

Activity	2010												2011								
	J	F	M	A	M	J	J	A	S	O	N	D	J	F	M	A	M	J	J		
1. Preparation of working document for the regional consultations		●	●	●																	
2. Regional consultation for Europe (Tirana, Albania)					●																
3. Regional consultation for Africa (Nairobi, Kenya)						●															
4. Regional consultation for Latin America and the Caribbean (La Antigua, Guatemala)							●														
5. Regional consultation for Asia (Chiangmai, Thailand)								●													
6. Regional consultation for North America (Beltsville, USA)								●													
7. Regional consultation for Near East, North Africa and Central Asia (Aleppo, Syrian Arab Republic)										●											
8. Regional consultation for South Pacific Island Countries (Suva, Fiji)											●										
9. E-consultation with partners (NGOs; Private sector)											●	●									
10. Preparation of first draft updated GPA												●	●								
11. Joint Bureau Meeting of the Bureaus of CGRFA and ITPGRFA													●								
12. Fourth Session of the Governing Body of the International Treaty													●								
13. Fifth Session of the ITWG-PGRFA														●							
14. Thirteenth Session of the CGRFA																			●		



Activity completed



Activity to be completed

7. During the regional consultations the *Global Plan of Action* was reviewed on the basis of a working document which presented the 20 priority activity areas of the *Global Plan of Action* adopted in 1996 together with those sections of the SoWPGR-2 that identify specific gaps and needs or summarize changes since the publication of the *The State of the World's Plant Genetic Resources for Food and Agriculture* in 1996/1998.

7. The regions seem to agree that there is no need for major modifications to the *Global Plan of Action*. However, there is also agreement that given the many developments since 1996, as highlighted in the SoWPGR-2, the *Global Plan of Action* needs to be updated, in particular with regard to the developments in the international legal and policy framework for plant genetic resources for food and agriculture. These include developments under the Convention on Biological Diversity (CBD) and the Commission, as well as the entry into force of the Treaty and decisions taken by its Governing Body. In addition, the regions confirmed that the gaps and needs identified in the SoWPGR-2 are by and large those which also exist in many countries and regions.

8. Different suggestions were recorded with regard to the implementation and financing of the updated *Global Plan of Action*. While some regions seem to favour the development of a funding mechanism for the support of specific components of the *Global Plan of Action*, others consider the Benefit-sharing Fund of the International Treaty and the Global Crop Diversity Trust as adequate and sufficient for the implementation of the *Global Plan of Action*.

9. In the review and updating of the *Global Plan of Action*, FAO also took into consideration comments received in response to a Circular State Letter from a broad range of institutions, including civil society, the private sector, non-governmental organizations, United Nations and other intergovernmental organizations.

10. The updated *Global Plan of Action*, which is based on global, regional and national views and priorities, addresses the new challenges and opportunities plant genetic resources for food and agriculture face in the 21st century. It is a forward-looking document that streamlines activities; the number of priority activity areas could be reduced from 20 to 18. Priority Activity Area 5, *Sustaining existing ex situ collections*, and Priority Activity Area 8, *Expanding ex situ conservation activities*, were merged into the Priority Activity Area 6, *Sustaining and expanding ex situ conservation of germplasm*. Priority Activity Area 12, *Promoting development and commercialization of underutilized crops and species*, and Priority Activity Area 14, *Developing new markets for local varieties and 'diversity-rich' products* were merged into Priority Activity Area 11, *Promoting development and commercialization of farmers' varieties and underutilized species*. In addition, the focus of a number of other activity areas has been changed in order to accommodate newly-defined priorities. The draft updated *Global Plan of Action* gives more emphasis and visibility to plant breeding, as is reflected in Priority Activity Area 10, *Supporting plant breeding, genetic enhancement and base-broadening efforts*. Finally, efforts have also been made, following guidance from the regional consultations, to simplify and clarify the language of the text in the document.

### **III. NEXT STEPS IN THE FINALIZATION OF THE UPDATED GLOBAL PLAN OF ACTION**

11. The Chairs of the Bureaus of the Treaty and the Commission will orally present during the Fourth Session of the Governing Body the conclusions of the third Joint Bureau Meeting, at which the two Bureaus reviewed the draft updated *Global Plan of Action*. Comments and suggestions from the Joint Bureau Meeting, from the Governing Body and from e-consultations will be made available to the Commission's Intergovernmental Technical Working Group on Plant Genetic Resources for Food and Agriculture which will review the draft updated *Global Plan of Action* at its Fifth Session (27-29 April 2011), for consideration by the Commission. The Commission will consider the draft updated *Global Plan of Action* at its forthcoming Thirteenth Regular Session (18-22 July 2011).

*Appendix*

**APPENDIX**

**DRAFT UPDATED  
GLOBAL PLAN OF ACTION  
FOR THE  
CONSERVATION AND SUSTAINABLE UTILIZATION  
OF PLANT GENETIC RESOURCES FOR FOOD AND  
AGRICULTURE**



## Executive Summary

1. Plant genetic resources for food and agriculture provide the biological basis for agricultural production and world food security. These resources serve as the most important raw material for farmers, their custodians, and for plant breeders. The genetic diversity in these resources allows crops and varieties to adapt to ever changing conditions and to overcome the constraints caused by pests, diseases and abiotic stresses. They are essential for sustainable agricultural production. There is no inherent incompatibility between conservation and use of these resources. In fact, it will be critically important to ensure that these activities are fully complementary. The conservation, sustainable use, and fair and equitable sharing of benefits from their use, are both an international concern and an imperative. These are the objectives of the International Treaty on Plant Genetic Resources for Food and Agriculture, which is in harmony with the Convention on Biological Diversity. In reaffirming the sovereign rights of states over their biological resources, this updated Global Plan of Action addressing plant genetic resources for food and agriculture is an appropriate manifestation of the international community's continued concern and responsibility in this area.
2. Over the last 15 years the Global Plan of Action has been the main reference document for national, regional and global efforts to conserve and sustainably use plant genetic resources for food and agriculture and to share equitably and fairly the benefits that derive from their use. As part of the FAO Global System for the conservation and sustainable use of plant genetic resources for food and agriculture, the Global Plan of Action has been the key element used by the FAO Commission on Genetic Resources for Food Agriculture in fulfilling its mandate with respect to plant genetic resources, and has provided an important reference for other genetic resources sectors. The Global Plan of Action assisted governments in the formulation of national policies and strategies on plant genetic resources for food and agriculture. It was used by the international community to define priorities at the global level, to improve coordination of efforts and to create synergies. The Global Plan of Action has proven to be instrumental in the reorientation and prioritization of the research and development agenda of relevant international organizations with regard to PGRFA-related activities.
3. The adoption of the Global Plan of Action by 150 countries in 1996 was a key milestone in the development of the international governance of plant genetic resources for food and agriculture. It set the stage for the successful completion of the negotiations of the International Treaty under the FAO Commission on Genetic Resources for Food and Agriculture.
4. Since its adoption, there have been a number of major developments with respect to the conservation and use of plant genetic resources for food and agriculture which call for an update of the Global Plan of Action. The recently completed and published Second Report on the State of the World' Plant Genetic Resources for Food and Agriculture has provided a solid foundation for, and guidance to, this updating process. The world is facing increasing food insecurity, reflected in unstable food prices and competition between food and fuel production. Climate change, increasing urbanization, the need for greater sustainability of agriculture and continued genetic erosion all require increased attention to both conservation and use of plant genetic resources for food and agriculture. At the same time, there are important new opportunities that can improve the management of plant genetic resources for food and agriculture, including powerful and widely available communication and information technologies as well as significant advances in biotechnology. Furthermore, the policy environment has changed significantly, particularly with the entry into force of the International Treaty on Plant Genetic Resources for Food and Agriculture, and among others, the Cartagena protocol on

biosafety and the Nagoya protocol on access and benefit sharing of biodiversity. The world has also experienced a renewed commitment towards agriculture and its research and development activities. An updated Global Plan of Action is needed to respond to, and reflect, these developments.

5. The updated Global Plan of Action addresses the new challenges and opportunities in its 18 Priority Activity Areas. The Second Report on the State of the World's Plant Genetic Resources for Food and Agriculture, a series of regional consultation meetings, as well as inputs from experts worldwide have provided the required inputs to make this Global Plan of Action up-to-date, forward looking and reflective of global, regional and national perspectives and priorities. The updating of the Global Plan of Action also serves the purpose of strengthening its role as a supporting component of the International Treaty on Plant Genetic Resources for Food and Agriculture.
6. Based on the various inputs listed above, it was possible to streamline the number of Priority Activity Areas, reducing them from 20 to 18. This was done by merging former Priority Activity Areas 5 and 8 (*Sustaining existing ex situ collections* and *Expanding ex situ conservation activities*) into the new Priority Activity Area 6, *Sustaining and expanding ex situ conservation of germplasm*. Former Priority Activity Areas 12 (*Promoting development and commercialization of underutilized crops and species*) and 14 (*Developing new markets for local varieties and 'diversity-rich' products*) have been merged into the new Priority Activity Area 11, *Promoting development and commercialization of farmers' varieties and underutilized species*. In addition, the focus of a number of other Priority Activity Areas has been adjusted in order to accommodate newly defined priorities. An effort has also been made, following guidance from the regional consultations, to simplify and clarify the document. The updated *Global Plan of Action* gives more emphasis and visibility to plant breeding, as reflected in Priority Activity Area 9, *Supporting plant breeding, genetic enhancement and base-broadening efforts*.

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# **Draft Updated Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture**

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## **Priority Activity Areas**

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1. Surveying and inventorying plant genetic resources for food and agriculture
2. Supporting on-farm management and improvement of plant genetic resources for food and agriculture
3. Assisting farmers in disaster situations to restore crop systems
4. Promoting *in situ* management of crop wild relatives and wild food plants

### ***Ex Situ* Conservation**

5. Supporting targeted collecting of plant genetic resources for food and agriculture
6. Sustaining and expanding *ex situ* conservation of germplasm
7. Regenerating and multiplying *ex situ* accessions

### **Sustainable Use**

8. Expanding the characterization, evaluation and further development of specific collection sub-sets to facilitate use
9. Supporting plant breeding, genetic enhancement and base-broadening efforts
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## **Introduction**

### **Continued need for plant genetic resources for food and agriculture and their conservation and sustainable use**

1. Agriculture in the 21<sup>st</sup> century will face many new challenges. Food and fibre production will have to increase drastically to meet the needs of a growing and modernizing population with a proportionally smaller rural labour force. Changes in diets and food habits will drive changes in crop and livestock production systems. Increased demand for biofuels for an expanding bio-energy market will compete with food production. In many parts of the world, the effects of climate change will likely exceed the adaptive capacity of many crops and forages, increasing countries' interdependence for plant genetic resources for food and agriculture (PGRFA). Furthermore, climate change will lead to changes in production areas and practices, as well as in the occurrence of pests and diseases of crops and livestock. Increasingly, voices can be heard that agriculture will need to reduce its negative impact on the environment and biodiversity and adopt more efficient and sustainable production practices. Land-use changes will limit the area available for agriculture and increase pressure on populations of crop wild relatives (CWR) and wild food plants.
2. PGRFA underpin agriculture's ability to cope with these changes, whether environmental or socio-economic. They will therefore have to play an increasingly important role in securing continuing improvements in agricultural production and productivity; not only through the provision of new genes for improved crop varieties, but also through contributions to effective agro-ecosystem function. In many poor rural areas around the world, PGRFA, as a part of agricultural biodiversity, are an essential component of local communities' livelihood strategies.

### **History of the Global Plan of Action**

3. The Global Plan of Action (GPA) for the conservation and sustainable utilization of plant genetic resources for food and agriculture was formally adopted by representatives of 150 countries during the Fourth International Technical Conference on Plant Genetic Resources in Leipzig, Germany in 1996. During the same conference, the Leipzig Declaration, which provides a clear focus on the importance of PGRFA for world food security and commits countries to implement the GPA, was adopted. More than 150 countries, as well as the public and private sectors, actively participated in the preparation of the GPA. FAO committed itself to carry out the GPA, under the guidance of the intergovernmental Commission on Genetic Resources for Food and Agriculture, as part of the FAO Global System for the Conservation and Use of Plant Genetic Resources.
4. At its Eighth Regular Session in 1999, the Commission reaffirmed that FAO should periodically assess the state of the world's PGRFA to facilitate analyses of changing gaps and needs and contribute to the updating process of the rolling GPA. At the Ninth Regular Session, the Commission agreed on the application of a new approach for monitoring GPA implementation based on internationally agreed indicators, which led to the establishment of the National Information Sharing Mechanisms (NISM). At its Twelfth Regular Session in 2009, the Commission endorsed the Second Report on the State of the World's PGRFA as an authoritative assessment of this sector and requested

FAO to prepare the updated GPA, based primarily on the Second Report, and, in particular, on the identified gaps and needs, taking into account further contributions from Governments, as well as inputs received from regional meetings and consultations. It decided that the updated GPA would be considered at its Thirteenth Regular Session.

5. In 2001, the FAO Conference adopted the International Treaty on Plant Genetic Resources for Food and Agriculture (the International Treaty), which in its Article 14 recognizes the GPA as one of its supporting components and, in 2006, its Governing Body decided that the GPA's priorities are also priorities under the International Treaty's funding strategy. In 2009, the Governing Body of the International Treaty noted the need to ensure close collaboration between the Commission and the Governing Body with regard to the GPA, and invited the Commission, in the GPA revision, to take into account specific issues of relevance to the International Treaty and to adequately reflect the provisions of the International Treaty in the updated GPA.

### **Implementation of the Global Plan of Action**

6. Since the formulation of the first GPA, based largely on the information generated during the preparatory process of the First Report on the State of the World's PGRFA in the early 1990's, considerable progress has been made with the implementation of the GPA around the world. One of the main changes that can be reported when comparing the situation in 2010 with that in 1996 is an increase of almost 20% in the number of accessions that are conserved in genebanks worldwide, reaching 7.4 million in 2010. Over 240,000 new samples have been collected and added to *ex situ* genebanks, 1,750 of which were identified in 2010 compared to approximately 1,450 in 1996. The number of botanical gardens has grown from about 1,500 in 1996 to more than 2,500 in 2010. The number of national programmes on PGRFA has increased often with a broader participation of stakeholders. Most countries have now adopted or revised national legislation dealing with PGRFA and seed systems. The application of modern plant biotechnologies in the conservation and use of PGRFA has increased; farmers increasingly participate in breeding programmes; and the conservation and use of CWR and landraces has improved. The important role of information in the conservation and use of PGRFA, and technological advances, are reflected in the improved situation with regard to information management at the national, regional and global level.
7. Overall, international activity in conservation and sustainable use of PGRFA has increased. Many new regional and crop networks and programmes have been set up, also in response to the action priorities of the GPA. Networks remain very important for promoting cooperation, sharing knowledge, information and ideas, exchanging germplasm, and for carrying out joint research and other activities. Initiatives, such as the efforts of the Global Crop Diversity Trust (the Trust), to contribute to more rational *ex situ* conservation, especially for the crops covered under the Multilateral System of the International Treaty (i.e. the Annex I crops), build on such networks. The existing network of international *ex situ* collections of major crops played an important role in the negotiations of the International Treaty, and they continue to form the backbone of the FAO Global System for the Conservation and Sustainable Use of PGRFA. The Svalbard Global Seed Vault (SGSV) now provides an additional level of security to existing *ex situ* collections. Furthermore, the development of a global portal of accession level data and the imminent release of an advanced genebank information management system are other important steps towards the strengthening and more effective operation of a global system for *ex situ* conservation. Complementary to this is the establishment of NISMs in more than 65 countries to facilitate access to relevant information, monitor GPA implementation and strengthen partnerships among stakeholders and national decision-making processes. The Global Partnership Initiative on Plant Breeding Capacity Building

represents an effort to fill an important gap in national programmes, i.e. linking the conservation of PGRFA to use in crop improvement. In addition, the GPA Facilitating Mechanism has been established to identify and disseminate information on funding opportunities for all priority activity areas.

### The rationale for the updated Global Plan of Action

8. Since the GPA was formulated and adopted, a number of substantial changes and new challenges and opportunities with respect to the conservation and utilization of PGRFA have occurred. These new developments, which have been highlighted in the Second Report on the State of the World's PGRFA and which featured prominently in the regional meetings and consultations, provide the justification and rationale for updating the GPA. The most important issues are discussed below.
9. The following **developments and trends in agriculture** are expected to have significant impacts on the conservation and use of PGRFA:
  - a. Throughout most of the developed world, most food is supplied by industrialized food production systems which are driven by strong consumer demand for cheap food of uniform and predictable quality. Crop varieties are bred to meet the requirements of these high-input systems and strict market standards, often under mono-cropping and monoculture production systems. These developments have strengthened the downward trend in species and genetic diversity in farmers' fields.
  - b. In the developing world, however, a substantial portion of food is still produced with few, if any, chemical inputs and any food surplus of subsistence farming or home gardens is sold locally. Many millions of small-scale farmers throughout the world depend on locally available PGRFA for their livelihoods and well being.
  - c. Urbanization will occur at an accelerated pace and it is expected that more than 70% of the world population will be urban in 2050 (compared with about 50% today). Income levels are expected to rise steadily to many times their current levels.<sup>3</sup> Nonetheless, income disparity between rich and poor will remain very high.
  - d. Another trend, related to globalization, is the significant concentration of international seed companies. International seed trade has increased, but it is dominated by fewer and larger multinational seed companies than in 1996.
  - e. The ever increasing production and marketing of genetically modified varieties for a growing number of crops is closely related with the previous point and needs close monitoring by the genetic resources community, especially to avoid contamination of existing collections during regeneration activities and/or when germplasm is being collected in farmers' fields or in nature.
  - f. There is increasing recognition of Farmers' Rights, as included in Article 9 of the International Treaty, and of the important role farmers have been playing in the conservation and sustainable use of PGRFA.
10. **Climate change** represents an immediate and unprecedented threat to livelihoods and food security and may well be a major barrier to achieving the required increase of 70% in global food production by 2050. The following strategic components are needed to secure PGRFA and use them optimally to help cope with climate change:

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<sup>3</sup> FAO 2009. How to Feed the World in 2050.  
[http://www.fao.org/fileadmin/templates/wsfs/docs/expert\\_paper/How\\_to\\_Feed\\_the\\_World\\_in\\_2050.pdf](http://www.fao.org/fileadmin/templates/wsfs/docs/expert_paper/How_to_Feed_the_World_in_2050.pdf)

- An increased emphasis on *in situ* conservation of genetically diverse populations, especially of CWR, to allow evolution to continue and thus permit the continued generation of adaptive traits;
  - A significantly expanded programme of *ex situ* conservation, especially of CWR, to ensure maintenance of diversity of species, populations and varieties adapted to extreme conditions and from areas expected to be highly impacted by climate change;
  - Improved availability of information on the characteristics of material held *ex situ* which will become useful under new conditions;
  - Increased support for access and movement of materials to meet the increased interdependence resulting from the new environmental conditions;
  - Increased support for building capacity in plant breeding and seed systems management that make effective and sustainable use of PGRFA;
  - A targeted and increased involvement of farmers and farming communities in national and local crop improvement activities, including support to participatory research and plant breeding.
11. Over the last 15 years considerable information has become available with respect to the extent and nature of genetic erosion of PGRFA and the extent of genetic vulnerability. Genetic erosion is reported to continue in many regions of the world and the genetic vulnerability of crops has further increased over the past 15 years. The major causes of erosion that have been identified include replacement of farmers' varieties, land clearing, over-exploitation, population pressures, environmental degradation, changing agricultural systems, over-grazing, legislation and policy, and pests diseases and weeds. Changes in the seed sector and production methodologies have a major impact on the vulnerability of crops. This vulnerability applies in particular to those species that do not find much, if any, support from research and/or plant breeding and are increasingly neglected even by farmers. These so-called neglected and underutilized species have a great potential in the context of climate change, eco-agriculture, dietary diversity and in general for the sustainability of agricultural production systems.
12. Major **advances in key areas of science and technology** relevant to PGRFA conservation and use have occurred over the last 15 years. Of these the most important have been the rapid development of information and communication technologies (ICT), which include the internet and mobile phones, the management and analysis of information, and the developments in molecular biology.
- g. **Information management and exchange technologies** have greatly advanced over the last 15 years. There is significantly increased accessibility to information as well as enhanced analytical capacity available to genetic resources workers. The most important element of the latter has been the way in which Geographic Information Systems (GIS) and satellite-based methods such as Global Positioning System (GPS) and remote sensing have been developed so that PGRFA data can be combined with a wide range of other data to locate specific areas of diversity or to identify material from particular habitats.
  - h. The dramatic **advances in molecular and genomic methods** over the last 15 years have already had a profound impact on key areas of GPA implementation. These methods allow the generation of additional and much more detailed information on the extent and distribution of genetic diversity and can be used as part of the planning strategies of PGRFA conservation and use. In addition, significantly improved technologies for identifying and transferring genes between related and even unrelated species open completely new horizons for the exploitation of genetic diversity.
  - i. Whereas relatively few major developments have occurred with respect to *ex situ* **conservation** practices and procedures over the last decade, the new information

and molecular tools have the potential to make the conservation and use of PGRFA more effective and efficient. Much work has been undertaken on *in situ* **conservation**, both of CWR and, to an even greater extent, on farm. The experience gathered and knowledge created have resulted in the recognition of the importance of an integrated, multi-disciplinary approach, in which farmers and communities play a leading part and in which livelihood and well-being perspectives are fully reflected.

13. There have been major policy developments with respect to conservation and use of PGRFA. These include the adoption by the Conference of the Parties of the Convention on Biological Diversity (CBD) of an Agricultural Biodiversity Programme of Work in 2000, the adoption of the Millennium Development Goals in 2000, the establishment of the Global Strategy for Plant Conservation in 2002, the establishment of the Global Crop Diversity Trust in 2004 and the adoption by the Commission on Genetic Resources of the Multi-Year Programme of Work (MYPOW) in 2007, which includes substantial work on PGRFA.
14. Undoubtedly, the most important development has been the entry into force of the International Treaty in 2004. Contracting Parties recognize that the rolling GPA is important to this Treaty in Article 14, and that they should promote its effective implementation, including through national actions and, as appropriate, international cooperation to provide a coherent framework, among others, for capacity-building, technology transfer and exchange of information, taking into account the provisions of benefit-sharing in the Multilateral System. Contracting Parties also recognize that the ability to fully implement the Global Plan of Action, in particular of developing countries and countries with economies in transition, will depend largely upon the effective implementation of Article 13, Benefit-sharing in the Multilateral System, and of the Funding Strategy as provided in Article 18. The GPA framework has been taken into account by the Governing Body of the International Treaty in establishing the priorities of the Benefit-Sharing Fund to enable the strategic use of the fund to catalyze the sustainable use and conservation of PGRFA. The updated GPA will be an important resource for the identification of future priorities.
15. At its 10<sup>th</sup> meeting (2010), the Conference of the Parties to the CBD adopted the Strategic Plan for Biodiversity for the period 2011-2020, with 20 Targets. Target 13 of the “Aichi Biodiversity Targets” is the key target relating to genetic diversity: “By 2020, the genetic diversity of cultivated plants and farmed and domesticated animals and of wild relatives, including other socio-economically as well as culturally valuable species, is maintained, and strategies have been developed and implemented for minimizing genetic erosion and safeguarding their genetic diversity”. A number of the other targets would also relate to the conservation and sustainable use of plant genetic resources.<sup>4</sup> The updated GPA aims to contribute significantly to the achievement of these targets. Work on international indicators related to these targets has been initiated. The recently adopted Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits Arising from their Utilisation, may, when in force, also have implications for the access to and utilization of certain plant genetic resources.
16. The GPA itself mandates the Commission to develop a procedure for the review of the GPA. Such a review should deal with the progress made at national, regional and international levels in implementation, elaboration, and adjustment as appropriate, of the GPA, thus making it a “rolling” plan as recommended in Agenda 21.

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<sup>4</sup> Including target 2 (biodiversity values integrated into national and local development and poverty reduction strategies and planning processes etc.), target 5 (rate of loss of natural habitats halved etc.), target 6 (all aquatic plants harvested sustainably etc.), target 7 (areas under agriculture, aquaculture and forestry are managed sustainably etc.), target 11 (protected areas etc.) target 12 (extinction of known threatened species prevented), target 18 (traditional knowledge, innovations and practices etc.).

## Aims and strategies of the Global Plan of Action

17. At its Eleventh Regular Session the FAO Commission agreed that the GPA should be based on clear, but succinctly stated, aims and principles, and should include, among others, a strategy and information on each proposed priority activity. It agreed that the aims would refer to, and draw upon, as appropriate, applicable international agreements.
18. The main aims of this updated GPA are:
  - a. to ensure the conservation of PGRFA as a basis for food security, sustainable agriculture and poverty reduction by providing a foundation for current and future use;
  - b. to promote sustainable use of PGRFA by enhancing the capacity to use the resources for crop improvement, in order to foster economic development and to reduce hunger and poverty, particularly in developing countries, as well as provide options for adaptation to and mitigation of climate change;
  - c. to promote fair and equitable sharing of the benefits arising from the use of PGRFA, in recognition of the enormous contribution that the local and indigenous communities and farmers of all regions of the world, in particular those in the centres of origin and crop diversity, have made and will continue to make for the conservation and development of plant genetic resources which constitute the basis of food and agriculture production throughout the world;
  - d. to enable countries, as appropriate, and subject to their national legislation, to take measures to protect and promote Farmers' Rights, as provided in Article 9 of the International Treaty;
  - e. to assist countries, regions, the Governing Body of the International Treaty, as well as other institutions responsible for conserving and using PGRFA, to identify priorities for action;
  - f. to create and strengthen national programmes in particular, and increase regional and international cooperation, including research, education and training, on the conservation and use of PGRFA, and to enhance institutional capacity;
  - g. to promote information sharing on PGRFA among and within regions and countries.
  - h. to set the conceptual bases for the development and adoption of national policies and legislation for the conservation and sustainable use of PGRFA.
19. The GPA is based on the fact that countries are interdependent with respect to PGRFA and therefore that substantial regional and international cooperation will be necessary to meet its aims effectively and efficiently. In this context, the GPA has developed a broad strategic framework comprised of seven basic and interrelated aspects:
  - a) A large and important amount of PGRFA, vital to world food security, is stored *ex situ*. Whereas the maintenance of genetic resources in genebanks is a well established procedure in most countries, many of the existing collections need to be further developed and strengthened. Securing adequate storage conditions for the genetic materials already collected and providing for its regeneration and safety duplication is a key strategic element of the GPA. In general, there is a need for standard operating procedures for all routine genebank operations.
  - b) Linking conservation with use and identifying and overcoming obstacles to the greater use of conserved PGRFA are necessary if maximum benefits are to be obtained from conservation efforts. Effective information management, including the sharing of relevant information widely with users by taking full advantage of the advanced information technologies will be an important prerequisite to achieve this. This will increasingly include molecular and genomic data on PGRFA, which will

- need to be linked to, and analyzed together with, the characterization and evaluation data managed in genebank databases.
- c) Enhancing capacity at all levels is a key strategy used in the individual activities in the GPA. The GPA seeks to promote the pragmatic and efficient use and development of institutions, human resources, cooperation, and financial mechanisms, among others by enhancing the mobility of human and financial resources as a contribution to the establishment of a true global system for PGRFA. Furthermore, there is a need to enhance linkages between scientific and technological innovation and its application to the conservation and use of PGRFA.
  - d) Strengthening the efforts and partnerships of public and private sector breeders to use PGRFA is essential. In addition, participatory breeding and selection, as well as participatory research in general, with farmers and farming communities, need to be strengthened and recognized more broadly as appropriate ways of achieving sustainable and long-lasting conservation and use of PGRFA.
  - e) *In situ* conservation and development of PGRFA occur in two contexts: on-farm and in nature. Farmers, rural communities and indigenous peoples play a crucial role in both. Enhancing the capacity of farmers and communities through linkages to extension agencies, the private sector, NGOs and farmer-owned cooperatives, as well as through the provision of incentives for the *in situ* conservation of PGRFA, will help promote food security, adaptability and resilience, particularly among the many rural people who live in areas of low agricultural potential.
  - f) Considering the importance of CWR for crop improvement and the fact that they have not been given adequate attention, specific conservation and management activities will be required, including their better protection through improved land-use practices, nature conservation and strengthened community involvement.
  - g) Conservation and use strategies at the community, national, regional and international levels are most effective when they are complementary and well-coordinated. *In situ* conservation, *ex situ* conservation and sustainable use, need to be fully integrated at all levels.
20. Resource mobilization to allow the timely and adequate implementation of the strategic elements above will require due attention and efforts at all levels, including coordination with the numerous initiatives underway within countries, regionally and globally (e.g. CBD, UNFCCC, etc.) to realize much needed synergies.

### Structure and Organization of the Global Plan of Action

21. The updated GPA has 18 priority activity areas. For pragmatic and presentational purposes, these are organized into four main groups. The first group deals with ***In Situ Conservation and Management***; the second with ***Ex Situ Conservation***; the third with **Sustainable Use**; and the fourth with **Building Sustainable Institutional and Human Capacities**. As the GPA is a set of integrated and intertwining activities, the placement of the activities into four groups is intended simply to help order the presentation and guide the reader to areas of particular interest. Many priority activity areas relate and are relevant to more than one group.
22. For each priority activity there is a basic set of headings or sections to aid in the presentation of the proposed priority activity. In some cases, recommendations found under one heading might as appropriately have been placed under another. While no strict section definitions are considered necessary, a few explanatory remarks might be useful:

- (a) The Background section provides a rationale for the priority activity area and a summary of the achievements made since 1996, mainly based on the findings reported in the Second Report on the State of the World's PGRFA.
- (b) The Long-term Objectives and Intermediate Objectives sections specify the ultimate and intervening objectives respectively to be accomplished by the priority activity. The explicit articulation of goals can aid the international community in judging the extent of implementation of the activity over time.
- (c) The Policy/Strategy section proposes national and international policies and strategic approaches to implement the objectives of the priority activity. In some cases there are recommendations for new international policies; in other cases there are proposals for changes in approach, priorities, and visions.
- (d) The Capacity section indicates what human and institutional capabilities should be developed or provided.
- (e) The Research/Technology section, including technology development and transfer, identifies areas of scientific, methodological, or technological research or action relevant to the implementation of the priority activity.
- (f) The Coordination and Administration section addresses how these issues might be approached as the priority activity is planned and implemented. The focus of this section has been mainly limited to the national level to avoid repetitions as the need to further strengthen collaboration with relevant international organizations and agricultural research centres, and to increase sharing of information among all organizations and stakeholders applies throughout all priority activity areas. International collaboration is critical to gaining maximum benefits under legal and policy instruments such as the CBD and the International Treaty and to meet associated obligations.
23. On occasion, institutions or constituencies are specifically identified in the body of a Priority Activity Area. This is not meant to imply their exclusion in other Activities. Such references are used to highlight a role which is particularly critical, or one which may otherwise be overlooked, or both.

## ***In Situ* Conservation and Management**

- 1. Surveying and inventorying plant genetic resources for food and agriculture**
- 2. Supporting on-farm management and improvement of plant genetic resources for food and agriculture**
- 3. Assisting farmers in disaster situations to restore crop systems**
- 4. Promoting *in situ* management of crop wild relatives and wild food plants**

### **1. Surveying and inventorying plant genetic resources for food and agriculture**

**24. Background:** Rational conservation of PGRFA (*in situ* and *ex situ*) begins with surveys and inventories, as highlighted by the International Treaty in Article 5. In order to elaborate policies and strategies for conservation and use of PGRFA, national programmes need to know what resources exist in their countries, their distribution and the extent to which they are already being conserved. Countries that have ratified the CBD have acknowledged specific responsibilities concerning this (for example in the Programme of Work on Agricultural Biodiversity). Wider accessibility to geo-referencing tools has facilitated surveying, and development and application of modern molecular biology techniques have assisted in assessing the extent of genetic diversity and genetic erosion. During the past decade most surveys have been restricted to individual crops or limited areas, although some progress has also been made in inventorying CWR and establishing specific sites for their *in situ* conservation. Nonetheless, efforts in protected areas regarding surveying, inventorying and conservation of PGRFA have been limited in comparison with those devoted to many other components of biodiversity. Several international organizations have contributed to monitoring the conservation status of wild plants of agricultural relevance regionally and globally, but improved partnerships with organizations in the environment sector need to be pursued, especially at the country level.

**25. Long-term objectives:** To facilitate the development, implementation and monitoring of complementary conservation strategies and national policies related to the conservation and sustainable use of PGRFA. To strengthen linkages between ministries of agriculture and of the environment and promote monitoring of the status and trends in PGRFA and thereby ensure their adequate conservation.

**26. Intermediate objectives:** To develop and apply methodologies for surveying and inventorying *in situ* and *ex situ* PGRFA, including GIS, satellite-based methods (e.g. GPS and remote sensing) and molecular markers. To identify, locate, inventory, and assess threats to PGRFA, particularly from land-use and climate changes.

**27. Policy/strategy:** The surveying and inventorying of PGRFA should be considered as the first step in the process of conservation and of reducing the rate of biodiversity loss. Without the capacity to conserve and/or use biodiversity, however, such work may have marginal utility. Thus, surveying and inventorying should ideally be linked to specific objectives and plans for *in situ* conservation, collecting, *ex situ* conservation and use. Standard definitions

and methods need to be promoted for assessing genetic vulnerability and genetic erosion directly. There is also an urgent need to develop improved indicators, including proxy indicators, of diversity, genetic erosion and vulnerability that can be applied to establish national, regional and global baselines. General agreement on the design and use of such indicators needs to be pursued.

28. Local and indigenous knowledge should be recognized as an important component of surveying and inventorying activities and should be carefully considered and documented.

29. **Capacity:** Countries should provide and may need financial and technical support to survey and inventory PGRFA. There are numerous obstacles to surveying and inventorying PGRFA, including lack of adequately trained human resources. Training and capacity-building should be undertaken in several areas of research, including plant identification, population biology, ethno-botany, use of GIS and GPS, and molecular tools. The capacity to gauge climate change impact and assess adaptation is also increasingly relevant, particularly if *in situ* conserved genetic diversity is to be maintained sustainably in the longer-term.

30. **Research/technology:** Adequate support should be given to developing better methodologies for surveying and assessing inter- and intra-specific diversity in agroecological systems. There is also a strong need to develop scientifically sound and easily implemented indicators for monitoring the status and trends of PGRFA, especially at the genetic level.

31. There are specific research needs related to on-farm management and *in situ* conservation of PGRFA. More complete inventories are needed to enable better targeting of *in situ* conservation activities. If these were associated with actual or predicted data on specific traits of interest, they would have even more value, and provide a useful link to *ex situ* conservation and use. Existing information sources should be used in research to determine the extent to which CWR exist in protected areas.

32. A particularly important research area is the development of indicators that can be used to monitor changes in extent and distribution of diversity at different scales and to aggregate information on individual species and populations. This research will materially strengthen national conservation planning and decision-making.

33. **Coordination/administration:** Coordination must take place in-country between ministries of agriculture and of the environment, and regionally, realizing that species cross national boundaries. Regional and global level coordination is needed to strengthen linkages between existing *ex situ* and *in situ* conservation efforts.

34. Strong linkages need to be established with national, regional and crop networks and with the users of PGRFA (breeders, researchers and farmers) in order to inform, direct and prioritize the entire conservation process. Countries should collaborate in surveying and inventorying activities in order to build capacity.

## 2. Supporting on-farm management and improvement of plant genetic resources for food and agriculture

35. **Background:** Plant breeding has helped raise crop yields, improve resistance to pests and diseases and enhance quality of food products, especially in favourable environments. Farmers choose to grow modern varieties for many reasons, including market conditions, family food security and environmental sustainability. Although these choices often result in significant genetic erosion, the last two decades have provided substantial evidence that many farmers in the developing world, and increasing numbers in developed countries, continue to maintain significant crop genetic diversity in their fields. This diversity constitutes an important element for the livelihood strategies of farmers because of their adaptation to marginal or heterogeneous environments. This diversity is also maintained to meet changes in market demands, labour availability and other socioeconomic factors, and for cultural and religious reasons.

36. A range of initiatives and practices has become available to help farming communities continue to benefit from the maintenance and use of local crop genetic diversity in their production systems. Building capacity and leadership in local communities and their institutions is a precondition for implementing such community-based activities. Promoting and supporting the on-farm management of genetic resources has become firmly established and systematized as a key component of crop conservation strategies. As a result, on farm management of PGRFA is one of the three first priorities of the Benefit Sharing Fund of the International Treaty.

37. Despite this progress, significant technical and methodological questions remain. In particular, there is room for improvement in coordination of on-farm management with *ex situ* conservation and use. In order to realize the full potential of on-farm improvement, these practices need to be fully integrated into rural development policies.

38. Concerns about the impact of climate change on agriculture have grown substantially over the past decade. Farmers may no longer be able to grow their own traditional varieties and landraces in changed climates, and they will therefore need access to new germplasm. Furthermore, agriculture is both a source and a sink for atmospheric carbon. PGRFA are becoming recognized as critically important for the development of farming systems that are resilient to climate change, capture more carbon and produce less greenhouse gasses. They will underpin the breeding of the new adapted crop varieties that will be needed for agriculture under future environmental conditions. There will be an increased need for linkages between local seed systems and genebanks to secure new germplasm adapted to changed climates.

39. **Long-term objectives:** To use the knowledge generated during the past two decades to promote and improve the effectiveness of existing on-farm conservation, management, improvement and use of PGRFA. To achieve a better balance and integration between *ex situ* and *in situ* conservation. To realize Farmers' Rights as detailed in Article 9 of the International Treaty, at regional and national levels. To promote the equitable sharing of benefits from PGRFA as called for in Article 13 of the International Treaty. To foster the future emergence of public and private seed companies and cooperative enterprises that address local needs as an outgrowth of successful on-farm crop selection and breeding. To encourage traditional seed exchange and supply systems, including community genebanks, and strengthen local markets for products. To take full account of the role of women in

agricultural production, particularly regarding on-farm management of PGRFA, in many developing countries. To foster successful traditional and innovative selection and breeding, particularly in the light of climate change.

**40. Intermediate objectives:** To address gaps in knowledge about the dynamics, methodologies, effects, and potential of on-farm conservation and crop improvement. To establish or strengthen programmes and networks for on-farm management of farmer's varieties, CWR, wild food plants and rangeland genetic resources, and integrate their work into rural development policies and activities. To extend the role of national, regional and international genebanks to include support for, and provision of materials to, on-farm improvement programmes in a more integrated manner. To build on-farm programmes based on local and traditional systems of knowledge, institutions and management, ensuring local participation in planning, management and evaluation. To focus greater public and scientific attention on the diverse roles that gender and age play in production and resource management in rural households.

**41. Policy/strategy:** Although on-farm management activities have now moved beyond the stage of small-scale research of methodological projects, these activities still need to be fully integrated into wider conservation and development strategies and/or action plans. On-farm activities are complementary to more formal crop variety development and strengthen seed supply systems. Institutional flexibility will be needed in working with farming communities. Specific strategies for conserving PGRFA *in situ*, and for managing crop diversity on-farm and in protected areas, need to be developed. Special attention should be paid in these strategies to conservation of CWR in their centres of origin, major centres of diversity and biodiversity hotspots. Working examples must be disseminated of conservation and sustainable use of PGRFA that support and maintain the social, economic and cultural values of local and indigenous communities and improve the quality of life. This will be best achieved by involving local communities in all aspects of management and improvement of PGRFA on-farm.

42. Governments should consider how production, economic incentives, and other policies, as well as agricultural extension and research services, might facilitate and encourage on-farm management and improvement of PGRFA. Increasingly, the value of conservation activities needs to be demonstrated in terms of continued provision of ecosystem services. The importance of PGRFA as one of these services is just beginning to be fully recognized, and efforts should continue and intensify to document the value of CWR and landrace diversity in this regard.

43. There will be a specific need to integrate CWR and landrace conservation into existing conservation strategies to ensure that agricultural biodiversity and more general biodiversity are not addressed as separate entities. This will require that conservation of agricultural biodiversity becomes a feature of wider biodiversity conservation initiatives and programmes.

44. Where appropriate, national policies should aim to strengthen the capacity of local communities to participate in crop improvement efforts. Decentralized, participatory and gender sensitive approaches to crop improvement in order to produce varieties that are specifically adapted to socio-economically disadvantaged environments in particular need to be strengthened. This may require new policies and legislation, including appropriate intellectual property protection and seed certification procedures for varieties bred through

participatory plant breeding, in order to promote and strengthen their use and ensure that they are included in national agricultural development strategies.

45. Greater attention needs to be paid to on-farm conservation and use of underutilized species, many of which can make a valuable contribution to improving diets and incomes. In order to capture the potential market value of such crops there needs to be greater cooperation among different actors in the production chain, from the development and testing of new varieties, through value-added activities, to the opening up of new markets. Increasingly, the value of conservation activities needs to be demonstrated in terms of continued provision of ecosystem services. The importance of agricultural biodiversity as one of these services is just beginning to be fully recognized, and efforts should continue and intensify to document the value of CWR and landrace diversity in this regard.

46. **Capacity:** Adequate support should be given to community-based organizations and user groups engaged in providing practical assistance to on-farm conservation and improvement work. The ability of farmers, indigenous and local communities and their organizations, as well as extension workers and other stakeholders, to manage agricultural biodiversity sustainably on-farm needs to be strengthened.

47. Considering the needs, and numbers, of the farmers served, genebanks and national/international organizations should consider identifying appropriate farmers' varieties for multiplication and/or developing new breeding populations that incorporate specific traits into locally adapted materials for on-farm improvement activities. Step-by-step incorporation and improvement should be encouraged rather than the hasty replacement of existing on-farm diversity. As a general practice, the quantities of seed and planting materials distributed should encourage experimentation by farmers, and not be so large as to displace normal seed supply sources or on-farm seed management.

48. Interdisciplinary training programmes should be developed for extension workers, NGOs and others in facilitating and catalyzing on-farm activities, including selection and breeding techniques appropriate to supplement and improve those already used by farmers.

49. The focus of training programmes should be on helping farmers to gain new knowledge and technologies and explore new markets for their products, and researchers to become better enablers and supporters of farmers. Training should be aimed at four different groups: scientists (including plant breeders, researchers and agricultural economists), technical support staff, extension agents (including NGOs), and farmers. Support for advanced degree work should include relevant work in the biological and social sciences. Training of extension agents should aim to increase their skills in ethno-botany, participatory selection and breeding, seed maintenance and using ICT.

50. Training of farmers should focus on the identification of plant traits, selection/breeding, utilization and maintenance of local crops, and the promotion of product sales. It is important to develop farmers' skills in selecting plants at the vegetative state and not only after harvest.

51. Training programmes should be designed in close collaboration with the National Agricultural Research System (NARS) and farmers and their organizations, and be based on particular needs as they see them. Such programmes should not neglect the central role that

women play in both influencing and directing the evolution of crops. Programmes should consider the different uses of biological resources by women and men, including women's concern for the multiple uses and processing requirements of crops.

**52. Research/technology:** Seven basic types of rigorous, multi-disciplinary scientific research are needed:

(a) further ethnobotanical and socio-economic/socio-cultural research to understand and analyze farmer knowledge, selection/breeding, utilization, and management of PGRFA, consistent with the approval of the farmers involved and with applicable requirements for protection of their knowledge and technologies;

(b) population and conservation biology to understand the structure and dynamics of genetic diversity in local farmers' varieties (including population differentiation, gene flow, genetic pollution, degree of inbreeding, and selective pressures);

(c) crop improvement research, including participatory breeding, as a means of increasing crop yields and reliability without significant losses of local biodiversity;

(d) research and extension studies for neglected and underutilized crops, including production, marketing and distribution of seed and vegetatively propagated planting materials;

(e) studies of the most effective ways to integrate on-farm and *ex situ* conservation;

(f) studies on the extent and nature of possible threats to existing diversity on-farm and *in situ*, particularly regarding threats represented by climate and land use change (including their effects on pollinators);

(g) spatial analysis to identify varieties likely to have climate-adapted traits to aid plant breeding.

53. Scientific research should, when possible, be coupled with on-farm activities in order that the context and purpose of the work are fully appreciated. Research should assist in the monitoring, evaluation, and improvement of on-farm activities. Research should be undertaken in a participatory and collaborative manner to foster interaction and cooperation between rural people and the staff of national institutions. Other institutions must be involved appropriately whenever necessary.

54. Methods should be developed and assistance provided for integrating *in situ*, farm and garden management and conservation of PGRFA with national and regional genebanks and research institutes.

55. **Coordination/administration:** Coordination efforts in this area should allow for and encourage local, community-level initiatives in proposing programmes. Small, grass-roots projects should receive priority in funding and support services. Priority should be placed on farmers with a technical project promoting the maintenance of pre-existing diversity and on collaboration between communities and research institutions. Subject to satisfactory progress, programmes should be sufficiently long (10 years or more) to achieve results.

56. Links between organizations primarily concerned with conservation of PGRFA and those dealing with its use are often weak or absent in many countries and require strengthening.

### 3. Assisting farmers in disaster situations to restore crop systems

57. **Background:** Natural disasters and civil strife often challenge the resilience of crop systems, in particular affecting small-scale and subsistence farmers in developing countries. Seed security is a key component of such resilience. Whereas immediate seed assistance can help the farmers affected by an acute disaster, a more systematic approach to re-establishing seed security and crop systems is needed in the case of chronic stresses. In particular, there has been recognition over the past decade of the extent and nature of the threats posed by climate change to seed and food security, and the importance and potential of PGRFA in helping agriculture to remain productive and robust under changed conditions. When crop varieties are lost from farmers' fields in an area, they can often be re-introduced over time from surrounding areas, with some support, through local markets and farmer-to-farmer exchange. They can also be re-introduced from additional sources, in particular national, regional or international genebanks. However, genebanks themselves are sometimes compromised by natural and man-made disasters and in these cases their ability to support restoration of crop systems will rely on access to materials held in other genebanks. The International Treaty, in Article 12, provides a sound basis for improving and facilitating such access. National, regional and global information systems are needed to support such restoration activities.

58. Food aid, combined with the importation of often poorly adapted seed varieties, can lower yields and keep them low for years. In the long run, inappropriate food and seed aid practices can exacerbate hunger, undermine food security, distort local seed systems and increase costs of donor assistance. Realizing this, a fundamental shift in thinking has occurred in the past decade, based on the seed security framework. The objective is to investigate in detail the functioning of seed systems and to describe the seed situation in terms of availability, access and quality. After disasters, farmers often have difficulty accessing seeds of locally-adapted varieties, even though they may be available, because they have lost financial and other assets. The new thinking engendered by the seed security framework has led to better coordination among agencies and new types of seed interventions, moving beyond direct distribution of seeds and other inputs to farmers. These include market-based approaches such as seed vouchers and input trade fairs and community-based seed multiplication initiatives for both farmers' and improved varieties.

59. **Long-term objectives:** To rehabilitate affected crop systems based on locally adapted PGRFA, including the restoration of germplasm as appropriate, in support of community livelihoods and sustainable agriculture.

60. **Intermediate objectives:** To develop capacity to assess and establish seed security, including helping farmers to access locally adapted PGRFA.
61. To establish institutional responsibilities and mechanisms for the identification, acquisition, multiplication and delivery of appropriate PGRFA.
62. To strengthen the capacity of rural communities and farmers to identify and access relevant PGRFA held *ex situ*.
63. To ensure that crop varieties delivered to stressed communities are adapted to local conditions.
64. **Policy/strategy:** Governments, with the co-operation of relevant farmers' organizations and communities, UN bodies and regional, intergovernmental and NGOs, should establish necessary policies at all levels that allow implementation of appropriate seed security activities in response to disasters, including climate change.
65. Governments should develop policies and strategies for disaster risk planning and response which take fully into consideration seed security issues, and the location-specific conditions and requirements of seed security interventions. This will include promoting seed security assessments, and developing guidelines for best practices for seed interventions.
66. Efforts are needed to conserve farmers' varieties and CWR before they are lost as a result of changing climates, or other threats. Special efforts are needed to identify species and populations most at risk and that carry potentially important traits.
67. There is a need for countries to establish or strengthen genetic erosion monitoring systems, including easy-to-use indicators. Support should then be given to urgent collecting farmers' varieties in especially vulnerable or threatened areas, where these are not already held *ex situ*, so that they can be multiplied for immediate use and also conserved for future use. There should be duplication of national genebank collections outside of the country, such as in genebanks of neighbouring countries, and/or regional or international genebanks. A systematic global assessment is needed of the extent to which existing collections are backed-up, to avoid excessive duplication.
68. Genebanks should make available characterization and evaluation information that will assist in identification of useful accessions to be deployed for restoration of crop systems, respecting access and benefit sharing agreements. The Multilateral System of the International Treaty should facilitate this process.
69. **Capacity:** National and international agricultural research institutions should collaborate with FAO and other appropriate agencies to establish mechanisms for rapid acquisition and multiplication, restoration and provision of PGRFA to countries in need. Such agencies should ensure that capacity is sufficient for the task. Cooperation with NGOs and private organizations is an important component of efforts to distribute locally adapted germplasm in regions that are recovering from disasters.

70. Information systems must be established to identify and obtain appropriate germplasm for reintroduction.

71. Governments and international emergency agencies should consider making available adequate funds for multiplication of seed of locally adapted PGRFA in response to emergency demand after disasters.

72. Response interventions can be complemented by preventive national and community-based seed multiplication initiatives, and governments should strengthen capacities to cope with disasters and support the re-emergence of local seed supply networks and crop systems.

73. **Research/technology:** Studies are needed on the extent and nature of possible threats to existing diversity on-farm and *in situ*. Previous experience should be reviewed and options developed to enhance preparedness for rescue of *ex situ* collections and seed collecting in the context of emergencies, including civil strife, industrial accidents and natural disasters. These efforts will benefit from close collaboration among governments of countries affected, donors, NGOs and private organizations, national, regional and international agricultural research institutes, regional plant genetic resource networks as well as relevant inter-governmental agencies. Research on how rural communities can identify, obtain and use PGRFA held *ex situ* is also needed.

74. Studies are also needed on pre-disaster seed production and delivery systems, including crop agro-ecologies, crop calendars, local seed flows, seed markets and stocks. Information that would assist planners in disaster risk reduction and response is lacking, especially regarding the anticipated effects of climate change.

75. **Coordination/administration:** At the national level, coordination will be needed among ministries of agriculture, the environment and agencies involved in disaster preparedness and response. NGOs will have a particularly important role to play. Public awareness efforts are needed to sensitize the donor community and NGOs to the importance of adapted PGRFA in relief and rehabilitation efforts. Such efforts should also increase awareness of the need for safety duplication of *ex situ* collections in other countries.

#### 4. Promoting *in situ* management of crop wild relatives and wild food plants

76. **Background:** Natural ecosystems contain important PGRFA, including rare, endemic and threatened CWR and wild food plants. These species are becoming increasingly important as providers of new traits for plant breeding. CWR and wild species are ideally conserved *in situ*, where they can evolve under natural conditions. Unique and particularly diverse populations of these species must be protected *in situ* when under threat. Most of the world's 8,500 national parks and other protected areas, however, were established with little specific concern for the conservation of genetic diversity of any plants, let alone specifically CWR and wild food plants. Management plans for protected areas are not usually specific enough to conserve genetic diversity of these species, but could be modified to complement other conservation approaches. It can be argued that actively conserving CWR genetic diversity in protected area networks significantly raises the understanding of their value in ecosystem services, which in turn underpins the long-term security of the protected area itself.

77. Many protected areas are also under threat of degradation and destruction. Climate change represents an additional serious threat. It is therefore necessary to complement conservation in protected areas with measures aimed at conserving genetic diversity that lies outside such areas, and also with *ex situ* conservation as appropriate. *In situ* conservation implies comprehensive planning, which should consider and accommodate the often conflicting demands of environmental protection, food production and genetic conservation.

78. **Long-term objectives:** To use genetic resources of CWR and wild food plants sustainably and conserve them in protected areas and on other lands not explicitly listed as protected areas.

79. **Intermediate objectives:** To promote planning and management practices in important *in situ* conservation areas for CWR and wild food plants. To assess the threats to, and conservation status of, priority CWR and wild food plants and develop management plans for their protection *in situ*. To improve knowledge of the uses of wild plants as sources of income and food, in particular by women.

80. To create a better understanding of the contributions of CWR and wild plants to local economies, food security, and environmental health. To improve management and planning, and promote complementarity between conservation and sustainable use in parks and protected areas by, among other things, increasing the participation of local communities and ensuring the active conservation of CWR and wild food plant genetic diversity.

81. To establish better communication and coordination among various bodies engaged in *in situ* conservation and land use management, nationally and regionally, especially between the agriculture and environment sectors.

82. **Policy/strategy:** Governments, subject to national legislation, with the NGOs, and taking into account the views of farmers and local communities, should:

- (a) include as appropriate, among the purposes and priorities of national parks and protected areas, the conservation of PGRFA, including appropriate forage species, CWR and species gathered in the wild for food;
- (b) consider integrating conservation and management of PGRFA, particularly CWR and wild food plants in their centres of origin, major centres of diversity and biodiversity hotspots, in national land use plans. Recognizing that the centres of diversity are primarily located in developing countries where resources may be limited and capacity building and resource transfer required. *In situ* conservation strategies need to be linked better with *ex situ* strategies;
- (c) support the establishment of national and local objectives for protected area management through broad based participation, involving in particular groups most dependent on wild food plants;
- (d) support the creation of advisory panels to guide management of protected areas. Where appropriate, involve farmers, indigenous communities, PGRFA scientists, local government officials (from various ministries), and community leaders, according to national legislation;
- (e) recognize the rights of indigenous communities to PGRFA in protected areas according to national legislation;
- (f) recognize that women are a valuable source of information on the feasibility of *in situ* conservation and management practices;
- (g) adopt improved measures to counter the threat of invasive alien species that could impact negatively on *in situ* conservation of CWR and wild food plants;
- (h) support indigenous and local community efforts to manage CWR and wild food plants in protected areas, or where existing aboriginal or treaty rights are recognized;
- (i) review existing environmental impact statement requirements to incorporate an assessment of the likely effect of the proposed activity on local biodiversity for food and agriculture, particularly on CWR;
- (j) integrate genetic conservation objectives into the sustainable management of CWR and wild food plants in protected areas and other managed resource areas;
- (k) collate information on CWR and wild food plants and make the information available through national information sharing mechanisms and specialized global information systems.<sup>5</sup>

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<sup>5</sup> Crop Wild Relatives Portal and Genesys.

83. Governments, in cooperation with the relevant UN bodies and regional, intergovernmental and NGOs and the farming, indigenous and local communities living in non-protected areas, should seek, where possible and appropriate, to:

(a) develop national strategies for CWR conservation and use as a basis for *in situ* and *ex situ* conservation action and sustainable use;

(b) take conservation action to maintain the diversity of CWR and wild food plants as an integral component of land-use planning;

(c) encourage local communities to conserve and manage CWR and wild food plants, and provide for participation in decisions relating to local conservation and management.

84. As appropriate and feasible, protected area policies should promote and sustain, rather than restrict, those human activities that maintain and enhance genetic diversity within and among plant species. Participatory approaches to protected and related area management should also be encouraged to reconcile the sometimes conflicting goals of conservation and local livelihood security.

85. In parallel with the national approach there is also a need for a complementary global perspective that focuses on securing the *in situ* conservation of the world's most important CWR species, including the establishment of a global network of genetic reserves. While it is recognized that the prime location for *in situ* conservation of CWR diversity will be existing protected areas, because these are already established for ecosystem conservation, the possibility of *in situ* conservation of CWR outside of protected area should also be evaluated.

86. FAO should promote the adoption and implementation of a global strategy for CWR management that can serve as a guide for government action, recognizing there is a requirement for action at both the national and global levels.

87. **Capacity:** Governments should, whenever possible, and as appropriate:

(a) develop a prioritized plan, particularly for those ecosystems in which high levels of diversity of CWR and wild food plants are found, and conduct national reviews to identify management practices needed to safeguard the desired level of genetic diversity for CWR and wild food plants;

(b) assist local communities in their efforts to identify, catalogue and manage CWR and wild food species;

(c) monitor the holdings, the distribution and diversity of CWR and wild food plants, integrate and link data and information from *in situ* conservation programmes with that from *ex situ* programmes and encourage private and nongovernmental organizations to do likewise.

88. **Research/technology:** Research needs relating to *in situ* management of CWR and wild food plants includes studies on their reproductive biology and ecological requirements. Strengthened research capacity is also required in areas such as species identification, ethnobotany, gene pool description and population surveying using new molecular tools. Research should also target understanding the value of CWR *in situ* and the role they play in ecosystem services.

89. **Coordination/administration:** Governments should, as appropriate:

(a) link protected area planning and management with organizations responsible for the conservation and sustainable use of CWR and wild food plants, such as centres for crop genetic resources, national crop genetic resources coordinators, national protected area network managers and botanical gardens, and including organizations involved in the environment sector;

(b) designate focal points, as appropriate, to catalyze coordination of *in situ* protection programmes and liaise with other countries in the region;

(c) establish mechanisms for periodic review and modification of conservation plans;

(d) link information on CWR to specialized global information systems to aid information exchange and dissemination.

## ***Ex Situ* Conservation**

**5. Supporting targeted collecting of plant genetic resources for food and agriculture**

**6. Sustaining and expanding *ex situ* conservation of germplasm**

**7. Regenerating and multiplying *ex situ* accessions**

**5. Supporting targeted collecting of plant genetic resources for food and agriculture**

90. **Background:** The prime motivating forces behind most collecting are gap-filling, imminent risk of loss and opportunities for use. The germplasm currently conserved in genebanks does not represent the total variation in PGRFA. Many major crops have generally been well collected, but some gaps still exist. Collections of most regional, minor, and underutilized crops are much less complete. CWR, even of major crops, have received little attention relative to their potential importance in breeding. The global crop strategies supported by the Trust make an attempt to identify gaps in global holdings of some major food crops. However, in the absence of comprehensive analysis of all the genetic diversity represented in the world's genebanks, these conclusions remain tentative. In addition, collecting missions conducted with inadequate methodologies may not have successfully sampled diversity. Also, the extent and distribution of diversity in wild populations and

farmers' varieties (particularly for annual crops) changes over time. Sub-optimal conditions in genebanks may also have led to the loss of collected materials, requiring re-collection.

91. Global threats to PGRFA *in situ* and on-farm have increased during the past 20 years. Major threats to landraces and CWR are the introduction of modern varieties, climate change, alien invasive species, and land use change, including urbanization. A recent assessment indicates that up to 20% of plant species may be threatened with extinction globally. It is unlikely that the figure is lower for CWR. An urgent need for resistances to biotic and abiotic stresses and nutritional and other traits often warrant further collecting.

92. **Long-term objectives:** To collect and conserve diversity of PGRFA together with its associated information, in particular diversity that is missing from *ex situ* collections, under threat or of anticipated usefulness.

93. **Intermediate objectives:** To identify priorities for targeted collecting in terms of missing diversity, potential usefulness and threatened environments.

94. **Policy/strategy:** Policy makers need to be made aware of the continuing need to improve the coverage of diversity in *ex situ* collections, including CWR, farmers' varieties and wild food plants. Collecting best practices should be developed and documented with regard to the objectives and obligations set forth in the CBD and Article 5 of the International Treaty, for example the right of Contracting Parties to require prior informed consent before providing access to genetic resources and the obligations of Contracting Parties, subject to their national legislation, to respect the knowledge of indigenous communities regarding the conservation and sustainable use of biological diversity.

95. **Capacity:** Collected material should be deposited in facilities with the capacity to manage them in the country of origin, and elsewhere for safety duplication, as agreed by the country of origin prior to collection. Where such facilities do not exist in the country of origin, they should be developed, as appropriate, and in the meantime, the materials could be managed in other countries as agreed in the country of origin prior to collection.

96. Full consideration should be given to the capacity to conserve the material collected effectively and sustainably before collecting is initiated.

97. Training should be undertaken in scientific collecting methods for PGRFA, especially in connection with the use of tools and methods that enhance collecting efficiency and effectiveness, such as GPS, spatial modeling programs and ecogeographic surveying.

98. **Coordination/administration:** Coordination, as appropriate, should take place within a country, in particular between genebanks and herbaria and other institutes with taxonomic expertise. Regional and international level coordination is needed to provide linkages with *ex situ* collections and gap-filling and regeneration efforts. Such coordination might concern the identification of global needs or specific national needs that could be met by PGRFA in another country.

99. Strong linkages need to be established with regional and crop networks and with the users of PGRFA (breeders, researchers and farmers) in order to inform, direct and prioritize the entire conservation process, including surveying, inventorying and collecting.

100. Mechanisms need to be developed at all levels for emergency collection of PGRFA. These mechanisms should make full use of, and therefore should be closely linked with, information and early warning systems at all levels.

101. As part of national PGRFA programmes, governments should designate a focal point for administering requests for collecting.

## 6. Sustaining and expanding *ex situ* conservation of germplasm

102. **Background:** Currently seed, field and *in vitro* genebanks conserve approximately 7.4 million germplasm accessions, about a quarter of which are estimated to be distinct samples duplicated in several collections. These are complemented by over 2,500 botanical gardens worldwide that grow over one third of all known plant species and maintain important herbaria and carpological collections. Driven by an increasing need for diversification, interest in collecting and maintaining collections of underutilized crops, wild food species and CWR is growing, but such species tend to be more difficult to conserve *ex situ* than major food crops. Even many important crop species do not produce seed that can be stored under conditions of low temperature and humidity and the conservation of genetic resources of such plants, with recalcitrant seeds or vegetatively propagated, is still not being given appropriate attention.

103. Globally, governments and donor agencies need to invest more in conservation infrastructure, in particular for species that cannot be conserved in seed banks, taking particular account of maintenance costs. This will stem the steady deterioration of many facilities and enhance their ability to perform basic conservation functions. The severity of the threat to *ex situ* collections is reflected in the high percentage of accessions reported as being in need of regeneration in many national reports, as well as the lists of technical and administrative problems associated with maintaining genebank activities. The Trust aims to support better planning and more coordination and cooperation at the global level, to reduce the overall cost of conservation work and place genebank operations on a scientifically sound and financially sustainable basis. Options need to continue to be explored for more cost-effective and rational conservation.

104. The Svalbard Global Seed Vault opened in 2008, and represents a major new international collaborative initiative to improve the safety of existing collections of orthodox seeds. Similar efforts are not yet planned for recalcitrant species and vegetatively propagated crops.

105. **Long-term objectives:** To develop a rational, efficient, goal-oriented, economically efficient and sustainable system of *ex situ* conservation and use, covering both seed- and vegetatively-propagated species.

106. **Intermediate objectives:** To develop and strengthen national, regional and international networks, including the existing Multilateral System of the International Treaty. To develop sufficient capacity to provide options to countries for the voluntary storage of appropriate genetic materials and their duplicates. To develop management strategies for *ex situ* conservation of vegetatively propagated and non-orthodox seeded plants, as well as for species neglected in current conservation activities. To promote the development and transfer of appropriate technologies for the conservation of such plants and to encourage and strengthen the involvement of botanic gardens in the conservation of PGRFA. To promote access to and exchange of information about PGRFA.

107. To reduce unnecessary redundancy of germplasm accessions in current conservation programmes, make use of available storage space and promote access to and exchange of information about PGRFA in line with applicable international agreements, including the International Treaty. To provide for the planned replication and safe storage of materials not currently duplicated.

108. **Policy/strategy:** The international community has interests in and responsibilities for the *ex situ* conservation of PGRFA. It is this understanding which provides the basis for an effective, integrated and rational global plan to secure existing collections. Countries have national sovereignty over, and responsibility for, the PGRFA they conserve, but there is a need for greater rationalization of the global system of *ex situ* collections. This is the objective of the work of the Trust.

109. Governments, international agricultural research centres, NGOs and funding agencies, should provide adequate, appropriate and balanced support for the conservation of vegetatively propagated and recalcitrant seeded plants in addition to the support provided for conservation of seeds of orthodox species. In this regard, botanic gardens and field genebanks should be strengthened in their capacity to conserve important neglected and underutilized species.

110. Full use should be made of existing facilities, including national, regional and international centres. Conserved materials should be replicated and stored in long-term facilities meeting international standards, in accordance with applicable international agreements. Unintended and unnecessary duplications between collections should be reduced to promote cost efficiency and effectiveness in global conservation efforts. Countries could be assisted in identifying which genetic resources are already stored and duplicated in long-term facilities.

111. FAO, in co-operation with countries and with relevant institutions, should facilitate the formalizing of agreements to safeguard diversity in *ex situ* collections in conformity with applicable international agreements, including the International Treaty. This would allow those countries so desiring to place collections voluntarily in secure facilities outside their boundaries.

112. **Capacity:** Personnel should be recruited and trained at all levels to implement and monitor the above policies and agreements. National institutions should evaluate current genebank management practices to create more rational, efficient, and user-oriented *ex situ* conservation systems. Appropriate facilities, human resources and equipment should be made available to national programmes.

113. Ongoing conservation of collections of PGRFA should be secured, and particular care must be taken to safeguard the original accessions of threatened collections.

114. Simple, low-cost botanic gardens, arboreta and field genebanks associated with universities, schools and other institutions should be strengthened and encouraged to promote education and public awareness.

115. Support should be given to training in *in vitro* techniques and other new and appropriate technologies. In accordance with national, sub-regional and regional needs and priorities, support should be given to establishing the capacity to use such technologies.

116. Support should be given to defray expenses incurred by institutions providing designated storage and related conservation and research/documentation services for other countries. This support could help all unique material to be identified, suitably duplicated, stored safely, and characterized, regenerated, evaluated, and documented. This would include the identification of materials both inadequately and excessively duplicated. Materials not yet duplicated should be suitably multiplied and placed in secure storage, with the full observance of applicable international agreements and national legislation. Additional *ex situ* duplications of accessions would be maintained at the discretion of countries. Expansion of some existing storage facilities and the creation of new facilities may be desirable.

117. **Research/technology:** Research should be aimed at the development of improved conservation methods, including *in vitro* and cryopreservation, and in particular, reliable low-cost techniques appropriate to local operating conditions. Technologies and procedures directly transferred from temperate climates may not be appropriate for conditions in tropical countries and vice versa.

118. Research based on the improved documentation foreseen under the GPA should be undertaken to assist decision-making on developing a rational, effective system. This might include, among other things, research on identifying priority germplasm and duplications, on methods of identifying duplicates as well as of testing viability of accessions, procedures for the rational conservation and duplication of vegetatively-propagated species, and on the modalities and technologies of conserving genes, genotypes and gene complexes.

119. Research needs to be done on the best storage conditions for orthodox seeds, non-orthodox seeds and vegetative material. Genomic and phenotypic studies need to be undertaken that better link molecular data with phenotypic descriptor data. Protocols should be developed for *in vitro* conservation and other conservation technologies for important vegetatively propagated and non-orthodox seed plants, and an assessment should be made of the conservation needs of other species for food and agriculture that are not adequately conserved.

120. **Coordination/administration:** Coordination should take place within the country, between the national genebank, national crop working groups, and all users of PGRFA (breeders, researchers, farmers and NGOs). Strong links need to be established with regional networks and international centres.

121. Periodic administrative and technical reviews should be encouraged to assess the effectiveness of the actions taken. Subject to these reviews, as well as the specific provisions of relevant agreements, financial support should foster long-term security and allow efficient planning.

122. NARS, crop and regional networks, as well as relevant international botanic garden organizations, with the support of international agricultural research centres and regional organizations, should regularly assess the state of conservation of vegetatively propagated and non-orthodox seeded plants, and make recommendations and take action when necessary.

123. Botanic gardens should be encouraged to participate actively in the activities of international associations. Linkages between organizations such as the International Association of Botanic Gardens and Botanic Gardens Conservation International and those responsible for and engaged in conservation of PGRFA (*e.g.* FAO, Bioversity International and other international agriculture research centres) should be strengthened. Similar linkages should be made between organizations, including those in the private sector (such as the nursery trade), at the national level. Practical cooperation should be encouraged as a matter of priority.

## 7. Regenerating and multiplying *ex situ* accessions

122. **Background:** As accessions stored *ex situ* decline in viability, both genes and genotypes are lost. Even under optimal *ex situ* storage conditions, all accessions eventually require regeneration. Capacity for regenerating was often not considered when assembling collections and disseminating accessions, with the unintended consequence that much material collected in the past cannot now be properly maintained. Consequently, a large backlog of materials developed. Low initial sample size, low viability and frequent demand for samples from long-term storage facilities can shorten the regeneration/multiplication cycle. But, because proper long-term storage conditions should obviate the need for regeneration for decades, average, routine, on-going annual regeneration requirements (as opposed to multiplication needs) amount to fewer than 10% of conserved accessions. However, some 55% of countries contributing information on regeneration to WISM report continuing significant backlogs, and that regeneration capacity has declined in 20% of genebanks. Global crop strategies supported by the Trust indicate that regeneration backlogs occur in all crops and regions. However, significant advances have been made, including at the global level as a consequence of the funding provided to the CGIAR centres for the 'Global Public Goods' projects, and at the national level through funding by the Trust. The Trust has also supported the development of regeneration guidelines for a number of Annex I crops. Inadequate documentation of accessions continues to represent a constraint to a rational global approach to regeneration, although the necessary information is now increasingly available electronically. Many countries cite lack of facilities for handling cross-pollinated species and inadequate funds and human resources as major problems. Good planning and coordination will minimize the amount of material to be regenerated, but continued intervention is necessary to maintain viability of much of the stored genetic diversity of PGRFA.

123. **Long-term objectives:** To regenerate and multiply *ex situ* accessions to satisfy needs for conservation, distribution and safety duplication.

124. **Intermediate objectives:** To establish the processes, partnerships and capacity needed for regeneration and multiplication of *ex situ* collections to satisfy needs for conservation, distribution and safety duplication.

125. **Policy/strategy:** Priority should be given to:

(a) regenerating samples currently in long-term storage or intended for placement in long-term conditions and experiencing a loss of viability;

(b) regenerating samples which meet the criteria of being globally unique, threatened, and having the potential of maintaining the diversity of the original sample.

126. Input from crop and regional networks should be sought in refining priorities and identifying priority germplasm for regeneration and multiplication.

127. Identification of specific samples for regeneration and multiplication should be made in cooperation with national programme breeders and curators, who often have intimate and detailed knowledge of collections and of the availability of similar materials from *in situ* locations.

128. Regeneration and multiplication efforts should strive to maintain the allelic and genotypic diversity and adapted complexes of the original sample. Minimizing the frequency of regeneration is an important goal and consequence of other activities under the GPA.

129. Efforts should be encouraged to reduce unneeded redundancies within and among collections as a means of improving efficiency and minimizing on-going conservation costs.

130. Governments, the private sector, organizations, including in particular the CGIAR, and NGOs should:

(a) cooperate to make efficient use of existing capacity and to ensure that regeneration and multiplication can take place, if scientifically, technically and administratively feasible, at sites where conditions approximate to those from where the sample was collected;

(b) promote and facilitate access to PGRFA stored *ex situ* to minimize the need for storing identical samples in several locations, and the consequent need to regenerate each of them.

131. Characterization activities should be undertaken in conjunction with regeneration without compromising the effectiveness or scientific goals of the regeneration exercise. Characterization should be developed in line with globally accepted standards.

132. **Capacity:** Proper facilities, adequate human resources, appropriate technology, and necessary equipment should be available to national programmes and international organizations involved in regeneration and multiplication activities undertaken as part of the GPA. Particular attention should be given to establishing or strengthening capacity for the regeneration and multiplication of cross-pollinated, vegetatively propagated and recalcitrant species. Consideration should also be given to involving the private sector, farmers, and NGOs.

133. Genebanks should ensure monitoring and have the capacity to determine the status of their accessions and prioritize those in need of regeneration and multiplication.

134. Training programmes should take into consideration the differences in regeneration and multiplication requirements among species.

135. **Research/technology:** Guidelines for regeneration, including standards and specific technologies, should continue to be developed, especially for cross-pollinated, vegetatively propagated and recalcitrant species.

136. There is a need to reinforce research to improve conservation technologies in various key areas: lengthening of the interval between regeneration cycles (orthodox seeds), physiological mechanisms linked to low temperature tolerance and dehydration (recalcitrant seeds), and *in vitro* conservation technologies.

137. Research should be undertaken to increase the effectiveness and efficiency of regeneration efforts, including methodologies for minimizing genetic drift, to identify markers associated with seed longevity to assist in devising regeneration strategies, to develop an understanding of the causes of mutations in conserved germplasm, to eliminate seed-borne pests. Important questions remain regarding breeding systems, reproductive biology, dormancy mechanisms and technical problems associated with regeneration practices.

138. Data on existing accessions in *ex situ* collections should be assembled and analyzed in order to assist in planning and implementation.

139. **Coordination/administration:** The active involvement of crop and regional networks is important to the success of regeneration and multiplication efforts, particularly in the identification and prioritization of germplasm to be regenerated and multiplied. Similarly, national plans for regeneration should be formulated, particularly with regard to PGRFA of national priority.

140. There should be on-going monitoring of the need for regeneration and multiplication, including consideration of the necessity for adequate duplication, storage behaviour of the species, storage conditions, and individual accession viability.

## Sustainable Use

**8. Expanding the characterization, evaluation and further development of specific collection sub-sets to facilitate use**

**9. Supporting plant breeding, genetic enhancement and base-broadening efforts**

**10. Promoting diversification of crop production and broadening crop diversity for sustainable agriculture**

**11. Promoting development and commercialization of farmers' varieties and underutilized species**

**12. Supporting seed production and distribution**

**8. Expanding characterization, evaluation and further development of specific collection sub-sets to facilitate use**

141. **Background:** Genebank collections should help users respond to new challenges and opportunities, to improve productivity, enhance sustainability and respond to change, particularly climate change. It is widely recognized that crop germplasm collections house much of the diversity that will be needed to meet these challenges. In order for plant breeders, researchers and other users of PGRFA to make the most effective use of collections they need to quickly identify a manageable number of genotypes that possess or are likely to possess the many different traits needed in their programmes. Improved characterization and evaluation can encourage greater and more efficient use of collections. Understanding genetic variability and expression are also important for improving use of plant genetic resources. The development of limited sets of material based on either capturing total diversity in a small number of accessions or the variation in particular traits has been found to improve use of collections. These efforts require close collaboration between germplasm curators and plant breeders in the delineation of manageable collection sub-sets. Evaluation can also aid the identification of germplasm of potential for more direct use by farmers.

142. In the past decade, significant progress has been made in the characterization and evaluation of crop germplasm collections. Many countries have acquired the capacity for using molecular techniques in germplasm characterization, a development that is leading to the generation of more comprehensive and reliable data. Efforts will have to continue in developing such capacity where it is still needed. Significant advancements have also been made in the development of high throughput phenotyping techniques and related infrastructure. In order to characterize efficiently germplasm accessions and breeding materials for traits associated with adaptation to, and mitigation of, the effects of climate change, it is equally important to continue developing phenotyping capacity.

143. Despite such overall progress, there are still large data gaps and much of the existing data are not easily accessible. The lack of adequate characterization and evaluation data, and of the capacity to generate and manage it, remain serious constraints to the use of many germplasm collections, especially of underutilized species and CWR. With improved access to molecular and computational biology techniques, information technology and geographic information system (GIS), the utility of PGRFA collections could be greatly enhanced by increasing the types and volume of data on germplasm. Efforts should equally be invested in developing standard descriptors and uniform characterization

methodologies for more crops and species. Increased funding and capacity building will contribute to increasing the breadth and depth of germplasm characterization efforts and consequently lead to greater ease for mining genebanks for traits of interest.

**144. Long-term objectives:** To enhance the use and management of conserved plant genetic resources. To identify germplasm of potential value for research and crop improvement and for direct use by farmers in the rehabilitation of degraded ecosystems, and other forms of direct use in agro-ecosystems.

**145. Intermediate objectives:** To develop innovative, crop specific characterization and evaluation programmes, including for underutilized species, to identify potentially useful accessions and genes for improved productivity and sustainability, especially in the context of climate change.

146. To improve the efficacy of the evaluation process by developing and adapting high throughput evaluation methods such as rapid, computerized assays of genetic diversity and metabolic content; new biochemical analyses; and novel methods for rapidly-capturing morphological and structural variation in the field via hand-held devices, for identifying accessions with valuable traits.

147. To establish sub-sets of material including trait specific collections for crops of global importance.

148. To improve and facilitate exchange and access to quality characterization and evaluation data across genebank collections, including through national, regional and global information systems.

**149. Policy/strategy:** Governments with the co-operation of the relevant UN bodies and regional, intergovernmental and NGOs, international agricultural research centres, and including the private sector, and taking into consideration views of the scientific community and farmers' organizations and their communities should:

(a) establish baseline characterization and evaluation data, define priorities and periodically assess progress in evaluation in relation to the different needs of the various users of PGRFA, with emphasis on identifying traits that counter limits to production in staple crops and of crops of national economic importance;

(b) support collaboration and complementarities between breeders, researchers, extension services, farmers and genebanks;

(c) encourage access to, and exchange of, characterization and evaluation information, including through networking of genebank databases within and among countries;

(d) note that access to PGRFA is subject to applicable international agreements such as the International Treaty. In compliance with such agreements, users of PGRFA should be

encouraged to agree to provisions for sharing relevant evaluation data with source institutes, giving also due regard to the special needs of commercial users for appropriate confidentiality;

(e) use characterization and evaluation data to help improve in situ management of landraces, crop wild relatives, other wild food plants, and forages;

(f) give appropriate financial support for characterization and evaluation programmes for crop species of primary or exclusive importance to food security in their countries, given the importance of medium and long-term financing, and promote synergies with existing funding mechanisms (e.g. BSF of the International Treaty).

150. Crop networks and genebanks should be encouraged to identify useful traits and establish trait specific and other collections of limited size of interest to users with special focus on adaptation to climate change, sustainability and food security. Characterization and evaluation should be strengthened and standardized and the data made more accessible through improved information system.

151. **Capacity:** Support should be given to continue targeted characterization and evaluation programmes for selected priority germplasm. The characterization and evaluation process would begin with an assessment of current information and an effort to assemble, collate, computerize and make available existing information contained in notes, reports, punched cards, etc. Much evaluation work needs to be done in a use-oriented, site-specific manner.

152. Governments and appropriate organizations should identify institutions and individuals who may have the capacity and expertise to carry out germplasm characterization and evaluation for specific stresses and should develop a national portfolio of such expertise, including farmers in high stress areas who may perform preliminary evaluation to identify subsets of accessions that hold promise for further evaluation under more stringent scientific conditions. The cost efficiency of sub-contracting evaluation work should also be investigated as well as cooperative programmes between national programmes and the private sector.

153. National programme staff should receive training in germplasm characterization and evaluation techniques on a crop-specific basis. Such training should begin with crops deemed important nationally, and for which there are current or planned breeding programmes. Capacity building should target the development of a critical mass of personnel that are skilled in the use of standardized characterization methodologies, including molecular biology techniques and data management using modern information technology platforms.

154. Training of farmers, including women farmers, participating in on-farm PGRFA evaluation programmes, in the necessary relevant skills should be supported. As their responsibilities often extend from the propagation, production and harvesting of crops to the processing, storage and preparation of foods, women's knowledge of the uses and usefulness of plants is often extensive.

155. Young students should be educated and trained in basic topics related to characterization, evaluation and use of plant genetic resources.

156. **Research/technology:** Various kinds of research must be undertaken if the cost effective use of current collections is to be encouraged. This should include:

- (a) access to the latest technology and support from plant breeding research to improve the use of molecular methods in characterization and evaluation to identify useful genes and understanding their expression and variation;
- (b) improved methods of germplasm characterization and evaluation using biochemical assays and rapid high throughput phenotyping, in particular for adaptation and mitigation of climate change and nutritional features;
- (c) improved data exchange through further development and harmonization of standards for characterization and evaluation data.

157. Research is also needed to develop more useful sub-sets of material, including core collections, mini and micro-cores and specific trait collections. This will require systematic development and testing of different sampling procedures. Further work is also needed on optimizing the ways in which such sub-sets are used by breeders to access best-bet materials from the full collection.

158. **Coordination/administration:** Characterization and evaluation efforts should be planned and implemented with the active participation of national programmes, and crop and regional networks. As appropriate, farmers' organizations, private companies and their associations, and others should also be involved.

159. Limited user-friendly collections such as trait specific collections, core or micro-core collections should be developed with the active participation of breeders and other users as well as relevant crop networks. Work on such collections must be considered within and integrated firmly in the context of the entire effort to improve utilization.

160. Cooperation and exchange of information are needed, especially by developing country genebanks that manage very diverse collections but do not have staff with expertise in all of the species conserved.

## **9. Supporting plant breeding, genetic enhancement and base-broadening efforts**

161. **Background:** The germplasm collections maintained in genebanks can be used both to identify specific alleles useful for developing new varieties adapted to new conditions, and to broaden the overall genetic base of breeding programmes. While some materials can be used directly by breeders for either of these purposes, pre-breeding or genetic enhancement is often necessary to produce material that can be easily used by breeding programmes.

162. The challenge of using PGRFA is hampered by the stagnant or dwindling capacity at all stages of the plant breeding process in many countries. There is now a shortage of plant breeders in the public sector and a declining enrolment in conventional plant breeding courses in universities, with students opting rather for disciplines offering careers paths in what are seen as more modern sciences such as molecular biology. There is a compelling need to redress this situation. The role of conventional plant breeding in crop varietal development is irreplaceable. Modern biotechnologies can only offer increased efficiencies, and cannot take the place of traditional crossing selection and field evaluation.

163. Currently, the challenges of climate change is placing increasing demands on breeding programmes, and this is likely to intensify. Significantly strengthened human capacity and infrastructure are necessary for such programmes to deliver varieties with enhanced tolerance to biotic and abiotic stresses needed for adaptation to climate change. Such capacity enhancements must go together with a re-thinking of strategies. Breeding must be needs-based, with greater integration of farmers' perspectives in setting priorities and defining goals. The efficiency of traditional plant breeding activities must be enhanced by the judicious integration of cost-efficient novel biotechnology and phenotyping strategies. Pre-breeding and genetic enhancement activities must be encouraged, including by pooling the resources of both germplasm curators and plant breeders, so that the most appropriate germplasm can be identified and used in addressing clearly defined objectives. Greater emphasis must be paid to improving the less studied crops that constitute important staples in many parts of the world. Crop wild relatives must be used more systematically to identify the genes needed for generating the resilient crop varieties needed to safeguard food security in the face of changing climatic conditions.

164. Improving the sustainability, resilience and adaptability of crop production will require the use and deployment of increased amounts of diversity in terms of both the crops and varieties available to farmers. An important contribution can be made through base broadening strategies which seek to widen the genetic diversity in plant breeding programmes and in the products of such programmes.

165. An example of a multilateral effort in capacity enhancement is the FAO-convened Global Partnership Initiative for Plant Breeding Capacity Building (GIPB). This multi-stakeholder partnership of public and private sector parties from developing and developed countries was created in direct response to the need for capacity for implementing Article 6 of the International Treaty. It aims to enhance the plant breeding capacity and seed delivery systems of developing countries and improve agricultural production through the sustainable use of PGRFA. The Generation Challenge Programme (GCP), an initiative of the CGIAR that aims to create improved crops for small farmers through partnerships among research organizations, is another example of public multi-stakeholder initiatives that promote the use of PGRFA in crop improvement. GCP focuses on using novel biotechnology tools, including genomics, molecular breeding and bioinformatics, to enhance efficiencies in crop varietal development.

166. **Long-term objectives:** To contribute to food security and improved farmers' livelihoods through the deployment of adapted crops and the development of resilient crop varieties that guarantee high yields under adverse environmental conditions and minimal input agricultural systems. To increase the use of genetic resources and thus provide further tangible incentives for their conservation.

167. **Intermediate objectives:** To reduce vulnerabilities in cropping systems by increasing genetic diversity in the production systems themselves, as well as in crop breeding programmes through the utilization of CWR, farmers' varieties, and introductions as appropriate. To increase sustainability of agricultural systems and the capacity for adaptation to environmental changes. To strengthen the capacity of public sector plant breeding programmes and encourage participatory breeding. To provide tools and resources necessary for sustained increases in the genetic diversity used by breeding programmes for both major and minor crops through appropriate base-broadening and genetic enhancement approaches.

168. **Policy/strategy:** Governments, international organizations, NGOs and funding sources should:

(a) recognize the importance of providing long-term funding and logistical support to plant breeding and research, pre-breeding, genetic enhancement and base-broadening activities;

(b) recognize the importance of providing adequate support for the routine integration of novel biotechnology tools, computational biology and information technology platforms in PRGFA management, especially in germplasm characterization and in facilitating the introgression of desired traits into breeding materials;

(c) encourage the development of public-private and other partnerships that foster participatory approaches to the setting of crop improvement priorities and goals and their implementation;

(d) develop policies and legislation that support participatory breeding, including appropriate regulatory frameworks for varieties developed through participatory plant breeding;

(e) encourage the institutionalization of participatory, gender and youth-sensitive approaches to plant breeding as part of national PGRFA strategies in order to facilitate the adoption of new crop varieties;

(f) help to improve access by plant breeders to the widest possible genetic diversity in order to identify the traits needed for developing crop varieties adapted to novel climatic conditions; and

(g) in devising national strategies and fostering collaborations, be fully cognizant of the provisions of the Multilateral System of Access and Benefit Sharing of the International Treaty, through which material can be accessed "for the purposes of utilization and conservation for research, training and breeding for food and agriculture."

169. **Capacity:** Support should be given to national systems, regional networks, international agricultural research centres, NGOs, universities and other relevant organizations to carry out plant breeding, including genetic enhancement and base-broadening activities. Priority should be given to addressing problems identified by crop and regional networks, regional research and development forums, other competent scientific bodies and institutions, and farmers' organizations. Efforts should extend beyond addressing the most pressing problems

identified in the crops of Annex I of the International Treaty, to include crops that support local food security around the world.

170. Capacity building will require greater attention being paid to producing skilled personnel in traditional as well as modern plant genetic improvement techniques. In addition, capacity for both field and laboratory evaluation must be strengthened. Capacity building must be accompanied with the provision of adequate incentives, such as structured career opportunities, to facilitate the attraction and retention of experienced staff. Improved international collaboration could help cut training costs and reduce unnecessary duplication of investments. In this regard, regional centres of excellence may be a means of reducing costs and duplication.

171. **Research/technology:** Institutions, should further develop, adapt and use validated efficiency-enhancing biotechnologies and ancillary tools for genetic enhancement, and extend research and development activities to include increased domestication efforts and to optimize the use of CWR in breeding programmes. These contain important genes for biotic and abiotic stress resistance and improved productivity and can be important sources for base broadening. Procedures are needed to improve useful gene identification and transfer.

172. Research is needed to develop selection procedures and breeding methods that support base broadening and improve sustainability at the same time as enhancing productivity. This is likely to include research on the selection of appropriate base materials for breeding programmes and population breeding procedures.

173. **Coordination/administration:** Activities should be planned and undertaken in close collaboration with national programmes with the collaboration of crop and regional networks, other scientific bodies and institutions, and farmers' organizations taking cognizance of prevailing relevant international initiatives. Close communication among genebank curators, plant breeders and other scientists in both the public and private sector should be encouraged. Networking among breeders communities of practice should be encouraged as vehicle for mentoring and exchange of ideas. The cooperation of key stakeholders in the development of crop value chains at the national level is another effective way of coordinating the necessary activities and efforts to ensure sustainable progress.

## **10. Promoting diversification of crop production and broadening crop diversity for sustainable agriculture**

174. **Background:** Despite progress in the diversification of crop production, monoculture and genetically uniform crops increasingly dominate agricultural systems, resulting in serious risk of yield losses to pests, diseases and abiotic stresses, as well as lack of stability and resilience. Several new challenges have been recognized in the past decade that will require strengthening of diversification efforts. These include: the need for long-term sustainability in agricultural practices; increasing competition from biofuel crops; declining nutritional security undermining health; increasing rural poverty in some parts of the world; and climate change.

175. To cope with the coming challenges, agricultural systems will need to incorporate a broader range of crop varieties and of crops, including crops that produce raw materials for agroindustry and energy, crops that are now underutilized and wild food plants. Similarly, plant breeders will need to incorporate more diversity into their improvement programmes.

The participatory evaluation, selection and improvement of farmers' varieties and early breeding lines are measures which could bring higher levels of diversity, adaptation and stability to crops. Diversification at the species and genetic level should be complemented with diversification of production systems. Diverse production systems will both provide enhanced ecosystem services and be better able to benefit from the services provided by surrounding landscapes. Together with solutions such as rotations, varietal mixtures and multi-lines, these practices will improve the resilience and stability of agricultural systems and thus help ensure food, nutritional and income security.

176. **Long-term objectives:** To promote sustainable agriculture through diversification among and within crops.

177. **Intermediate objectives:** To review periodically genetic vulnerability in crops and encourage breeders, and other relevant groups, to take the necessary mitigating action nationally, regionally and internationally.

178. To develop models for diversified production consistent with higher productivity as well as consumers' preference.

179. **Policy/strategy:** Governments and relevant intergovernmental organizations, in cooperation with crop networks, research institutions, extension agencies, the private sector, farmers' organizations and NGOs, should:

- (a) regularly monitor genetic uniformity and assess vulnerability in crops;
- (b) promote policies that support diversification programmes and incentives to include new species in production systems;
- (c) increase diversification by planting mixtures of adapted varieties and species;
- (d) promote awareness among policy makers, donors and the general public of the value of diversified production systems;
- (e) encourage countries to adopt appropriate and effective strategies, policies, legal frameworks and regulations that promote diversified productions systems;
- (f) support farmers' management of diversity;
- (g) increase investment in the improvement of underutilized crops and the development and use of traits in major crops of relevance to human and environmental health and to the effects of climate change.

180. Funding agencies should be encouraged to continue to provide support to international agricultural centres, national agricultural research systems, and other relevant research bodies and NGOs, for work aimed at enhancing levels of diversity in agricultural systems.

181. **Capacity:** Governments, and their national agricultural research systems, supported by the International Agricultural Research Centres and other research and extension organizations should:

(a) increase their capacity to develop and use multilines, mixtures and synthetic varieties;

(b) increase their capacity to adapt different integrated pest management strategies to their production systems;

(c) develop strategies for the deployment and use of a range of varieties;

(d) explore and, in appropriate circumstances, make use of decentralized and “participatory” plant breeding strategies to develop plant varieties specifically adapted to local environments;

(e) make use of biotechnological techniques to facilitate broadening of the genetic base of crops; and

(f) strengthen the ability of farmers, indigenous and local communities and their organizations, as well as extension workers and other stakeholders, to manage agricultural biodiversity and ecosystem services sustainably.

182. **Research/technology:** Support efforts to identify those plant breeding and agronomic practices that foster diversification of crop production. This might include reviews of the track record of different practices.

183. Research should be promoted on the domestication of wild species, increased use of underutilized crops for the development of nutritionally enhanced adapted cultivars, and on developing crops and crop varieties adapted to climatic change.

184. It will be important to develop improved tools and methodologies for assessing the genetic vulnerability of crops, the provision of services by agroecosystems, including pollination and application of the ecosystem approach to sustainable agriculture.

185. **Administration/coordination:** There is a need for close collaboration between ministries of agriculture and the environment in the development and implementation of policies and strategies for diversification of crop production for sustainable agriculture. Such policies should be coordinated at regional level to be truly effective.

## **11. Promoting development and commercialization of farmers’ varieties and underutilized species**

186. **Background:** Commercial production is increasingly dominating agricultural systems. In such commercial systems a limited number of varieties of a few major crops provide for a large proportion of global needs. However, a large number of species, and indeed of farmers’ varieties of both major and minor crops, are used by local communities to meet local demand for food, fibre, energy and medicine. Knowledge concerning the uses and management of these varieties and species is often localized and specialized. Increasingly,

this diversity at both the species and variety levels is being replaced by uniformity in the agricultural marketplace. In support of the commercial production system, varieties are bred to meet the strict needs of high-input production, industrial processing and demanding market standards.

187. Farmers' varieties and underutilized species are not fully participating in the trend towards modernization of agriculture, and are being lost, along with the knowledge associated with them. Although there has been a modest increase in efforts to conserve such species *ex situ*, overall, their diversity is not yet adequately represented in collections. Also, many underutilized crops are not included in Annex I of the International Treaty. Nonetheless, many of these species and varieties have great potential for wider use and could contribute significantly to sustainable livelihoods through improved food and nutritional security, income generation and risk mitigation.

188. There is, however, growing global recognition of the value of farmers' varieties and underutilized species in the face of uncertain climates, malnutrition and rural poverty. For example, there is evidence of growing awareness both by the public and policy-makers of the importance of traditional vegetables and fruits and of potential new energy crops. So-called "niche" or "high-value" markets are expanding as consumers are increasingly willing to pay higher prices for better quality, novel or indeed heritage foods, from sources they know and trust. New legal mechanisms are enabling farmers to market "lost" heritage crops and farmers' varieties and legislation supporting the marketing of geographically identified products are available, providing incentives for farmers to conserve and use local crop genetic diversity.

189. In order to capture the potential market value of farmers' varieties and underutilized species, there is a need for greater integration of the efforts of individuals and institutions having a stake in different parts of the production chain. In particular, the involvement of local communities is essential, and fully taking into account traditional knowledge systems and practices.

190. Recently, a new organization, Crops for the Future, which evolved from the International Centre for Underutilized Crops and the Global Facilitation Unit for Underutilized Species, has been established. It is dedicated to the promotion of neglected and underutilized plant species as a contribution to humanity.

191. **Long-term objectives:** To contribute to sustainable livelihoods, including improved food and nutritional security, income generation and risk mitigation, through the sustainable management of farmers' varieties and underutilized species.

192. **Intermediate objectives:** To stimulate stronger demand and more reliable markets for farmers' varieties and underutilized species and their products. To promote local processing, commercialization and distribution of the products of farmers' varieties and underutilized species. To increase public awareness of the value of farmers' varieties and underutilized species.

193. **Policy/strategy:** Governments and their national agricultural research systems, with the support of the international agricultural research centres, and NGOs, and taking into account the views of farmers' organizations and their communities are encouraged:

(a) to promote policies consistent with the sustainable use, management and development of underutilized species, as appropriate, identified as having a potential to make significant contributions to local economies and food security;

(b) to develop and adopt policies in extension, training, pricing, input distribution, infrastructure development, credit and taxation which serve as incentives for crop diversification and the creation of markets for biodiverse food products;

(c) to create enabling environments to manage and monitor local diversity as well as to develop local and export markets for a wider range of traditional and new products originating from farmers' varieties and underutilized crops;

(d) to foster public-private partnerships and put in place legislation to promote benefit sharing that targets farmers and traditional custodians.

**194. Capacity:** Training and capacity building for scientists and extension specialists and for farmers and local communities, with particular emphasis on women, should be provided in establishing, running and advising local small-scale enterprises concerned with the commercialization of underutilized species and farmers' varieties, including

(a) identifying underutilized species and farmers' varieties with potential for increased commercialization and sustainable use;

(b) developing and implementing sustainable management practices for underutilized species of importance to food and agriculture;

(c) developing post-harvest processing methods for farmers' varieties and underutilized species;

(d) developing marketing methods for farmers' varieties and underutilized species; and

(e) documenting local and traditional knowledge on farmers' varieties and underutilized species.

195. Appropriate bodies, including NGOs, should promote public awareness on the value of underutilized species and farmers' varieties in various media and through appropriate mechanisms, such as street fairs, initiatives in schools, etc.

196. Appropriate bodies should promote awareness of policy makers and entrepreneurs on the value of underutilized species and farmers' varieties.

**197. Research/technology:** Research should be undertaken to:

(a) develop sustainable management practices for farmers' varieties and underutilized species of importance to food and agriculture;

(b) characterize and evaluate farmers' varieties and underutilized species;

(c) document ethnobotanical information on farmers' varieties and underutilized species;

(d) develop post-harvest processing and other methods to improve marketing possibilities of farmers' varieties and underutilized species;

(e) develop marketing strategies and brand development for farmers' varieties and underutilized species.

198. Commercialization processes and activities which have or are likely to have significant adverse impacts on the conservation and sustainable use of agricultural biodiversity should

be identified and their effects monitored.

199. **Coordination/administration:** Coordination should be strengthened between gene banks, farmers' and local communities in order to identify material of potential value. Regional networks together with national programmes and in cooperation with international agricultural research centres, NGOs and other relevant organizations, should regularly review the status of farmers' varieties and underutilized species in their region, to:

- (a) identify possibilities for commercialization;
- (b) identify common research and development needs; and
- (c) facilitate and, as appropriate, coordinate requests for relevant financial and technical assistance.

## 12. Supporting seed production and distribution<sup>6</sup>

200. **Background:** Effective seed systems need to be in place to ensure that farmers have access to planting material in adequate quantity and quality, in a timely manner and at reasonable cost. Only in this way will farmers benefit from the potential of both local and improved varieties to increase food production and adapt to climate change. In the last 20 years, there has been a significant growth of the private seed sector in developed and developing countries; however, the main focus of its interest has been high value products, such as hybrid, genetically modified and vegetable seed. The expansion of the seed trade has been accompanied by the development of increasingly complex seed regulatory frameworks. In recognition of some concerns about such frameworks, seed harmonization has been promoted at regional and sub-regional levels over the last decade. Investment by the public sector in seed production, already at a low level in most developed countries in 1996, has also decreased significantly, in many developing countries, where access to improved varieties and quality seed remains limited. In many developing countries farmers' seed systems remain the main purveyor of seed of local and, in some cases, improved varieties also. Farmers' seed systems and formal seed systems often operate side by side, but with different levels of success depending on the crop, the agro-ecological zone and output market opportunities. There is therefore a need to develop integrated approaches which strengthen both systems and the connections between them in order to produce and distribute seed of crop varieties that are useful for diverse and evolving farming systems.

201. **Long term objectives:** To increase the availability of high quality seed of a wider range of plant varieties, including improved and farmers' varieties.

202. To contribute to the maximization of both agro-biodiversity and productivity.

203. **Intermediate objectives:** To improve the complementarity in seed production and seed distribution between public and private sectors, as well as between the formal and farmers' seed systems.

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<sup>6</sup> The term "seed" refers to all planting materials in this priority activity area.

204. To develop and expand viable local-level seed production and distribution mechanisms in the formal and farmer's systems for varieties and crops important to small-scale farmers.

205. To help make new crop varieties available to farmers and to make suitable germplasm materials that are stored ex situ available for multiplication and distribution to farmers to fulfil their needs for sustainable crop production.

206. To develop/review seed regulatory frameworks that facilitate the development of seed systems and take into account the specificities of the formal and the farmers' seed systems.

207. **Policy/strategy:** Governments and their national agricultural research systems and seed producers, subject to national laws and regulations as appropriate, with support from international agricultural research centres, regional cooperation programmes and NGOs, and taking into account the views of the private sector, farmers' organizations and their communities, should:

(a) develop appropriate policies that provide an enabling environment for the development of both formal and farmers' seed systems, including small-scale seed enterprises. Efforts of governments should focus in particular on the crops and varieties needed by resource-poor farmers, especially women farmers. Such an approach should be complemented by policies that facilitate the development of commercial seed companies to meet the needs of larger-scale, commercial farmers. Governments should prioritise major and minor crops that are not adequately covered by the private sector where appropriate. These policies should be integrated in general agriculture policies;

(b) strengthen linkages between genebanks, plant breeding organizations, seed producers, and small-scale seed production and distribution enterprises to ensure a wide utilization of available germplasm;

(c) consider seed quality control schemes, particularly those appropriate to small-scale enterprises;

(d) adopt legislative measures which create adequate conditions for the deployment of farmers' varieties in both formal and farmers' seed systems, taking into account their specificities; and

(e) develop sub-regional/regional agreements which streamline certification, plant quarantine requirements and other standards in order to facilitate the development of cross-border seed trade.

208. **Capacity:** Governments, subject to regional harmonized legislations, national laws, regulations and policies as appropriate, and in conjunction with international aid agencies, NGOs and existing seed enterprises should:

(a) establish/strengthen systems, based on a public/private partnership, to ensure the maintenance of plant breeding programmes for significant crops and the multiplication of

early generation seed;

(b) encourage existing seed production systems, in particular seed enterprises, to increase the range of varieties they offer, by strengthening the link with genebanks and agriculture research institutes;

(c) strengthen capacities to implement efficient seed quality assurance systems;

(d) provide appropriate incentives, credit schemes, etc., to facilitate the emergence of seed enterprises, paying attention as appropriate in each country, to the needs of the small farming sector, of women and of vulnerable or marginalized groups;

(e) provide infrastructural support and training to small-scale seed enterprises in the field of seed technology as well as in business management in order to facilitate the establishment of a sustainable quality seed supply system;

(f) improve the linkages between farmers' organizations and seed producers (public or private) so that farmers, and in particular women and vulnerable or marginalized groups, can access high quality seed of the varieties they need; and

(g) provide training and infrastructural support to farmers on seed technology, in order to improve the physical and genetic quality of farmer-saved seeds.

**209. Research/technology:** Governments should:

(a) assess current incentives and disincentives as well as needs for support to seed production and distribution systems, including small-scale, farmer-level efforts; and

(b) develop approaches to support small-scale, farmer-level seed distribution, learning from the experiences of community and small-scale seed enterprises already underway in some countries.

**210. Coordination/administration:** National capacity for farmers to acquire appropriate seed should be regularly monitored by governments. Coordination is needed in the seed sector among the public sector, the private sector and farmers to ensure that farmers have access to high quality seed of the crops and varieties they need to response to the challenges of increased food production.

## **Building Sustainable Institutional and Human Capacities**

### **13. Building and strengthening national programmes**

#### **14. Promoting and strengthening networks for plant genetic resources for food and agriculture**

#### **15. Constructing and strengthening comprehensive information systems for plant genetic resources for food and agriculture**

#### **16. Developing and strengthening systems for monitoring erosion of plant genetic resources for food and agriculture**

### **13. Building and strengthening national programmes**

211. **Background:** National PGRFA programmes are the foundation of regional and global PGRFA efforts, contributing to the objectives of international instruments such as the GPA, the CBD, the International Treaty, and other trade and Intellectual Property Rights (IPR) agreements. Especially in the context of climate change, they are the key to maximizing the contribution of PGRFA to food security, rural development, poverty alleviation, and sustainable development. Strong national programmes are needed to fully contribute to, and take full advantage of, international cooperation on access to PGRFA and the fair and equitable sharing of the benefits arising from their use. Effective national programmes provide the enabling policies, supportive strategies and concrete action plans that are necessary for setting well-defined goals and clear priorities, allocating resources, distributing roles and responsibilities, identifying and strengthening linkages between all relevant stakeholders. The success of national programmes requires commitment from governments to provide funding, and design policies and legal and institutional frameworks.

212. PGRFA activities are carried out by public entities, private companies, NGOs, botanic gardens, communities and individuals from the agriculture, environment and development sectors. The integration of such different PGRFA activities in the framework of a unified national programme provides the opportunity to add value to such diverse efforts, so that the whole is bigger than the sum of its parts.

213. During the last decade, there has been considerable progress in establishing national programmes and enhancing stakeholder participation in national strategies and action plans, especially as regards the private sector, NGOs, farmer organizations and research and educational bodies. The commitment that this suggests is also seen in the fact that several important agreements relating to PGRFA have been negotiated, adopted or revised at the international level in this period, including the International Treaty, the International Plant Protection Convention and the Cartagena Protocol on Biosafety of the CBD. National legislation has also been enacted in many countries with respect to phytosanitary regulations, biosafety, seed regulations, and IPRs, including plant breeders' rights and Farmers' Rights.

214. However, many countries still lack adequate policies, strategies and/or action plans for PGRFA. Many existing national programmes suffer from inadequate and unreliable funding and isolation from related activities. Areas that require particular attention include setting priorities, enhancing collaboration between the public and private sectors, national and international cooperation, strengthening the links between PGRFA conservation and use, developing information systems and publicly accessible databases (e.g. the NISM on the implementation of the GPA), identifying gaps in the conservation and use of PGRFA (including CWR), increasing public awareness, and implementing national policies and legislation and international treaties and conventions.

215. Many of the countries that do not have strong national programmes, or appropriate long-term conservation facilities, often have the most urgent food security problems, even if they have rich sources of PGRFA. Efficient management of PGRFA collections is often limited by weak national programmes.

216. National *ex situ* collections are an integral part of national PGRFA programmes. Genebanks work best as dynamic centres that foster integration of conservation, documentation and use. Overemphasis on conservation can detract from sustainable use, which has supported progress in agriculture together with conservation of PGRFA. The increasing impacts of climate change make it essential to support activities related to crop adaptation, including genetics, genomics and breeding. Capacity for such adaptation is an essential part of an efficient and effective management of PGRFA. Since 1996 public-private research and development partnerships have increased in most countries, especially in plant breeding and biotechnology. However, public organizations alone often manage conservation and plant breeding in developing countries, which can result in inefficiencies, reduced benefits and lost opportunities.

217. **Long-term objectives:** To meet needs identified at the national level for the conservation and sustainable use of PGRFA through rational, effective, coordinated and sound approaches for the benefit of present and future generations.

218. To maintain an adequate national capacity in all technical and political aspects of conservation, access and use of PGRFA, as well as the fair and equitable sharing of the benefits arising from their use.

219. **Intermediate objectives:** To establish and strengthen the essential elements of an integrated national programme: (i) recognized national status; (ii) appropriate policy, legal and institutional frameworks including mechanisms for coordinated planning and action; and (iii) a programme strategy, including well-defined goals, clear priorities, and adequate and sustainable funding. Where appropriate, to upgrade conservation and use facilities at the national or regional level.

220. To improve institutional and sectoral linkages, enhance synergies among all stakeholders involved in conservation, development and use of PGRFA, including seed systems, and strengthen integration of institutional and community efforts.

221. To develop, strengthen and regularly update national capacities in the technical, managerial, legal and policy areas.

222. **Policy/strategy:** National programmes should have a formally recognized status and be given high priority within the national development agendas. Their contribution to the objectives of international instruments, including the GPA, the CBD, the International Treaty, and various other trade and IPR agreements, should be highlighted. The ecological, economic, social and aesthetic values of PGRFA, including the importance of crop improvement in increasing food security, mitigating climate change and meeting other global challenges, should be recognized in national planning and policies and in the prioritization and deployment of long-term financial and other resources. These could include financial incentives for the retention of qualified staff and for farmers to maintain and make local varieties available. Specific funding allocations should be made to PGRFA programmes in the budget process of national governments. In this regard, awareness of policy-makers and donors should be raised.

223. National commitment to provide adequate and sustainable funding for national programmes and projects is essential; however, regional or international support is a necessary complement to domestic efforts.

224. National programmes should set well-defined goals and clear priorities, including priorities for assistance sought from regional and international agricultural development programmes. National programmes should develop the capability to assess and determine the PGRFA required to meet national conservation and development needs and related international obligations and should have supporting policies and strategies on conservation, access and use of PGRFA, and on the fair and equitable sharing of the benefits arising from their use. National programmes should provide for the periodic adjustment of strategies as necessary. National programmes should make available, as appropriate, the widest possible representative collection of PGRFA to meet farmers' needs, and for the improvement of farmers' varieties. Governments, in cooperation with national, regional and international institutions should monitor the development of new technologies relevant to the conservation, characterization and sustainable use of PGRFA. In addition, the adoption and implementation of appropriate, non-conflicting and complementary national legislation related to the conservation, exchange and sustainable use of PGRFA, should be fostered, taking into account the needs and concerns of all stakeholders.

225. National programmes should establish or strengthen coordination and linkages among all relevant individuals and organizations involved in conservation, crop improvement, seed production and seed distribution. National programmes should link with regional and international activities wherever possible. National strategies should encompass conservation, development and use of PGRFA, including seed systems, and should coordinate with organizations in the environment and agriculture sectors. Broad based national committees will help in organization and coordination in most countries.

226. The structure and organization of a national programme will depend on the infrastructure and capacities available in the country and policy decisions will determine strategies and modes of operation, in particular regarding regional and international collaboration. In countries with limited capacity, the strategy may include use of facilities and expertise from outside the country.

227. Existing programmes should consider establishing or strengthening partnerships with private enterprises, NGOs, rural, indigenous communities, and research and educational organizations. Cross-sectoral links should be forged with agencies engaged in national planning and other programmes involved in agriculture, land reform, and environmental protection.

228. Institutional links should be promoted, as appropriate, among national institutions and entities specialized in technology transfer, in order to assist national bodies in negotiation for the acquisition of technologies needed for the conservation, characterization and sustainable utilization of PGRFA and associated data processing, under fair and most favourable terms, including on concessional and preferential terms, as mutually agreed to by all parties to the transaction. In the case of technology subject to patents and other IPR, access and transfer of technology should be provided on terms that recognize and are consistent with the adequate and effective protection of IPRs.

229. **Capacity:** Assistance from regional and international institutions should be provided on request to facilitate regular national planning, priority setting and coordinated fundraising. High priority should be placed on the assessment and improvement of management practices in genebanks and research stations. The capacities of farmers, indigenous and local communities, extension workers and other stakeholders, including entrepreneurs and small-scale enterprises, to manage PGRFA sustainably, should be strengthened.

230. **Research/technology:** Research is particularly needed in on-farm management, *in situ* conservation, participatory plant breeding and crop improvement. Research is also needed on management of national PGRFA programmes, including testing of institutional frameworks; evaluating use needs; database management; the economic efficiency of different approaches to conservation and use; the value of PGRFA; strengthening agricultural market information systems; and developing accurate and reliable measures, standards, indicators and baseline data for monitoring and assessing the specific role of PGRFA in food security and sustainable agricultural production.

231. Specific policy, legal and institutional issues, including those related to ownership, IPR, access and benefit-sharing, Farmers' Rights, traditional knowledge, exchange, transfer, biosafety, trade and awareness-raising, including seed systems, are increasingly important for national programmes. Assistance in developing policies, strategies, legislation, regulations and practical measures in these areas is needed from bodies such as the FAO and the International Treaty with regard to access and benefit-sharing and Farmers' Rights. Coordination is needed to provide national programmes with information on these issues and to assess the impact of international developments in these fields on the conservation and exchange of PGRFA, and to incorporate new research developments into national systems and practices.

232. **Coordination/Administration:** Coordination mechanisms should be implemented nationally to ensure prioritization in deploying financial and other resources. Strong linkages should be established between all relevant in-country stakeholders involved in conservation, development and use of PGRFA, including seed systems, as well as between the agriculture and environment sectors, in order to ensure synergy in developing and implementing policies, strategies, legislation, regulations and activities and realize PGRFA's full potential.

Governments should periodically review their policies to evaluate effectiveness and adjust their strategies accordingly. Coordinated and prioritized action at the national level should be complemented by an international system that is likewise coordinated and prioritized. International organizations involved in conservation and use of PGRFA, agricultural production, sustainability and food security, as well as related areas such as environment and health, should coordinate their efforts and activities. International collaboration is necessary in a world where countries are interdependent and where they wish to establish practical, rational and economical means to conserve PGRFA, enhance their use, and encourage access and share benefits. PGRFA networks and regional and international fora provide useful mechanisms through which countries can coordinate activities and agree on common policies, as appropriate

#### **14. Promoting and strengthening networks for plant genetic resources for food and agriculture**

233. **Background:** The extent of interdependence among countries with respect to their need to have access to PGRFA and information held by others is arguably more important than ever, as the world faces the new environmental conditions and pest and disease spectra that will result from climate change. Networks not only facilitate the exchange of PGRFA, but they also provide a platform for scientific discussion, information sharing, technology transfer, and research collaboration. The regional and global crop strategies developed with support from the Trust highlight the value of networks in identifying and sharing responsibilities for such activities as collecting, conservation, distribution, evaluation, genetic enhancement, documentation, safety duplication and crop improvement. In addition, they can serve to help set priorities for action, develop policy, and provide the means whereby crop-specific and regional views can be conveyed to various organizations and institutions. The importance of networks is recognized by the International Treaty under Article 16.

234. Many regional, crop-specific and thematic networks now operate, some of which have been either established, or significantly strengthened, in the past decade. Each has an important role to play in supporting the coordination of efforts in the sustainable conservation and use of PGRFA. The synergistic relationship between national programmes and these networks is the key to the sustainability of both; networks support national programmes and national programmes support networks. As such, networks are of particular importance in regions where there is limited national capacity in PGRFA (for example, many of the least developed countries and small island states) as it gives them easier access to information, technology and materials, and, importantly, a stronger voice in the development of global policies and actions. Crop-specific networks have a particular role to play in bringing conservation and use closer together. Thematic networks are an effective means to bring together experts and interested parties around a common theme, thereby strengthening coordination and avoiding duplication of efforts. One of the challenges faced by all types of networks, however, is the long-term availability of resources. Countries should also be prepared to contribute to supporting them in a sustainable fashion.

235. **Long-term objectives:** To foster partnerships and synergies among countries to develop a more rational and cost-effective global system for PGRFA conservation and use.

236. **Intermediate objectives:** To ensure the sustainability of networks by analyzing and identifying the benefits of participation, highlighting the contribution they make to achieving sustainable conservation of PGRFA at the national, regional and global levels.

237. To facilitate the setting of integrated eco-regional, regional and thematic goals and priorities for the conservation and sustainable use of PGRFA.

238. To promote the participation of all stakeholders in networks, in particular women farmers and NGOs and ensure the involvement of public-private partnerships.

239. **Policy/strategy:** Governments should as a matter of policy support the active participation of public and private institutions in regional, crop and thematic networks. Participation should be seen as benefiting countries and providing a means by which countries with similar challenges can pool efforts, and benefits can be shared. The funding constraints experienced by networks require sustainable and innovative solutions, which are mindful of the often intangible, though no less important, benefits of networks. As such, studies are required to highlight these benefits, which will both strengthen government support and assist in accessing funds. To underpin funding strategies, increased efforts are needed to raise awareness among policy makers and the general public of the value of PGRFA, the interdependence of nations and the importance of supporting increased international collaboration. Both cash and in-kind contributions by governments to the networks should be considered as a priority.

240. Networks provide the means by which gaps can be identified, systems developed and new initiatives promoted. Given that international germplasm exchange is a key motivation behind many networks, additional attention is needed both to promote the effective implementation of International Treaty, and in particular its Multilateral System of Access and Benefit Sharing, as well as to develop arrangements for those other crops that are not currently included in the system but that are within the overall scope of the International Treaty.

241. **Capacity:** The building of networks requires not only technical expertise, but substantial coordination, communication and organization skills. Resources and capacity should be available for such activities as: planning; communication, including travel; meetings; network publications such as newsletters and reports of meetings; servicing and strengthening of the network. The importance of resources to sustain networks requires that networks have the capacity to prepare successful projects for submission to donors.

242. For regional networks, priority should be given to strengthening existing networks. Inter-network collaboration also needs enhancing and would have a significant impact on capacity building and technology transfer. The added value from this level of collaboration would highlight the importance of networks and illustrate how existing networks can be more effectively utilized. Countries with more advanced PGRFA facilities and programmes are encouraged to support network activities through the sharing of expertise and greater capacity development opportunities.

243. **Research/technology:** Networks provide a vehicle for collaborative research in mutually agreed priority areas. Funding obtained through research projects creates a basis on

which networks can continue to cement relationships and develop. As appropriate and feasible, research, training and technology transfer in PGRFA should be planned and/or implemented in collaboration with networks. The ease of planning and implementation using a network platform is especially evident when networks cover regions that are very fragmented but at the same time face common challenges.

**244. Coordination/administration:** Resources should be made available to continue to service existing networks as appropriate and to organize and facilitate the development of new regional, crop and thematic networks where appropriate. Effective use of resources is essential and, as such, coordination is not merely required within networks but among networks to ensure efforts are not duplicated and resources are used efficiently.

## **15. Constructing and strengthening comprehensive information systems for plant genetic resources for food and agriculture**

**245. Background:** Transparent and rational decision-making in the conservation and sustainable use of PGRFA must be based on reliable information. Along with the revolution that communication and information management systems have gone through during the past 15 years, there have been important improvements in the availability and accessibility of PGRFA information. Several decisions of the Commission since the adoption of the first GPA aimed at increasing the availability and accessibility of PGRFA information, including the further development of WIEWS, the adoption of the indicators and reporting format for monitoring GPA implementation, the establishment of NISMs and the preparation of the SOW-2. Information exchange is given high importance throughout the International Treaty and in particular in Article 17, the Global Information System, and is one of the main mechanisms for sharing fairly and equitably the benefits derived from the use of PGRFA under its Multilateral System.

246. Recent developments aimed at supporting documentation and exchange of genebank information include the release of GRIN-Global, a genebank management information system with built-in networking features, and of Genesys, a plant genetic resources portal that gives breeders and researchers a single access point to information on about a third of the world's genebank accessions, including those in the international collections managed by the CGIAR, the USDA National Plant Germplasm System and EURISCO.

247. Despite this progress significant gaps in documentation and information sharing on PGRFA still persist and need to be addressed, as they represent a serious obstacle to efficient planning and to the increased use of PGRFA in crop improvement and research. Much of the existing data is not accessible electronically and documentation of on-farm genetic resources and CWR is particularly inadequate. A significant imbalance exists among regions and even among countries within regions. Many countries still lack national strategies and/or action plans for the management of diversity, or they are not fully implemented, and as such they do not maintain an integrated national information system on PGRFA. This situation is exacerbated by the fact that at the national and institutional level, data management and documentation activities are often given an inappropriately low priority in the allocation of funding.

248. **Long-term objective:** To facilitate the better management and use of PGRFA through improved access to, and exchange of, high quality, up-to-date information.

249. **Intermediate objectives:** To develop and strengthen national information systems, including but not limited to accession level information systems, to better manage PGRFA data, and to support their participation in, and use of, global information systems.

250. To enhance the use of regional and global information systems through continual improvement of the overall functionality and productivity of the genebank-user interaction.

251. To strengthen the exchange and use of information, and the sustainability of current systems by promoting compatibility and usability among datasets through the establishment and adoption of common descriptors.

252. To monitor the effectiveness of systems and ensure that differences between systems are addressed to facilitate interoperability and promote use.

253. **Policy/strategy:** High priority should be given at all levels to developing, staffing and maintaining user-friendly documentation and information systems for PGRFA based on international standards. Such systems should be able to contribute to decision-making not just in PGRFA conservation and use but also on the specific role played by PGRFA in wider issues of agricultural development and food security. Efforts should be made to develop more accurate and reliable standards and indicators and collect baseline data for sustainability and food security that will enable a better monitoring and assessment of the progress made in these areas, and of the contribution made by PGRFA.

254. The effective management of collections and increased use of the germplasm requires strengthening and harmonization of documentation, characterization and evaluation, based on adoption of common standards for data exchange. Better standardization of data and information management systems is needed not only to facilitate access but to support technology transfer and global, regional and national assessments for PGRFA.

255. Information on PGRFA will be acquired and disseminated in accordance with Article 8(j) of the CBD and Article 17 of the International Treaty.

256. **Capacity:** Planning assistance should be provided to national programmes, and, where appropriate, regional programmes, to encourage the development of rational and compatible strategies for information management and sharing. Such strategies must promote the application of standards for interoperability and exchange among systems.

257. Despite progress, data and information still exist in vulnerable and inaccessible systems. These data need to be verified and compiled into a usable and easily accessible form.

258. Access by national programmes to basic scientific, research and bibliographic information should be facilitated.

259. National and regional genebanks should have sufficient personnel to manage information, thereby improving user accessibility and ensuring participation in global information systems. Appropriate training in data management and information systems should be supported as essential to the move to rationalize genetic resources efforts at the global and regional levels.

260. Appropriate self-teaching and/or e-learning should be developed as needed. Technical support should be provided on a continuing basis to improve management of data and information and to support the adoption of new, appropriate technologies.

261. **Research/technology:** Research should be supported to:

(a) develop appropriate and low-cost methodologies and technologies for compilation and exchange of data;

(b) develop methods for adapting these technologies at the local level as appropriate;

(c) facilitate easy access and use of data by electronic means and through the internet;

(d) develop means and methodologies to make useful information easily available to non-specialists, including NGOs, farmers' and indigenous peoples' organizations;

(e) develop descriptors based on international standards for new and underutilized crops.

262. **Coordination/administration:** With the development of new information systems at the national, regional and global level coordination and collaboration is essential to ensure that these systems are compatible and useful. The harmonization of descriptors, as well as expansion to cover new crops, remains very important.

263. Global and regional assessment, oversight, planning, and coordination are needed to promote cost efficiency and effectiveness.

## **16. Developing and strengthening systems for monitoring erosion of plant genetic resources for food and agriculture**

264. **Background:** Erosion of PGRFA can occur in *ex situ* collections, in farmers' fields and in nature. With modern molecular genetic techniques, it has been possible in the past decade to generate some data on the extent and nature of genetic erosion in particular crops in particular areas. The picture that is emerging is complex and it is not possible to draw clear conclusions about the magnitude and extent of these effects. In addition, there remains, in many countries, continuing concern over the extent of genetic erosion and the need for a

greater deployment of diversity. Better techniques and indicators are needed for monitoring genetic diversity, for establishing baselines and monitoring trends. The 2010 Biodiversity Indicators Programme brings together a large number of international organizations to develop indicators relevant to the CBD, including ones for monitoring trends in genetic diversity of crops. However, to date no really practical and internationally accepted indicators of genetic erosion are available and their development should be a priority.

265. Various factors, both natural phenomena and the results of human behaviour, including urbanization, agricultural development, civil strife and war, have historically been recognized as drivers of erosion of PGRFA. Loss of genetic resources in crops occurs mainly through adoption of new crops or new varieties, with the consequent abandonment of traditional ones without appropriate conservation measures. More recently, climate change and modern dietary preferences have also been seen as a threat. In some countries, the contamination of PGRFA, both crops and wild relatives, by gene flow from genetically modified plants is considered as contributing to genetic erosion. The threat of alien invasive species needs also to be considered. The loss of PGRFA varies within countries and from country to country. Support should be provided to establish monitoring mechanisms at all levels.

266. Following a review in 1997, the WIEWS application for remote search, update and reporting of genetic erosion, has been published on the web. In addition, the scope of the information covered by WIEWS has been expanded to host NISMs, which also address issues related to genetic erosion.

267. **Long-term objectives:** To minimize genetic erosion and its impact on sustainable agriculture through effective monitoring of genetic diversity and the drivers of genetic erosion, and the implementation of appropriate remedial or preventative action as required.

268. **Intermediate objectives:** To establish and implement monitoring mechanisms to ensure the timely transfer of information to appropriate points designated as responsible for analysis, coordination and action. To expand the use of advanced technologies for monitoring degradation of most threatened species.

269. **Policy/strategy:** Governments should periodically review and report on the situation of PGRFA, designating a focal point to convey this information to FAO, the Conference of the Parties to the CBD, and other appropriate bodies. Article 5 of the International Treaty requires Contracting Parties to monitor PGRFA, assessing threats and to minimize or, where possible, eliminate them. Special efforts are needed to identify those species and populations that are most at risk and that are most likely to harbour traits that will be important in the future; this is particularly important with farmers' varieties and CWR. Improving the linkages between *in situ* and *ex situ* conservation strategies will reduce the risk of inadvertent loss of biological and cultural information.

270. Indicators and methods for assessing over time genetic erosion and its drivers are required in order to be able to establish national, regional and global baselines for monitoring diversity and developing effective early warning systems. Efforts should be made to ensure that relevant information generated by extension services, local NGOs, the seed sector and farming communities can be linked to early warning systems at the national and higher levels. Novel ICTs, including now widespread devices such as mobile telephones, can

greatly facilitate the reporting and collation of information from such disparate sources. All development projects should be required to carry out an assessment of likely impacts on genetic diversity.

271. **Capacity:** Strengthened capacity is required in gathering and interpreting information on PGRFA, and in particular CWR species identification, and conducting inventories and surveys using new molecular and ICT tools and tools for spatial analysis of diversity. Training should also be provided for farmers and local communities. Training materials, including self-teaching tools, should be produced in different local languages as needed.

272. Realizing the importance of global monitoring and early warning of loss of PGRFA, the efficiency, purpose and value of the WIEWS should be re-evaluated.

273. **Research/technology:** Research is required to improve methods for surveying PGRFA, which would be useful in the development of monitoring systems. Continued research into the development of practical and informative indicators of genetic erosion is required.

274. Technical experts, representatives of national programmes, the United Nations Environment Programme (UNEP), the Consultative Group on International Agricultural Research (CGIAR), the International Union for Conservation of Nature (IUCN), NGOs, and the private sector, should be invited by FAO to continue discussions on the development of monitoring systems for genetic erosion.

275. Further research into applying GIS technology to monitoring and predicting erosion of PGRFA, and the incorporation of the resulting information into comprehensive information systems, is required.

276. **Coordination/administration:** Multi-sectoral collaboration and coordination needs to be strengthened at the national level, especially between the agriculture, environment and development sectors. National programmes should consider alerting regional and international networks of imminent risk of genetic erosion.

## 17. Building and strengthening human resource capacity

277. **Background:** Improvements in PGRFA conservation and use are very dependent on human resource capacity and its continuous development. There has been an increase in donor interest in, and funding of, capacity building over the past 15 years, which in particular has resulted in stronger collaboration in training among national, regional and international organizations. Training courses are more frequent and new training materials and facilities have been developed. Higher education possibilities have also expanded and there are now more universities offering a wider range of courses in areas related to PGRFA, especially in the application of biotechnology to conservation and crop improvement.

278. Despite these efforts, however, human resource capacity is still far from being adequate at virtually all levels and in all disciplines related to PGRFA conservation and use. In many

countries, genebank staff are too few and inadequately trained to collect, classify, conserve, regenerate, characterize, document and distribute PGRFA. This poses a serious threat to establishing and managing valuable PGRFA collections, especially those of underutilized crops and CWR. Limited plant breeding and pre-breeding capacity in most developing countries severely limits effective and sustainable use of PGRFA. In the context of on farm-conservation, in many cases extension services and NGOs also lack qualified personnel to impart appropriate training to farming communities.

279. **Long-term objectives:** To ensure the long-term availability of adequate human resources capacity in all areas of PGRFA conservation and use, including management, legal and policy aspects.

280. **Intermediate objectives:** To develop national and regional capacity for training at all levels and to establish effective collaborative arrangements between organizations in developed and developing countries in order to strengthen and regularly upgrade capacities of all PGRFA stakeholders. To maintain adequate national capacity in critical areas, and to stem the loss of trained personnel from developing countries.

281. To develop quality courses and educational materials in primary and secondary education in priority subjects at the national, regional and global levels. To encourage undergraduate and post-graduate educational institutions/establishments to include aspects of PGRFA in courses and programmes, including the use of e-learning and distance education.

282. To foster access to external training among those countries lacking national capacity and encourage advanced institution managing PGRFA to offer capacity development opportunities.

283. To develop a sound research agenda to bridge the gap between the science of PGRFA and its application to management and genebank activities.

284. To develop opportunities for hands-on learning, mentoring and leadership development in research and policy areas at policy and research organizations at national, regional and/or international level.

285. **Policy/strategy:** Governments should recognize the importance of education in PGRFA in primary, secondary and advanced education. In collaboration with relevant organizations, governments should commit to providing training and advanced educational opportunities for young researchers and development workers, and regularly upgrade the knowledge and skills of existing staff. Training opportunities and advanced education programmes should include all technical and scientific aspects of conservation, exchange and use of PGRFA, and their application in curricula for biology, agriculture, the environment, economics and health. Particular emphasis should be placed on training in conservation biology, especially with respect to agricultural biodiversity.

286. Regular assessments of human resource capacity and needs should be made, the results of which should assist in developing education and training strategies at national, regional and global levels.

287. **Capacity:** Support should be given to developing national and regional organizations and programmes able to update curricula, provide advanced education and strengthen research and technical capacity in all relevant aspects of PGRFA conservation and use. Support should also be given to students on undergraduate and postgraduate programmes. Collaboration should be encouraged between developed and developing country academic institutions, including with the private sector, and internships and staff exchanges should be promoted. Access to the internet will be particularly important to promote e-learning, communication, and data and information exchange.

288. As national and regional organizations are strengthened, existing capacity in developed countries should be used and supported, particularly when tailored to the capacity needs of developing countries.

289. In addition to current efforts, specialized training courses, including practical hands-on training and mentorship programmes, should be developed and regularly held in all regions. Technical topics, including links between conservation and use, and management, law, policy and public awareness, should be addressed to improve understanding of international agreements and treaties.

290. Expertise in technology transfer related to the conservation, characterization, exchange and sustainable use of PGRFA should be enhanced. National organizations in developing and developed countries, and international organizations, should play important roles in facilitating this, especially through staff exchanges.

291. Consideration should be given to developing educational material that is widely applicable and usable in different regions, but that maintains a distinctive regional focus. Where feasible, courses should be offered in the language most appropriate for the region.

292. Special consideration should be given to gender integration, especially to on-site training for rural women, as they play a significant, but sometimes under-appreciated, role in maintaining and developing PGRFA and associated knowledge and traditions.

293. Capacity to develop training materials and offer or coordinate training courses should be enhanced at the international level.

294. **Research/technology:** Where possible training should be linked to ongoing research and development in educational establishments and national programmes. Efforts should be made to involve university students in field, as well as research activities.

295. **Coordination/Administration:** Training courses should be developed and offered in close collaboration with international and regional networks and national programmes. In addition, advanced programmes should be developed in cooperation with relevant international and regional academic consortia or associations in response to national needs.

## **18. Promoting and strengthening public awareness on the importance of plant genetic resources for food and agriculture**

296. **Background:** Public awareness is the key to mobilize popular opinion and to generate and sustain appropriate political action nationally, regionally and internationally. Communicating effectively the widespread benefits that PGRFA can bring to food security and sustainable livelihoods is critical to the success of any conservation programme. Recent years have seen an increased understanding of the importance of PGRFA in addressing the challenges posed by climate change. Interest is growing in neglected and underutilized crops, in recognition of their potential as novel crops that will be productive under different climate scenarios. They also provide opportunities for high-value niche products. There is increasing recognition in the scientific community of the potential of CWR for contributing to sustainable intensification of production, but this has not yet reached a wider audience. Concern over the global increase in lifestyle related diseases has led to a growing interest in the nutritional benefits that can be gained from exploring and exploiting PGRFA. Many countries are aiming to reduce the cost of imported food by revitalizing local food production, which often has cultural value. The new social networking tools provide an extremely effective way to get such messages through to a significant mass of people, in particular the young generation. However, raising the awareness of policy makers, donors and the general public of the value of PGRFA is a continuing challenge.

297. A targeted public awareness programme can promote the development of international linkages and collaborative mechanisms such as networks, involving different sectors, agencies and stakeholders. Within countries, public awareness can support efforts to involve communities and local and non-governmental organizations in national genetic resources activities, thus ensuring a broader base for conservation and improvement. Working with the media at local and national level is a key aspect in raising awareness. Strong linkages between public awareness work implemented by international organizations and national programmes and organizations can increase effectiveness and reduce costs. Effective awareness programmes can bring financial rewards, as evident by the success of the Trust, established in 2004 as a specialized fund dedicated to supporting the conservation of PGRFA and promoting its use worldwide.

298. **Long term objectives:** To ensure continued support of PGRFA conservation and use by policy makers and the general public.

299. **Intermediate objectives:** To support and strengthen mechanisms, particularly in developing countries, for coordinated public awareness activities which involve and target all stakeholders. To fully integrate public awareness into all national, regional and international programme activities.

300. **Policy/strategy:** Greater efforts are needed to estimate the full value of PGRFA, to assess the impact of its use and to bring this information to the attention of policy makers and the general public. Public awareness and the roles that specific target audiences can play in sustaining plant genetic resources activities should be considered when developing any national programme activity.

301. National strategies should recognize the role of all stakeholders in PGRFA conservation and use, who should be involved in the development of public awareness activities.

Governments should recognize and encourage the work of NGOs in raising public awareness, and efforts should be made to foster the development of public-private partnerships. The important role of local communities in any *in situ* conservation or on-farm management effort, and their traditional knowledge systems and practices, needs to be fully taken into account.

302. Public awareness needs to be done in appropriate languages to facilitate broad use within countries, and exploit all available ICT options.

303. Public awareness needs to be adequately resourced to be effective—both human and financial resources.

304. **Capacity:** PGRFA programmes should have a trained focal point for public awareness who works closely with programme managers on PA related issues and develop the appropriate tools. Failing this, all people working within PGRFA programmes should develop some capacity to articulate the importance of the programme goals and activities in the broader context of sustainable agriculture and development. They should be able to communicate their message to all stakeholders using appropriate tools, and keep abreast of new and innovative approaches.

305. National programmes should work with well-known and influential people to increase access to the media and attract attention. Efforts are required to develop and strengthen relationships with the local media and to encourage them to cover PGRFA issues on a regular basis, involving them in awareness raising PGRFA workshops and meetings to gain a better understanding of the subject area.

306. National genetic resources programmes should draw on public awareness tools and technologies generated at the regional and international level for use in their own information efforts. These tools – and the messages they convey – may have to be adapted to reflect national priorities and circumstances. However, it is likely that many of the regional and global messages will prove useful in supporting national public awareness strategies and activities. This will substantially reduce costs to the national programme. This does not detract, however, from the need to enhance capacity for producing public awareness materials at the national level.

307. Awareness of the value of plant genetic resources for food and agriculture, and of the role of scientists, plant breeders, farmers and communities in maintaining and improving them, should be promoted in schools at all educational levels, as well as in specialized agricultural research institutions. This can be catalyzed through the production of education/training materials adapted using local case studies. This requires working relationships with national education institutions. The important role that botanic gardens play in promoting awareness must also be utilized by the PGRFA community.

308. **Research/technology:** Research into, or consideration of, the information needs of targeted audiences should be made before launching major public awareness initiatives. The information provided, or the activity through which the message is given, have to be relevant. Further research is required to provide information to underpin the development of appropriate policies for the conservation and use of genetic diversity, including the economic

valuation of PGRFA. At the international level, research into the use of the new ICTs to meet public awareness needs should be undertaken. The impact of promotional materials should not be assumed; there is need for impact analysis of promotional materials so that limited resources can be used for maximum impact

**309. Coordination/administration** Coordination and facilitation is needed at all levels to rationalize and bring cost efficiencies to public awareness work. National programmes and others can take advantage of materials developed at the international level. Linkages between international organizations and NGOs will facilitate the identification of opportunities for collaborative activities. The value gained in involving the private sector must also be considered. A coordinated multi-sectoral and multi-agency approach enhances the strength of the message.

## **Implementation and Financing of the Updated Global Plan of Action**

310. The updated GPA provides an important internationally agreed framework for the conservation and sustainable use of plant genetic resources for food and agriculture. The updated GPA is in harmony with the International Treaty and the implementation of the updated GPA will be an essential contribution to the achievement of the objectives of the International Treaty. It will also facilitate implementation of the CBD in the area of agricultural biodiversity and help reach targets of the Strategic Plan for Biodiversity 2011-2020.

311. The follow-up processes call for action at local, national, regional and international levels and should involve all relevant stakeholders: the national governments, local and regional authorities, regional and international organizations, both inter-governmental and nongovernmental, the scientific community, the private sector, local communities and farmers and other agricultural producers and their associations.

312. Overall progress in the implementation of the rolling updated GPA and of the related follow-up processes will be monitored and guided by the national governments and other Members of FAO, through the Commission. In order to discharge this function, the Commission will plan within its Multi-Year Programme of Work the review of the implementation of the updated GPA as well as the review of the updated GPA itself in close cooperation with the Governing Body of the International Treaty. The review of implementation should deal with the progress made at national, regional and international levels in implementation, elaboration, and adjustment as appropriate, of the updated GPA. A first review of the implementation of the updated GPA should be undertaken at the Commission's Fifteenth Regular Session.

313. To this end, the Commission, at its Fourteenth Regular Session, will, in light of past experiences, agree on formats for receiving progress reports as well as on criteria and indicators for monitoring the implementation of the updated GPA. The conclusions of the Commission should be brought to the attention of concerned governments and international institutions to fill gaps, rectify imbalances or lack of coordination, and to consider new initiatives or activities. The conclusions of the Commission which have major policy implications will also be brought to the attention of the FAO Council and Conference, to the Governing Body of the International Treaty and to the Conference of Parties to the CBD and/or to the Commission on Sustainable Development for action, endorsement or information, as appropriate.

314. The full implementation of the updated GPA requires a significant increase in the activities currently taking place. The updated GPA will have to be implemented progressively, and adequate financial resources commensurate with the scope of the updated GPA should therefore be mobilized. Each country should determine its own priorities in the light of those agreed in the updated GPA and in the framework of its food and agriculture development needs.

315. Significant, but indeterminate, funding for plant genetic resources for food and agriculture is currently provided by national governments and other domestic sources of funds, from bilateral and regional sources and multilateral organizations.

316. Given the importance of the contribution of domestic sources, including both public and private sectors, each country should make every possible effort to provide, in accordance with its capacities, financial support and incentives with respect to its national activities which are intended to achieve the objectives of the updated GPA, in accordance with its national plans, priorities and programmes.

317. International cooperation for conservation and sustainable utilization of plant genetic resources for food and agriculture should be strengthened, in particular to support and complement the efforts of developing countries and countries with economies in transition. The Governing Body of the International Treaty will play a key role in this regard. The extent to which developing countries and countries with economies in transition will effectively implement their commitments under the updated GPA will largely depend on the effective implementation of the International Treaty and its funding strategy. Two key elements of the funding strategy that will support the implementation of the updated GPA are the Benefit-sharing fund and the Trust. Funds of the Benefit-sharing Fund are under the direct control of the Governing Body and are used by the Governing Body to play a catalytic role in international cooperation in the area of plant genetic resources for food and agriculture taking the rolling GPA into account.<sup>7</sup> The Trust is an essential element of the Funding Strategy and promotes conservation activities in accordance with the GPA.<sup>8</sup> Every effort should also be made to seek new, additional and innovative sources of funding within the process of the implementation of the updated GPA.

318. Through the monitoring of the Funding Strategy of the International Treaty, the Governing Body will be able to monitor resources available for the implementation of the updated GPA. The priorities for support under the Funding Strategy are the priority activity areas of the rolling GPA. The monitoring of the Funding Strategy covers resources under the Benefit-sharing Fund as well as resources not under the Governing Body's direct control.

319. In order to enlist the widest participation and support for its implementation the updated GPA should be reported to the major international, regional and national bodies and fora dealing with food and agriculture and biodiversity, including, in particular, the FAO Conference, the Conference of the Parties to the CBD, the Commission on Sustainable Development of the United Nations, and the governing bodies of the United Nations Environment Programme, the Global Environment Facility, the United Nations Development Programme, the International Fund for Agricultural Development, the World Bank, the

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<sup>7</sup> The three current priority areas are: 1. Information exchange, technology transfer and capacity-building (reflecting priority activities 15 and 19 of the *first* Global Plan of Action); 2. Managing and conserving plant genetic resources on farm (reflecting priority activity 2 of the *first* Global Plan of Action); and 3. The sustainable use of plant genetic resources (reflecting priority activities 9, 10, and 11 of the *first* Global Plan of Action).

<sup>8</sup> The objective of the Trust is to ensure the long-term conservation and availability of plant genetic resources for food and agriculture with a view to achieving global food security and sustainable agriculture. The Trust, in accordance with its Constitution shall in particular, without prejudice to the generality of the foregoing, (a) endeavour to safeguard collections of unique and valuable plant genetic resources for food and agriculture held ex situ, with priority being given to those that are plant genetic resources included in Annex I to the International Treaty or referred to in Article 15.1(b) of the International Treaty; (b) promote an efficient goal-oriented, economically efficient and sustainable global system of ex situ conservation in accordance with the International Treaty and the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture (hereinafter referred to as "the Global Plan of Action"); (c) promote the regeneration, characterization, documentation and evaluation of plant genetic resources for food and agriculture and the exchange of related information; (d) promote the availability of plant genetic resources for food and agriculture; and (e) promote national and regional capacity building, including the training of key personnel, with respect to the above.

Common Fund for Commodities, Regional Development Banks, the Consultative Group on International Agricultural Research and the Trust, and their member constituencies should be invited to promote and take part as appropriate in the implementation of the updated GPA.

### List of acronyms and abbreviations

BSF	Benefit-Sharing Fund of the International Treaty
CBD	the Convention on Biological Diversity
CGIAR	the Consultative Group on International Agricultural Research
CWR	Crop wild relatives
GCP	Generation Challenge Programme
GIPB	Global Partnership Initiative for Plant Breeding Capacity Building
GIS	Geographic Information Systems
GPA	Global Plan of Action
GPS	Global Positioning System
GRIN	Genet Resources Information Network
ICT	Information and Communication Technologies
IPR	Intellectual Property Rights
MYPOW	Multi-Year Programme of Work of the Commission
NARS	National Agricultural Research System
NISM	National Information Sharing Mechanisms on GPA implementation
PGRFA	Plant genetic resources for food and agriculture
SGSV	the Svalbard Global Seed Vault
the Commission	the Commission on Genetic Resources for Food and Agriculture
the International Treaty	the International Treaty on Plant Genetic Resources for Food and Agriculture
the Trust	the Global Crop Diversity Trust
UNFCC	United Nations Framework Convention on Climate Change
WIEWS	World Information and Early Warning System on PGRFA
WISM	World Information Sharing Mechanism on GPA implementation

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