

ABCD

Document Number: ICW/97/08
Distribution: General
Date: September 29, 1997

**International Centers Week 1997
October 27 - 31
Washington D.C.**

**Research Impact: Yesterday's Achievements,
Tomorrow's Challenges**

**Report Submitted by the CGIAR Systemwide Genetic
Resources Program (SGRP) to the Seventh Session of
the FAO Commission on Genetic Resources for Food
and Agriculture, May 1997**

Attached is a paper prepared by the SGRP for the FAO Commission on Genetic Resources for Food and Agriculture. It is being distributed by the CGIAR Genetic Resources Policy Committee (GRPC) to ICW participants as an information paper.

**INTERNATIONAL AGRICULTURAL RESEARCH CENTRES OF THE
CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH
(CGIAR)**

INTRODUCTION

1. This report to the FAO Commission on Genetic Resources for Food and Agriculture is in two parts. Part I focuses on the measures which the CGIAR is undertaking to implement the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, and Part II provides information on the CGIAR's activities dealing with forest, animal and aquatic genetic resources, in light of the Commission's expanded scope. This is a consolidated report, reflecting input from the relevant CGIAR Centres, and was prepared in the context of the CGIAR System-Wide Genetic Resources Programme (SGRP). An Annex gives information on the recently concluded external review of CGIAR genebank operations and the response of Centres to this review. The report of the review is available to the Commission.
2. Established in 1994, the SGRP encompasses the individual Centre genetic resources programmes. Through coordination and collaboration among the Centres, the SGRP aims to enhance the efficiency, effectiveness and transparency of the CGIAR's contribution to the Convention on Biological Diversity, Agenda 21 and the evolving FAO global system for plant genetic resources. It promotes multi-Centre collaborative activities with partner organizations in areas of common concern such as *ex situ* and *in situ* management, and the use of crop, forage, agroforestry, forestry, livestock and aquatic genetic resources. The SGRP's scope includes scientific, technical and policy research, development of information systems, and institution and capacity strengthening. Strategies and plans are developed in accordance with global developments in genetic resources.
3. Two major initiatives of the SGRP are the establishment of the System-wide Information Network for Genetic Resources (SINGER) and, as noted above, the commissioning of an external review of the CGIAR genebank operations. SINGER links the genetic resources information systems of individual Centres and allows searches across databases for key information relating to the origin, characteristics and distribution of accessions in Centre genebanks, and access to further information in Centre databases. This enables the CGIAR Centres to provide partners with enhanced access to information concerning the genetic resources they hold in their genebanks. Progress on SINGER is referred to in the body of this report and in the Annex.
4. Separately, information will be made available to the Commission on guidelines for the regeneration of seed collections, and the management of field and *in vitro* collections developed by the SGRP, in association with FAO. A verbal report will be provided on the status of the Agreements signed in 1994, governing the placement of the CGIAR plant genetic resources collections under the auspices of FAO, and the designation of germplasm under these Agreements.

PART I: THE CGIAR AND THE GLOBAL PLAN OF ACTION

5. The process that led to the Fourth International Technical Conference on Plant Genetic Resources, and to its adoption of the Global Plan of Action, provided CGIAR Centres with a unique opportunity to review their programmes and priorities in light of those identified by the international community. In the course of the preparatory process leading to the Leipzig Conference, FAO conducted the first comprehensive assessment of the status of PGRFA and of the world's ability to care for these resources, and use them sustainably and equitably. The FAO assessment benefited from the participation of nearly 160 countries, numerous NGOs and many international agricultural research centres, including virtually all of the CGIAR Centres. The

Report on the State of the World's Plant Genetic Resources identified a number of strengths in current genetic resources efforts. However, it also uncovered areas in which current efforts are inadequate or even misguided. In this regard, the Report served as the basis and justification for the priorities and programmes contained in the Global Plan of Action.

6. The CGIAR welcomes the adoption of the Global Plan of Action, and the recognition by the World Food Summit of the importance attached to its implementation. In particular, the CGIAR wishes to acknowledge the significant and valuable role the Global Plan will play, both now and in the future, in giving guidance and direction to the SGRP and to the work of the individual Centres. As part of the global system for plant genetic resources, the Plan will set the specific context in which this work will take place.

7. The CGIAR Centres are involved in a very broad range of activities to conserve and develop PGRFA. In addition, most Centres provide substantial support to national programmes and networks, and are heavily involved in information, training and public awareness efforts. Indeed, it could be said that virtually all the CGIAR's activities support the implementation of the Global Plan of Action.

8. As the Global Plan of Action aims to improve upon past efforts, including those of national programmes, international institutions and NGOs, the Commission might be most interested in knowing how the Plan is changing the CGIAR's work and priorities. For this reason, and due to practical and space limitations, this report does not provide an exhaustive or complete description of all of the Centre's work relating to the Global Plan of Action. Instead, examples of activities have been chosen to illustrate how the CGIAR is responding to the 20 activities listed in the Global Plan of Action. In particular, the report focuses on a number of new and innovative activities. Additional information is available from the annual reports of the various Centres and SGRP, and from other published reports and documents.

Examples of the CGIAR Centres' Response to the Global Plan of Action

GPA Activity Number 1: Surveying and Inventorying Plant Genetic Resources for Food and Agriculture

9. The CGIAR Centres have initiated a number of programmes in response to this activity. For example, IRRI plans to develop methods to survey and assess intra- and inter-species diversity in agro-ecological systems and wild species populations of rice. IPGRI is also working to develop strategies and methods for locating and measuring genetic diversity, and for estimating and monitoring genetic erosion. CIAT has used GIS to predict the location of important *Phaseolus* populations from agro-climatic data and has used molecular markers to gauge the genetic diversity of these populations. IITA is planning to apply similar methods to cowpea and wild *Vigna*. The information can be used in selecting areas for *in situ* conservation and in planning future collecting missions. CIAT also has projects underway with partners in South America to assess diversity in *Centrosema* and to determine the genepool of Lima bean. In 1997, ILRI and CIAT, in partnership with CSIRO, will work on forage databases in support of this activity.

GPA Activity Number 2: Supporting On-Farm Management and Improvement of Plant Genetic Resources for Food and Agriculture

10. In response to this activity, a number of the Centres (e.g. CIAT, CIMMYT, CIP, ICARDA, ICRISAT, IITA and IRRI) are continuing to improve their knowledge of the dynamics and implications of on-farm conservation and plant improvement. For example, IRRI conducts research aimed at understanding the socio-economic and genetic dynamics of farmer-managed systems involving rice.

11. IPGRI is undertaking projects to develop ethnobotanical and agro-ecological methods for locating genetic diversity (including in home gardens) and participatory approaches to conservation and development, and is carrying out case studies on indigenous knowledge and the differential roles of men and women in the conservation and use of PGRFA. All of the Centres are placing greater emphasis on working with farmers – including women farmers – and with NGOs, in recognition of the Plan’s requirement that genetic resources programmes work more closely with these partners in the development and management of improved and locally adapted germplasm.

GPA Activity Number 3: Assisting Farmers in Disaster Situations to Restore Agricultural Systems

12. The CGIAR is ready to assist FAO and others to establish a standing capacity to support the restoration of agricultural systems in areas affected by disaster. The CGIAR has some experience in this area: a number of Centres, including CIAT, CIP, ICARDA, ICRISAT, IITA and IRRI have provided both practical assistance and germplasm in disaster situations (e.g. The “Seeds of Hope” project in Rwanda). Currently, IPGRI is working with the Kenyan National Genebank in an EU-funded project to restore traditional sorghum cultivars to Somalia. ICRISAT is placing high priority on collecting germplasm which might be useful in restoration efforts at a later date. Through SINGER, the CGIAR will be in an excellent position to assist in identifying and tracking appropriate germplasm held in CGIAR genebanks for restoration to farmers.

GPA Activity Number 4: Promoting In Situ Conservation of Wild Crop Relatives and Wild Plants for Food Production

13. In response to this activity, a number of the Centres are increasing their efforts to study and promote the conservation of genetic resources of wild crop relatives and wild plants. For example, ICARDA is working with the Syrian national programme to investigate *in situ* conservation strategies for the wild relatives of cereals and food legumes. ICRISAT is working on a project in Brazil for the *in situ* conservation of wild groundnut and IITA has initiated a study on wild yam populations. Other Centres are developing plans and techniques to improve their contribution to *in situ* conservation efforts. For example, IRRI’s Medium Term Plan proposes research to develop a methodological framework for *in situ* conservation of wild rice. ILRI will soon begin a new programme to assess variation under different grazing management regimes in order to develop guidelines for the management of natural pastures under *in situ* conservation.

GPA Activity Number 5: Sustaining Existing Ex Situ Collections

14. The CGIAR has a long standing commitment to *ex situ* conservation and thus attaches great importance to the implementation of this activity. A number of Centres now assist countries by holding national collections under “black box” arrangements or by maintaining duplicates of national material in their genebanks. Several Centres have indicated that they could offer additional space in their genebanks for such purposes. Centres such as WARDA, IITA, and IRRI are examining ways to use core subsets for further safety duplication purposes, as a means to respond to the Plan’s call for the replication and safe storage of material. All of the Centres routinely restore genetic resources, upon request, to national programmes.

15. IPGRI has helped to negotiate agreements with more than 50 national and regional genebanks to hold global or regional collections, and continues to work closely with FAO to promote the International Network of *Ex Situ* Collections. IFPRI is leading a project under the SGRP to determine the parameters for the costing of *ex situ* conservation with the goal of providing guidelines to assist genebanks attain greater cost-efficiency.

16. In association with FAO, the SGRP commissioned an external review of Centre genebank operations in furtherance of the FAO-CGIAR agreements for the holding of genetic resources

“in trust.” The review, while generally positive, drew attention to a number of problems and constraints. Centres are now responding to the recommendations of the review with specific improvements both at Centre level and at a System-wide level through the SGRP. This subject is addressed separately in the Annex to this report.

GPA Activity Number 6: Regenerating Threatened Ex Situ Accessions

17. In response to the Global Plan and to the recommendations of its own External Review, the Centres of the CGIAR are giving significant attention to the rational regeneration of their own collections (see Annex). In addition, the Centres are working to support the regeneration activities of their partners. In 1995, SGRP and FAO brought together national programmes and CGIAR Centres to examine regeneration procedures for seed collections. One outcome of the meeting was the development of guidelines to inform curator decision-making on regeneration. CIMMYT is coordinating a large effort involving 13 countries in Latin America and the Caribbean to regenerate national maize holdings. Upon completion of its own regeneration programme, ICRISAT plans to assist national programmes in their efforts.

GPA Activity Number 7: Supporting Planned and Targeted Collecting of Plant Genetic Resources for Food and Agriculture

18. The CGIAR has long supported the collecting of information and genetic resources of species that are under threat and/or of potential use. In recent years, the number of accessions added annually to *ex situ* collections held by the CGIAR has declined from its peak in the last decade. At least one Centre, ILRI, has suspended collecting activities, pending clarification by countries of terms and conditions of access to their genetic resources. However, in general, there has been a shift by the Centres to more targeted and prioritized collecting, in collaboration with national programmes, as a means to fill gaps in the genetic diversity of existing collections (*e.g.* by ICARDA, CIAT, CIMMYT). IRRRI also strictly targets its collecting, with the exception of material gathered in the Lao DPR, where little general collecting has been done in the past. IRRRI anticipates that the collecting phase for rice should be completed by the year 2000.

19. As noted under Activity 3 above, ICRISAT is using its collecting activities to strengthen its capacity to respond to restoration needs in disaster situations. All Centre collecting activities are carried out on the basis of agreements with countries of origin.

GPA Activity Number 8: Expanding Ex Situ Conservation Activities

20. The CGIAR Centres attach great importance to the development of conservation strategies using an appropriate combination of methods. This Activity of the Global Plan specifically cites botanical gardens, field genebanks and the use of new technologies, including *in vitro* conservation, for their potential to complement and expand the *ex situ* conservation of orthodox seed.

21. In response to the Global Plan, ICRISAT, in partnership with Brazil, is increasing its research on alternative storage methods (particularly cryopreservation) for wild accessions of groundnut. While IPGRI is investigating new technologies for *in vitro* conservation, especially of unorthodox/recalcitrant seeds. Improved *in vitro* and cryopreservation methods for clonal crops are under development and routinely used for the conservation of potato, sweet potato, cassava, yam and *Musa* at the Centres which have mandates for these crops. CIAT has upgraded its laboratory facilities to allow it to host duplicated *in vitro* collections for other institutions. ISNAR, through its Intermediary Biotechnology Service, is assisting national agricultural research systems in developing countries to manage biotechnology research programmes.

22. A number of the CGIAR Centres hold field collections. IITA, for example, maintains 5,500 accessions of yam, cassava and *Musa* in field genebanks. Based on consultations with national programmes and Centres in 1996, SGRP and FAO have developed guidelines for the management of field and *in vitro* genebanks as an aid to curators.

23. Relationships with botanical gardens and support to botanical gardens as recommended in this Activity are not generally well developed in the CGIAR and many Centres would question whether they are in a position to offer substantial assistance in this regard.

GPA Activity Number 9: Expanding the Characterization, Evaluation and Number of Core Collections to Facilitate Use

24. The Centres are now working to facilitate the use of conserved material by rationalizing genetic resources collections and by speeding-up the identification of useful accessions. For example, characterization and evaluation work recently undertaken at IITA resulted in the identification of 65 cassava accessions resistant to African cassava mosaic virus, some 50 accessions of virus-resistant yams, and 5 accessions of wild cowpea resistant to Maruca pod borers. These accessions can now be used by national programme researchers to enhance germplasm. A new IPGRI project emphasizes the use of characterization and evaluation of germplasm in the identification of useful traits. ICRISAT is completing the characterization of its in-trust collection and is examining the appropriateness of currently used characterization data for national collections. CIMMYT and national programmes in Latin America have generated a CD-ROM that contains information on the ecological adaptation and other traits of 12,000 maize accessions.

25. ILRI's Medium-Term Plan places increased emphasis on characterization, including the characterization of phytochemicals which relate to the use of the germplasm for livestock feeds. The Centre will expand its morphological and molecular characterization of key species this year. ICARDA's Medium Term Plan places greater emphasis on characterization and CIP is giving greater attention to characterization in its programme plans from 1997 onwards.

26. A number of the Centres are currently involved in the development of core collections. For example: ICARDA is participating in the preparation of an international core collection for barley and is preparing core collections for other mandate crops; CIAT and CIP are developing core collections for their mandate crops; ICRISAT is developing core collections of its own holdings and those of national collections; and IRRI is developing methods to establish a core collection of rice. The results of this research will be extremely useful to national programmes seeking to rationalize and promote better use of their collections.

GPA Activity Number 10: Increasing Genetic Enhancement and Base-Broadening Efforts

27. Most of the CGIAR Centres were already giving significant attention to genetic enhancement and base broadening efforts prior to the adoption of the Global Plan, recognizing the importance of such efforts to sustainable agriculture and food security worldwide. For example, many Centres have for some time supported crop networks to promote the distribution and use of improved germplasm (*e.g.* CIMMYT, IITA, IRRI). WARDA's interspecific rice hybridization programme has produced the first genetically stable and fully fertile hybrids which they are currently evaluating for adaptation and yield in 12 West African countries. The Centres find that their work in this area also helps to strengthen ties with national programmes.

28. In addition to current and ongoing activities, the Centres are likely to strengthen their work in this area in response to the Global Plan. ICARDA's Medium Term Plan includes an emphasis on pre-breeding efforts, with the focus on gene introgression from crop wild relatives. INIBAP

(IPGRI) recently reformulated its *Musa* germplasm programme and recruited a scientist to head the programme.

GPA Activity Number 11: Promoting Sustainable Agriculture through Diversification of Crop Production and Broader Diversity in Crops

29. The CGIAR promotes and facilitates the use of greater diversity in breeding programmes, and in the varieties and species grown on-farm, to reduce the vulnerability and increase the stability of agricultural systems. In response to this activity of the Global Plan, most of the Centres will continue to focus their efforts on providing improved populations as opposed to finished cultivars. ICARDA, for example, is emphasizing the delivery of improved forage and pasture populations targeted to different agro-ecological conditions in WANA. Some Centres are expanding the range of crops they are working with, although financial constraints present a barrier.

GPA Activity Number 12: Promoting Development and Commercialization of Under-Utilized Crops and Species

30. A number of the CGIAR Centres (eg. ICRISAT, IITA) actively support the conservation and use of under-utilized crops to contribute to food security and rural development, particularly in marginal areas, and to agricultural diversification. ILRI is seeking to identify forages that have not previously been used as livestock feed. CIP is promoting the *in situ* management and use of Andean root and tuber crops both within and outside the region. For a number of years, IPGRI has promoted the conservation and use of neglected and under-utilized crops, especially of Mediterranean species, and now plans to expand this work.

GPA Activity Number 13: Supporting Seed Production and Distribution

31. The CGIAR Centres are broadening their efforts to promote the availability of good quality seed of a wide range of crop varieties, in response to the Global Plan. For example, IRRI, through its work on on-farm management, promotes links between genebanks, plant breeding organizations, seed producers, and small-scale production and distribution enterprises. Some Centres, ILRI and ICARDA among them, offer training in seed production methods. ICARDA, in addition, promotes small-scale farmer and village level production of pasture and forage species seed, while ILRI provides basic seed to support national forage seed production. CIP, through three regional seed units, supports the production of high quality potato seed for farmers in the Americas, Africa and Asia. ICRISAT, which already works with the formal seed sector in southern Africa and has links with seed production and distribution efforts in West Africa, proposes to expand its work in this area.

GPA Activity Number 14: Developing New Markets for Local Varieties and “Diversity-Rich” Products

32. The CGIAR has not undertaken a great deal of work in this area to date and many Centres feeling they have no particular “comparative advantage” to offer. Nevertheless, some Centres are involved in activities to encourage farmers to grow distinct, local varieties. For example, ICARDA supports projects to study traditional foods made with local crop varieties and CIP has promoted the marketing of local Andean roots and tubers. ISNAR’s series of Agricultural Biotechnology Policy Seminars, with national programmes in Asia, Africa, Latin America and WANA, have included sessions addressing needs for market development and related research for indigenous diversity and crops of local importance. IPGRI is involved in the development of new markets for local cash crops through the coconut and bamboo/rattan networks, and has plans for socioeconomic research to examine community income generation and market development.

GPA Activity Number 15: Building Strong National Programmes

33. The CGIAR has long recognized that national programmes are the key to realizing national, regional and global goals in the conservation and use of genetic resources. Consequently, all Centres contribute to the development of strong national programmes, by working directly with national partners and through networks. In direct response to the Global Plan, ISNAR will undertake a new programme on management and human resource development needs in national programmes, with relation to biotechnology and biodiversity. This programme involves eight countries in Asia. IPGRI plans to intensify its research on infrastructure, operations and policy options for national programmes.

GPA Activity Number 16: Promoting Networks for Plant Genetic Resources for Food and Agriculture

34. The CGIAR has long supported the concept of networks as a means to help countries share the responsibilities and costs of genetic resources activities. All Centres are involved in regional and crop networks, a number of them currently provide or house the secretariats of certain networks. In response to this activity of the Global Plan, new networks are now being formed with the assistance of CGIAR Centres. For example, ICARDA and IPGRI are helping to establish a network for Central Asia.

GPA Activity Number 17: Constructing Comprehensive Information Systems for Plant Genetic Resources for Food and Agriculture

35. The CGIAR System-wide Information Network on Genetic Resources (SINGER) is a genetic resources data exchange network containing information on all CGIAR Centre collections. SINGER is accessible on the Internet and will shortly be available on CD-ROM. In addition, CIMMYT leads a multi-Centre project with national programme partners to develop an international crop information system that compiles information on the nomenclature, genealogy and performance of crop germplasm. In response to this activity of the Global Plan, the Centres are exploring the possibility of expanding SINGER to include a wider range of information on global genetic resources holdings. A number of Centres, including IRRI and IPGRI, continue to work with national programmes to enhance their capacity in data management.

GPA Activity Number 18: Developing Monitoring and Early Warning Systems for Loss of Plant Genetic Resources for Food and Agriculture

36. The CGIAR recognizes the need for mechanisms to monitor the natural and human phenomena that put plant genetic resources at risk, to assemble information and to respond appropriately. Thus most Centres feel that they can work most effectively on this topic through regional networks, where such mechanisms are more likely to exist or to be established. IPGRI will continue to work with FAO on the development of its World Information and Early Warning System (WIEWS).

GPA Activity Number 19: Expanding and Improving Education and Training

37. The CGIAR has a very long history of training scientists from developing countries in disciplines related to genetic resources. The Centres will continue to fulfil their commitment to training, whether through participation in national training efforts, through annual training activities sponsored by the Centres (e.g. ICARDA's annual training course in research methods for genetic resources staff in WANA) or through individual training programmes. In addition, in response to this activity of the Global Plan, the Centres will give greater attention to rationalizing their training activities and to developing new and innovative approaches to

training. For example, ILRI is convening an Inter-Centre Training Programme for Sub-Saharan Africa, which will include genetic resources training. IPGRI will continue to offer training for trainers and to develop a series of training materials.

GPA Activity Number 20: Promoting Public Awareness of the Value of Plant Genetic Resources for Food and Agriculture

38. In response to this activity of the Global Plan, the CGIAR Centres will continue their long-standing commitment to promote the role played by plant genetic resources in agricultural development. A four-part broadcast/educational video series will be released in 1997, as part of a project led by IPGRI and involving all Centres. Starting this year, a significant public awareness campaign, again involving all Centres, will promote the importance of agricultural research including genetic resources, to audiences around the globe. Public awareness efforts through the SGRP will focus on promoting the implementation of the Global Plan of Action. The CGIAR Public Awareness Association, which coordinates public awareness activities throughout the system, will expand to include representatives from national programmes, donor agencies and NGOs at all levels. A principal goal of IPGRI's public awareness strategy is capacity building in public awareness for national genetic resources programmes.

**PART II: ANIMAL, AQUATIC AND FOREST GENETIC RESOURCES ACTIVITIES
IN THE CGIAR**

39. The Centres with mandates for research on forestry, agroforestry, livestock and aquatic resources are lead Centres for genetic resources activities in their respective fields. Programmes focus on the *in situ* conservation of genetic resources, and have a strong emphasis on assessing genetic diversity and the threats facing it, as well as the management and sustainable use of diversity. Through the SGRP, these activities are coordinated with those of other Centres concerned with genetic resources conservation, policy research and institution strengthening and capacity development. Individually, and through the SGRP, the CGIAR Centres collaborate closely with FAO on forestry, animal and aquatic genetic resources.

Animal genetic resources

40. CGIAR research emphasizes the characterization of indigenous domestic animal diversity to facilitate the rational management of animal genetic resources. This includes the survey and documentation of the number and characteristics of local livestock breeds and their production environments, and estimates of within-species genetic diversity. The work aims to assist NARS to develop methodologies for on-farm characterization, and strategies for conservation and sustainable utilization, including exploitation of economically important unique attributes. Other priorities include adapting collecting techniques, evaluating and storing gametes and embryos for the *ex situ* preservation of endangered breeds, and investigating how existing institutions, including national artificial insemination centres, could become involved in domestic animal genetic resources conservation.

41. On-going activities take place principally at ILRI in collaboration with NARS. Activities are coordinated with FAO and undertaken in support of the development of the Global Strategy for the Management of Farm Animal Genetic Resources.

42. At present, research is being carried out, in collaboration with NARS scientists in Africa, to test alternative survey methods for collecting breed information, phenotypic characteristics (including performance) and population statistics, under field conditions. Information on indigenous breeds, including their geographic distribution, production systems, physical and performance characteristics, is also being compiled into a computerized database. Microsatellite markers and protein polymorphism, the latter in collaboration with NARS, are being used to

estimate within-species diversity. In addition, the characterization of selected populations for specific genetically controlled disease adaptations is being undertaken as part of ILRI's Animal Health Programme. This includes research on resistance to endoparasites in several Sub-Saharan countries, studies on tick resistance in cattle and continuing work on trypanotolerance, including the search for trypanotolerance markers in some African cattle populations.

43. ICARDA, in its Medium Term Plan, includes work on the phenotypic characterization of small ruminants in the WANA region. Initial research will focus on between and within breed variation in the utilization of low-quality forages.

Aquatic genetic resources

44. ICLARM carries out research, training and information activities to improve the production and management of marine, coastal and inland aquatic environments. In 1996, ICLARM established a Biodiversity and Genetic Resources Programme which has responsibility for ICLARM's main activities in aquatic biodiversity and genetic resources. Activities are carried out in close collaboration with the Centre's programmes on aquatic environments, coastal aquaculture and enhanced fisheries, fisheries resource assessment and management, germplasm enhancement and breeding, and integrated agriculture-aquaculture systems.

45. In participation with research organizations in Germany and Ghana, ICLARM has developed methods to characterize tilapia genetic resources. Genetic markers for tilapia species were identified and a manual of methods was finalized at an international workshop and later published. Proposed activities for 1997 include a case study on the genetic diversity, conservation and sustainable use in aquaculture and fisheries of the black-chinned tilapia in West African lagoons and watercourses, and the genetic diversity of the silver barb in Southeast Asia. In addition, there are proposals to develop a global information system on fish larvae and a global database of shrimps, prawns, lobsters and crabs. ICLARM, in collaboration with FAO and other organizations, has already developed ReefBase, a database on the world's coral reefs and FishBase, a database containing information on 17,000 of the world's 25,000 extant finfish species.

46. Guidance on the development of ICLARM's programme on aquatic genetic resources and the priorities for the SGRP in this field, was provided by a consultation meeting held in December 1995, attended by experts from a number of countries, FAO and IUCN. One of the meeting's recommendations was that ICLARM should be a focal point for processing, maintaining and disseminating information on fish genetic resources, particularly through links with NARS and NGOs. The full proceedings of the meeting will be published shortly.

47. The establishment of the Biodiversity and Genetic Resources Programme will enable ICLARM to expand collaborative activities within SGRP, and facilitate interaction with other institutions and organizations involved in aquatic genetic resources, particularly FAO. ICLARM is collaborating with FAO in the planning of an international conference in 1998 on the conservation and sustainable use of aquatic genetic resources.

Forest genetic resources

48. The CGIAR's contribution to forest genetic resources management and use is primarily through CIFOR, ICRAF and IPGRI, and brings together their combined research expertise. CIFOR is mainly concerned with natural forest ecosystems and plantations, ICRAF with agroforestry and IPGRI with plant genetic resources conservation and use.

49. CIFOR's work strongly emphasizes the *in situ* conservation and use of tropical forest ecosystems, and the integration of management strategies with the needs of rural people living in or near forests. Research focuses on the interactions between processes at the landscape level

that reduce genetic diversity, especially degradation (disturbance) and deforestation (fragmentation), and the genetic-level processes of gene flow, inbreeding, genetic drift, etc. Studies also aim to improve understanding of the impacts of the above on forest resources, local industry and the livelihood of local people. CIFOR and IPGRI have joined together to investigate these aspects through “in country” research, in partnership with NARS in Malaysia, Thailand and India, and CATIE in Costa Rica. In addition, CIFOR is developing tools to aid analysis of genetic diversity in tree species and is collaborating with the Oxford Forestry Institute, UK to develop and provide training on molecular marker techniques. CIFOR is also working with the University of Alberta, Canada to develop a computer programme to facilitate analysis of population genetics data.

50. ICRAF’s activities cover the collecting, *ex situ* conservation and on-farm management of agroforestry species, and the promotion of their use and domestication. Efforts focus on priority agroforestry species determined through surveys conducted by NARS and ICRAF in different ecoregions. Studies are now underway, together with local farmers, on the natural distribution of the key species and the efficiency of different collecting strategies in capturing and identifying useful diversity. ICRAF maintains germplasm of key species, under agreements with country partners, in field genebanks or, in the case of orthodox species, as seed. Farmers are closely involved in evaluating and conserving genetic diversity of the greatest utility. ICRAF is also expanding its efforts on molecular characterization.

51. The ICRAF programme strongly emphasizes the use of agroforestry species, particularly species that have been neglected in the past. The Centre supports seed production and is engaged in the policy, training and practical aspects of promoting farmer-based seed production. This includes paying close attention to new or expanded markets for tree products. Domestication of agroforestry species is viewed as a farmer-driven or market-led process, and ICRAF uses a range of improvement strategies, depending on the biology and use of the species. ICRAF has a strong partnership in conservation research and training with KEFRI, the Kenyan Forestry Research Institute. ILRI and IITA collaborate with ICRAF on research and in the maintenance of agroforestry germplasm.

52. IPGRI is involved in collaborative research with a range of national programme partners in the West African Sahel, the Americas and Asia, to develop methods for locating diversity and assessing genetic erosion in forest ecosystems. With partners in Asia, IPGRI is investigating strategies for the conservation and use of bamboo and rattan, including both *in situ* and *ex situ* methods. IPGRI is also managing a project with 25 country partners to develop cost-effective methods for conserving recalcitrant tropical tree seeds.

53. CIFOR, ICRAF and IPGRI were involved in the subregional meetings on forestry genetic resources, held prior to the International Technical Conference in 1996. The CGIAR also has close contacts with a number of forestry genetic resources networks. IPGRI hosts the coordinating secretariat for EUFORGEN, and ICRAF provides support to a number of tree seed networks as well as steering the miombo fruit tree network.

CONCLUSION

54. The CGIAR is committed to contributing to the global effort for the conservation and sustainable use of agricultural, forestry and aquatic genetic resources. To harness the collective strengths of the CGIAR Centres, and enhance the CGIAR’s contribution to the practical implementation of the Convention of Biological Diversity, the SGRP was established in 1994.

55. The Centres of the CGIAR are prepared to play a major role in the implementation of the Global Plan of Action. They hold large and important collections of PGRFA “in trust” for the

world community, as recognized in the Agreements signed with FAO. These Agreements acknowledge that while the Centres do not claim ownership over the materials, they accept certain responsibilities for conserving, duplicating and making the material available to users upon request. Experience with these Agreements has been uniformly positive and the CGIAR supports their renewal in 1998. To ensure their continued compliance with the International Undertaking, the CGIAR would propose a review of the Agreements once the current negotiations of the Undertaking have been completed.

56. The Global Plan of Action presents challenges to all institutions and programmes involved with plant genetic resources for food and agriculture and the CGIAR is no exception. The Global Plan promotes change by providing agreed activities and priorities. The CGIAR willingly accepts that implementation of the Plan will necessitate some changes, adjustments and improvements in existing programmes. This report highlights a few of the new, or lesser known, initiatives that Centres are undertaking in direct response to the Global Plan of Action. It also points to several areas where the CGIAR Centres might not be able to make substantial contributions.

57. The Global Plan of Action is now being widely used for planning and priority setting within the CGIAR. Explicit reference is made to it in many of the Centres' recently-formulated Medium Term Plans which reflect the pervasive influence of the Global Plan in the work of the CGIAR. They also reveal areas in which further adjustments and strengthening will be necessary in the coming months and years. The CGIAR's Inter-Centre Working Group on Genetic Resources, which serves as the Steering Committee for the System-Wide Genetic Resources Programme, will provide one internal forum in which Centres can plan and coordinate their ongoing efforts to implement the Global Plan of Action. Future reports to the Commission will provide updates on this work.

58. An overview of the current research by the CGIAR and its partners, in contribution to the global effort on the management and sustainable use of forestry, agroforestry, livestock and aquatic genetic resources, has been given in Part II.. As in the realm of PGRFA, rapid changes are occurring in these fields at both the policy and technical levels. Through the SGRP, greater coordination of Centre activities will enable the CGIAR to respond to these changes as they occur. The Centres will continue to work in close collaboration with FAO's programmes on animal, forestry and fish genetic resources, and in support of global developments in these fields, such as the Global Strategy for the Management of Farm Animal Genetic Resources.

EXTERNAL REVIEW OF THE CGIAR GENE BANK OPERATIONS

Introduction

A1. In 1995, the System-wide Genetic Resources Programme (SGRP) commissioned an external review of Centre genebank operations to assess the technical, scientific and financial constraints and opportunities for improving the services they provide. In doing so, the review examined compliance with the Agreements signed between FAO and eleven CGIAR Centres in October 1994, through which the Centres hold designated plant genetic resources in trust for the benefit of the international community within the International Network of *Ex situ* Collections, under the auspices of FAO. Under the terms and conditions of the Agreement, the designated germplasm is maintained by the Centres in accordance with internationally accepted standards, and made available without restriction for research, breeding, and conservation.

A2. The review was conducted in association with FAO, by a Panel composed of 20 experts from national and regional genetic resources programmes, and the FAO. The Panel was chaired by Dr. N.L. Innes. Over a period of six months, panel members visited the eleven CGIAR genebanks that hold plant genetic resources, as well as ICLARM (which holds germplasm of Nile tilapia *ex situ* under a current research project).

A3. The Panel paid particular attention to the status of the collections, the conservation facilities, standards of collection management and off-site safety duplication of the collections. It examined research related to germplasm management, training, collecting and use of the collections, and linkages with national programmes and networks, including the distribution of germplasm and opportunities for restoring duplicates to countries of origin. Individual reports were prepared for each genebank, giving specific recommendations for improving operations. In addition, the Panel produced a synthesis report with a number of overall recommendations. This report was published by the SGRP in 1996, together with the collective response of the Inter-Centre Working Group on Genetic Resources (ICWG-GR). Currently, the Panel's summary comments and specific recommendations for each genebank reviewed, together with the respective Centre's responses, are being compiled for publication as a supplementary annex to the review report. The report and a pre-publication version of the annex will be made available to the Commission.

A4. The information generated by this review was incorporated into the FAO Report on the State of the World's Plant Genetic Resources for Food and Agriculture. This annex provides an overview of the findings of the review and, through illustrative examples, of how the CGIAR is responding to its recommendations. Further information can be found in the formal Report and its annex, as well as in the Annual Reports of the SGRP and individual Centres.

Findings of, and Response to, the External Review

A5. The Panel concluded that most Centres' genebanks were operating satisfactorily and generally well managed, but voiced its concern over the problem of under-funding which was constraining some of the activities. Consequently, as recommended by the Panel, the SGRP has implemented a study of the costs of the CGIAR genebank operations that will help to determine adequate funding for the essential activities needed to adhere to the Agreements with FAO. (Centre resource allocations to their overall genetic resources programmes are contained in their Medium-Term Plans for 1998-2000, which go before the CGIAR for approval in May, 1997.)

A6. The Panel reported that most Centres were meeting the requisite international genebank standards. Individual Centres are giving priority to responding to the review's specific

recommendations regarding genebank facilities and standards. For example, ILRI has installed new conservation facilities, and WARDA, which has an agreement with IITA to maintain its base collection, is planning to modify one of its stores to meet accepted standards for medium storage. The new genebank facilities at CIMMYT are fully operational and ICRAF's new facilities will be completed by the end of 1997. CIAT has expanded its cassava *in vitro* store to allow it to host duplicate *in vitro* collections, and a new seed viability testing laboratory will be built in 1997. Also, IITA is planning to expand its tuber storage facilities for yam.

A7. The Panel noted that several Centres faced resource constraints in meeting the need for timely and comprehensive viability tests, regeneration and production of disease-free material. The Centres are addressing these and accelerating efforts, accordingly. For example, CIMMYT has grown out over 12,000 wheat accessions to ensure that they are free of Karnal bunt infection, prior to their transfer to its new genebank. IITA has multiplied more than 3,000 disease-free accessions of leguminous germplasm over the last two years and is speeding up work to complete duplication of the yam collection into *in vitro* culture. CIP has now regenerated about 63% of the wild potato collection for long-term seed storage and is increasing seed stocks of *Ipomoea* species. INIBAP/IPGRI, with three Virus Indexing Centres now in operation, expects to double capacity to virus index *Musa* germplasm in 1997. ILRI is now putting emphasis on the regeneration and germination testing of the forage collection in order to establish its long-term store according to international standards. It is currently establishing regeneration histories and regenerating more than 1000 accessions. IRRI has performed more than 170,000 individual tests in completing the viability testing of the all accessions in the base and active collection.

A8. In order to address the recommendations of this review and other recent reviews of the institute, ICRISAT has instituted fundamental changes to its genetic resources programme and genebank. These include, elevating its genetic resources activities to a status equivalent to the institute's other major programmes, as is the case at many other Centres. ICRISAT is now putting in place a comprehensive genebank management information system and developing a Procedures and Operations Manual. These initiatives follow the model of other Centres, notably IRRI, and will help ICRISAT to meet international standards and to assist in implementing the Global Plan of Action. A number of other Centres have reorganized their programmes in order to better respond to the review and the GPA. For example, ICARDA and CIP, among others, are placing more emphasis on characterization; an area highlighted by the review for further attention. From 1997, ILRI's programme will focus on the characterization of forage genetic resources for nutritional factors and other traits, to identify superior and better adapted germplasm for use in livestock feed.

A9. The Panel noted that one of the weakest and most variable of Centres' activities is the off-site duplication of the collections for safety purposes. The Centres are intensifying efforts to arrange safety duplication under formal agreements. Those in place and currently under development are noted in the Centre responses to the review. For example, in 1996 IPGRI/INIBAP concluded an agreement with CATIE, Costa Rica to host duplicates of the *in vitro Musa* collection and ICARDA completed arrangements for the safety duplication of the *Lathyrus* collection. IRRI, which has an agreement with the National Seed Storage Laboratory (USA) for the safety duplication of the entire rice collection, is investigating the establishment of core collections to facilitate the further duplication of this large collection as core subsets in different genebanks around the world. To facilitate the duplication of clonal germplasm, robust *in vitro* culture and packaging systems are under research, for example at CIAT for cultivated and wild *Manihot*.

A10. Data on more than 400,000 accessions held in CGIAR genebanks are now accessible through the System-wide Information Network for Genetic Resources (SINGER). Work is continuing to complete the data sets accessible through the system. Implementation of SINGER

has led to improvements in the quality and quantity of data in Centre genetic resources databases. Through SINGER, Centres are better able to attend to the review's recommendations on determining coverage and overlap in the collections and facilitating national programme access to information about collections for purposes of restoration and use. Significant progress has been made by IPGRI/INIBAP in the development of the International *Musa* Germplasm Database and this will be linked to SINGER in the near future. SINGER is accessible on the Internet World Wide Web (<http://www.cgiar.org/singer>) and a CD-ROM version will be available soon, for distribution to partners without an Internet connection.

A11. Work is now underway to establish a database on the microbial collections that have been assembled at Centres, primarily in association with the collections of legume species and rice. This will provide the basis for assessing the status of the collections and further development of strategies and policies for their conservation and dissemination.

A12. A number of the Panel's recommendations relate to advancing research on methods to improve the conservation, management and use of collections. Guidelines on the regeneration of seed collections and the management of field and *in vitro* genebanks have been developed by the SGRP in collaboration with FAO, through a consultative process, involving relevant Centres and many national programmes. Research efforts are also being extended to address the Panel's recommendations, for example through improving cryopreservation protocols for clonal crops such as *Musa*, yam, potato, cassava. IRRI and CIAT are addressing seed dormancy problems in conserving wild species of rice and *Manihot*, respectively. A major focus of current research at IPGRI/INIBAP is the development of new indexing methods and therapy techniques to clean material of virus diseases, the major constraint in the distribution and use of *Musa* germplasm. Increasing use is being made of geographic information systems and molecular marker techniques to determine genepool distribution and assess diversity in *ex situ* collections at several Centres (*inter alia*, ILRI, CIAT, CIP, ICARDA). Conservation research, genetic diversity assessment and the refinement of core collections are components in ICRISAT's expanded genetic resources programme. Most Centres are now engaged in establishing core collections and in research to improve the methodologies for their determination. For example, CIP is establishing core collections for potatoes and sweet potatoes and is leading a multi-Centre activity, under SGRP, on core collection development for clonal crops.

A13. The Panel commented positively on the extent of collaboration between the Centres and NARS, NGOs and networks, and noted scope for greater involvement of partners in the development of Centre policy and strategy on genetic resources. The coordination and collaborative action afforded by SGRP serves to enhance individual Centre efforts to strengthen network linkages, promote germplasm restoration and provide support to national programmes. This year, the SGRP and FAO together, will organize regional consultations in Africa and the Americas on the implementation of the GPA.

A14. The development of the SGRP strategy, currently underway, will take into account the recommendations of the review, not least their calls for a System-wide approach to research and training, and enhanced consultation with partners.