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REPORT ON ACTIVITIES ON PLANT GENETIC RESOURCES BY FAO, IBPGR AND OTHER ORGANIZATIONS

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REPORT ON ACTIVITIES ON PLANT GENETIC RESOURCES

BY FAO, IBPGR AND OTHER ORGANIZATIONS

I. INTRODUCTION

1. Numerous international organizations provide technical and financial assistance to countries to carry out activities aimed to promote the conservation and sustainable utilization of plant genetic resources for food and agriculture (PGRFA). Within the context of the Global System (see CPGR/93/5) which aims to enhance cooperation and coordination of efforts at the global level in the field of PGRFA the present document provides the Commission with information on the activities and programmes relevant to PGRFA of FAO and IBPGR as well as of a number of other relevant organizations. The Commission is invited to review the activities presented, and to make recommendations and comments as appropriate.

2. The Commission on Plant Genetic Resources, in line with its mandate, has regularly reviewed the policy, programme and activities of FAO in the field of plant genetic resources. Consolidated reports on FAO activities have been regularly provided to the Commission. IBPGR has also made regular reports on its activities and programmes to the Commission since 1989. Following the signing of the Memorandum of Understanding between FAO and IBPGR in 1990, a report on the joint FAO/IBPGR Programme was made to the Commission in 1991.

3. At its Fourth Session, the Commission requested the FAO Secretariat to invite other organizations working in the field of plant genetic resources to report on their programmes and activities on the conservation and use of plant genetic resources. It was considered that such reports "would be of value both to the Commission, and to those organizations which would thereby be able to better acquaint countries that are donors of germplasm and funds with their objectives and programmes, and benefit from their comments" (CPGR/91/Rep. Para 111). A letter from the Director-General invited contributions from United Nations Development Programme (UNDP), the UN Educational, Scientific and Cultural Organization (UNESCO), the U.N. Industrial Development Organization (UNIDO), the UN Environment Programme (UNEP), the World Bank, a number of International Agricultural Research Centres of the Consultative Group on International Agricultural Research (CGIAR), the International Union for the Conservation of Nature and Natural Resources (IUCN) and the World Wide Fund for Nature (WWF). At the time of preparing this report, UNESCO, UNEP, UNIDO, IUCN, WWF and the following CGIAR institutes have provided written reports: the International Centre for Agricultural Research in Dry Areas (ICARDA); the International Centre for Research in Agroforestry (ICRAF); the International Centre for Tropical Agriculture (CIAT); the International Centre for Maize and Wheat Improvement (CIMMYT); the International Livestock Centre for Africa (ILCA); the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT); the International Institute of Tropical Agriculture (IITA); the International Rice Research Institute (IRRI); the International Potato Centre (CIP); and the West Africa Rice

Development Association (WARDA). The reports received from such organizations are reproduced in this document.

4. Each one of the organizations cited in the above paragraph is fully responsible for the reports on its own activities which have been transcribed in this document.

II. FAO ACTIVITIES 1991-92 & FUTURE PROGRAMME

5. FAO's work on PGR encompasses four types of activities, related to the four main tasks of the organization: (i) it provides through its Commission on PGR an intergovernmental forum for discussion and negotiation, (ii) it provides policy guidance through internationally agreed documents (e.g. International Undertaking and its annexes, Codes of Conduct on PGR and related technologies, international standards for genebanks, Farmers' Rights, etc.) (see CPGR/93/5, CPGR/93/8 and CPGR/93/9), (iii) it collects, analyzes and disseminates information through its World Information and Early Warning System on PGR (see CPGR/93/5) and (iv) it provides technical assistance to developing countries.

6. Documents provided to previous meetings of the Commission (CPGR/89/5 & CPGR/91/8) summarize FAO's technical assistance provided to member countries , and related activities in the area of plant genetic resources of interest to food and agriculture (PGRFA), since its founding in 1945 to 1990. At the end of this section an outline of FAO's future programme in the field of plant gentetic resources is presented.

7. This section focuses mainly on technical assistance and related activities provided by FAO during the period 1991-1992. During 1991-92 FAO has provided support to countries on matters related to the conservation and utilization of PGR including *in situ* and *ex situ* conservation as well as plant breeding and seed production.

8. A strength of FAO activities in the conservation and utilization of PGR is that it is integrated into a broad framework of programmes and strategies to address the needs of member countries for research and sustainable agricultural and forestry development in general. These activities on crop and forest genetic resources, together with those on animal and fishery genetic resources, and environmental issues related to biological diversity are coordinated within FAO through an inter-departmental working group on biodiversity.

Crop Genetic Resources Activities

9. The FAO programme on plant genetic resources is based on a "farmers to farmers" approach, which covers a wide range of activities from the collection of genetic diversity in the farmers fields, the evaluation and selection of accessions for genetic enhancement

and improvement using classical plant breeding and/or modern biotechnologies, the development of high yielding varieties and hybrids, to the production of newly developed materials and its distribution to farmers. Emphasis is on the strengthening of national capacities.

10. Using funds from both its Regular and Field Programmes, FAO has provided technical assistance to member countries, especially developing nations, for programmes related to the policy, legal and technical issues of plant genetic resources conservation and utilization. The primary objective of FAO's support is to optimize the benefit from the world's genetic resources while safeguarding their conservation. This includes development measures to facilitate conservation through international and regional networks of *in situ* conservation areas, *ex-situ* base collections under the auspices of FAO, and of on farm conservation, evaluation, enhancement, management and use of plant genetic resources of importance for food and sustainable agriculture, including the development of improved crop varieties and seed production and distribution. Activities on PGR carried out in cooperation with IBPGR are detailed in Section III.

11. During 1991-92, FAO continued to support projects aimed at strengthening the national programmes on using germplasm and related technologies including advanced *in-vitro* techniques and gene manipulation. Examples include the development of new cultivars and hybrids of rice, oil seeds, *Brassicas* and vegetable crops in Viet Nam and India. Activities were also continued in the Republic of Korea (to strengthen the management of the national genebank), Turkey (development of an active genebank), and St. Vincent and Grenadines (upgrading of existing botanical gardens to improve the use of genetic diversity). The activities included provision of technical advice, equipment for seed storage, hands-on training and study tours. A programme in Yugoslavia to develop a new genebank was temporarily suspended.

12. During 1991-92 new activities were developed in Cuba and Guyana. Financial and technical assistance were provided to Cuba for the *in vitro* conservation of sugar cane germplasm, and to Guyana to conserve and evaluate germplasm and to develop as well as to produce high-yielding, well adapted varieties of rice, root and tuber crops, grain legumes and selected fruit trees. Technical assistance to develop proposals regarding germplasm conservation and utilization which might result in new projects funded by various sources was provided to China, Democratic People's Republic of Korea, Costa Rica, Mexico and Nigeria. FAO has been supporting several countries such as Brazil, Colombia, India and Viet Nam in exploring the potential and suitability of hybrid rice for their production systems and ecological conditions.

13. Besides these, several of FAO field projects in the area of integrated rural development have components which enhance conservation and utilization of plant genetic resources. In the field of crop improvement and management there were more than 300 national and regional projects involving support to national variety

development programmes and/or the transfer of improved crop germplasm to farmers. One such example was support to food legume and maize improvement in Zambia. Another example was a regional cooperation network on food legumes and coarse grains, involving many Asian countries.

14. In the area of seed development and production, during 1991-92 FAO provided support to over 100 projects in more than 70 countries[1]. Using Funds from UNDP and from bilateral donors through FAO's Field Programme, assistance was provided to countries for the development of their national policies and programmes on seed technology, processing, marketing and storage.

15. Using the funds provided by a U.S.A. non-governmental organization (NGO), through the FAO Fund on PGR over 2 500 accessions of teff germplasm (local crop of Ethiopia) were evaluated and elite materials were selected for further improvement. A catalogue of the teff germplasm including evaluation results has been published. Funds raised through an NGO popular campaign resulted in numerous small contributions from private individuals all over the world that were deposited in the FAO Fund on PGR and these funds will be utilized in promoting, through "diversity fairs", on-farm diversification and conservation of PGR in local communities in the Andean zone. Using funds provided by a German NGO, FAO is supporting, through another NGO in India, a project on the establishment of community genebanks and on-farm conservation in parts of India. The experience gained will be used in similar projects elsewhere.

16. Regional training activities were carried out with the support of specific donors as follows:

- In Argentina for 25 participants of the Latin America and Caribbean region on seed quality control, funded by the Government of Spain;
- In Cuba for 26 participants of the Latin America and Caribbean region on modern plant breeding and multiplication techniques of asexually reproduced crops, funded by the Government of France;
- In Mali for 20 participants of the Sub-Saharan Africa region on seed quality control, funded by the Government of Austria;
- Training activities in the Asia region were carried out under the aegis of a project funded by DANIDA for a total of 190 participants in seven national courses in Indonesia, Pakistan, Philippines, Sri Lanka and Thailand;
- A seminar for Mahgrebian countries was held on seed policies and programmes and attended by 25 participants;

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1. The recipient countries include Afghanistan, Angola, Antigua and Barbuda, Argentina, Bangladesh, Barbados, Belize, Benin, Bhutan, Bolivia, Brazil, Burkina Faso, Cambodia, Cameroon, Cape Verde, Central Africa, Chad, Chile, China P.R., Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Ethiopia, Grenada, Guinea, Guinea-Bissau, Guyana, Haiti,India,Indonesia, Iraq, Jordan, Laos, Lebanon, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mexico, Montserrat, Mozambique, Myanmar, Nepal, Nicaragua, Nigeria, Pakistan, Paraguay, Peru, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Somalia, Sudan, Suriname, Swaziland, Tanzania, Thailand, Trinidad & Tobago, Tunisia, Turkey, Uganda, Uruguay, Viet Nam, Yemen, Zaire and Zambia.

17. National training courses on seed technology and production were held in the Dominican Republic, El Salvador, Guinea, Malawi, Niger, Paraguay, Tanzania and Swaziland.

18. FAO also sponsors and coordinates the "Technical Cooperation Network on Plant Biotechnology" (REDBIO), the main objective of which is to facilitate the application of new technologies to crops of social and economic importance in Latin America and the Caribbean. REDBIO comprises over 200 laboratories in 18 countries. Besides this, FAO organized an expert consultation in mid-1992 to explore this application of molecular genetics to the development of cassava germplasm with improved post-harvest storability. A Latin American and the Caribbean Expert Working Group met in Santiago in December 1991 to develop a draft Code of Conduct on Plant Biotechnology. Within the context of the First Congress on Ethnobotany FAO and the Botanic Gardens of Cordoba cosponsored a symposium on under-utilized plant genetic resources in Latin America and jointly published a book *Cultivos Marginados: otra perpectiva de 1492.*

Activities on Forest Genetic Resources

19. In forestry, the main aim is to assist member countries in harmonizing conservation of forest genetic resources with their sustainable utilization, in incorporating genetic resources conservation concerns into tree breeding programmes and in becoming self-sufficient in the development and production of high quality genetic materials for planting.

20. The FAO activities, guided by the Panel of Experts on Forest Genetic Resources, focused largely on collaboration with national institutes through direct contact, correspondence, contractual agreements, dissemination of information and facilitation of exchange of germplasm. Through Regular Programme contributions to institutes in Indonesia, Brazil and Peru, FAO supported the establishment and management of pilot *in situ* conservation areas and research underpinning such conservation efforts. Similar contracts to support exploration and the collection of reproductive materials of forest trees and shrubs for field evaluation in internationally coordinated provenance trials and for research and conservation purposes, were established with institutes in Argentina, China, Chile, India, Peru, Senegal, Thailand, Turkey, a number of Maghreb countries and, through collaboration with the Centre Technique Forestier Tropical, CTFT/CIRAD (France), with a number of West African countries. Collaboration with and contributions to the Commonwealth Scientific and Industrial Research Organization, CSIRO (Australia) and the DANIDA Forest Tree Seed Centre, were specifically aimed at facilitating the availability and provision of seed and other reproductive materials to developing countries.

21. Among FAO coordinated field projects, support was continued to a strategically and methodologically important project related to the establishment and development of National Tree Seed Centres in the Sahelian zone countries of Africa, complemented

more recently by the elaboration of a sub-regional project in support of such centres, based at the Permanent Inter-state Committee for Drought Control in the Sahel (CILSS). Through cooperation with national authorities and relevant regional organizations, FAO has assisted within the framework of this project in the formulation of 15 country-specific project documents, in which the establishment of seed centres are complemented by activities in tree breeding, carried out with due concern for genetic conservation aspects. Similar regional forest genetic resources projects are operational in Asia and Latin America, in the former case focusing on dissemination and use of new technologies in conservation and forest tree breeding, in the latter case on the management of protected areas.

22. FAO has continued to be closely involved in the development of a European network on forest genetic resources, initiated following a Ministerial Conference on Forest Protection in Europe in December 1990; and in the preparations for the Second Ministerial Conference, in which a Resolution on the conservation of biodiversity is expected to be passed to complement the earlier Resolution on genetic resources.

23. Collaboration and coordination of activities were continued with other international institutes active in the genetic resources field, notably Unesco, UNEP and IUCN under the overall umbrella of the Ecosystem Conservation Group. FAO also collaborated with the International Tropical Timber Organization (ITTO) in the development of Guidelines for Conservation of Biodiversity in Production Forests. Involvement of activities of UNCED are reported on below.

24. International meetings of particular relevance included the 10th World Forestry Congress (Paris September 1991), attended by more than 2,500 foresters and forestry decision makers from 136 countries, and convened under the theme "Forests, a Heritage for the Future". The FAO Committee on Forest Development in the Tropics, in its 10th Session in December 1991, focused on sustainable management of the tropical forest, a subject of direct and major relevance to the issue of genetic conservation. FAO further provided technical support to a number of meetings organized by national institutes in collaboration with the Organization, including the International Symposium on Seed Procurement and Legal Regulations for Forest Reproductive Materials in Tropical and Sub-Tropical Countries (Nairobi, Kenya October 1992); and the Symposium on Tree Seeds (Ougadougou, Burkina Faso November 1992).

25. Over the past years considerable emphasis has been laid on the dissemination of information at policy-making, technical and grassroots levels. Work related to *in situ* conservation included the development of guidelines for the compatibilization of forest management for productive purposes with the conservation *in situ* of forest genetic resources; complemented by the production of guidelines on the role of *ex situ* conservation in long-lived, outcrossing forest species. A great number of individuals and institutes, worldwide, provided inputs and information for these two studies. Technical information produced further included publication of the FAO Forestry

Paper, "A Guide to Forest Seed Handling"; and the Conservation Guide, "Natural Parks Planning: a manual and annotated examples".

26. An FAO André Meyer Fellowship was awarded in 1991-1992 in the field of Biotechnologies in Forest Tree Improvement. The study undertaken closely linked the development and use of new technologies also to genetic conservation issues. Results and findings will be published in 1993 in an FAO Forestry Paper.

Legal Activities

27. In addition to its legal support to the Global System and related activities in other international fora, FAO continues to provide, at the national level, advice to countries in the formulation of national strategies, policies and legislation in the area of plant genetic resources and related matters. During 1991-92, at the request of the *Communauté Economique des pays des Grand Lacs* (CEPGL), the FAO Legal Office provided legal advice to Burundi, Rwanda and Zaire related to the control of their exchanges of seeds. The Office provided advice to Madagascar on the legislation related to the production, trade and exchange of seeds.

Activities at the Global Level

28. FAO continues to provide the Secretariat for the Commission on PGR and its Working Group. The Secretariat coordinates the follow-up and implementation of recommendations made and decisions taken by the Commission, including the development of the FAO Global System on PGR as detailed in document CPGR/93/5. The Secretariat which is located within the Seeds and PGR Service of the Plant Production and Protection Division is also assisted by other services in FAO, particularly the Forestry Department on *in situ* conservation and forest genetic resources, and the Legal Office in the elaboration of international agreements, which, in 1991-92 included the refining of the International Undertaking on Plant Genetic Resources through the adoption of Resolution 3/91 by FAO Conference as well as the finalization of the draft code of conduct for plant germplasm collecting and transfer, further elaboration of elements for a draft code of conduct on Plant Biotechnology, and taking further steps for the realization of the farmers' rights.

29. During the 1991-92 biennium FAO played an active role in the negotiations related to the Convention on Biological Diversity and the preparatory committee meetings of the United Nations Conference on Environment and Development (UNCED). FAO was also involved in the development of the "non-legally binding authoritative statement of Principles for a Global Consensus on the Management, Conservation and Sustainable Development of all types of forests". Following the UNCED, the Secretariat was involved in the initiation of discussions on the implementation of decisions of UNCED relevant to PGRFA. Also during 1992, preparations were made for the preparatory process of the International Conference on Plant Genetic Resources. An expert

consultation was held to advise on the preparatory process and a project document was subsequently prepared (see CPGR/93/10).

30. In 1991-92 the Secretariat was involved in the further development of the FAO Global System on PGR as detailed in document CPGR/93/5. In line with the request of the Commission and with the Agenda 21 of UNCED, a World Information and Early Warning System on Plant Genetic Resources is being established[2]. A questionnaire was sent out in mid-1992 and the responses are now being received for analysis (see CPGR/93/5 part III). Work related to the Conservation *in situ* and *ex situ* of forest genetic resources including the development of strategies for a network of *in situ* conservation areas and to the development and sustainable utilization of these resources was continued within the framework of the FAO Panel of Experts on Forest Genetic Resources. The Secretariat also supported the convening of the seventh session of the Working Group of the Commission from 22 to 23 October 1992 in Rome.

31. FAO continues to produce periodical publications, including the Seed Review, the FAO/IBPGR Plant Genetic Resources Newsletter and the annual FAO Newsletter "Forest Genetic Resources Information" complemented by newsletters published by FAO Regional Offices in Latin America, Africa and Asia. These publications also include information on new developments in biotechnology and their possible impact.

Future Activities and Programme

32. Programmes and activities in plant genetic resources will be carried out in line with recommendations of Agenda 21 of UNCED to aim at the strengthening of the global system on plant genetic resources and the implementation of the programme area on the "Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Sustainable Agriculture". This will also include assisting countries in the implementation of the Conservation on Biological Diversity in relation to PGRFA. The programmes and activities of FAO will be implemented at country, regional and global levels:

- at country level, FAO will continue to promote the establishment, or the strengthening of national capability and capacities to conserve, manage and utilize plant genetic diversity, including crop diversification and the promotion and use of under-utilized species and multi-purpose species; special emphasis is given to species which are not covered by CGIAR mandates;
- at regional and global levels, efforts will continue to the further development of international and regional network of *in-situ* conservation and *ex-situ* base collections and to promote collaboration with regional and international organizations including other UN agencies, CGIAR institutes, and NGO's in order to ensure rational utilization of plant genetic resources;

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2. The term and acronym "World Information and Early Warning System for Plant Genetic Resources (WIS/PGR)" is proposed rather than the previously used term and acronym of "Global Information and Early Warning System for Plant Genetic Resources (GIEWS/PGR)" to avoid confusion with either the "Global System" itself or the "Global Information and Early Warning System" on food security (GIEWS).

- also at the global level and in line with the principles outlined in the International Undertaking and UNCED Agenda 21, the FAO programme on Plant Genetic Resources will:
  (i) continue to provide the Secretariat for the Commission;
  (ii) continue to develop the principles contained in the International Undertaking and means for the implementation of the concept of Farmers' Rights;
  (iii) strengthen and make fully operational the Global System for the Conservation and Utilization of PGR;
  (iv) complete the development of the World Information and Early Warning System on PGR;
  (v) provide the Secretariat of the International Technical Conference on PGR and through its preparatory process, develop the first State of the World's Plant Genetic Resources and the first Global Plan of Action on PGR. These two documents will develop into budgeted projects, programmes and activities the recommendations of UNCED on PGR.

33. Financial, technical and legal assistance, within budgetary limits, will be provided to countries in order to strengthen national and regional programmes. Close contacts will be maintained in all fields with countries for identification of priorities and formulation and implementation of projects in the genetic resources collection, conservation, evaluation and utilization through plant breeding (conventional and through biotechnology), and seed production.

III. FAO/IBPGR COOPERATIVE PROGRAMME

34. There has always been a very close programmatic working relationship between FAO and IBPGR, and this was formalized through the signature, on 21 September 1990, of a Memorandum of Understanding (MOU) on Programme Cooperation between the two organizations. The purpose of this MOU is to establish a framework for programme cooperation between both organizations defining the main areas for collaboration within their respective mandates, with a view to achieving full complementarity of functions, avoiding overlaps and duplication of effort and ensuring effective cooperation in joint activities for the benefit of both Parties and for the ultimate benefit of all countries, with particular reference to developing countries (CPGR/91/Inf.4). IBPGR and FAO have cooperated in project formulation for technical assistance and also in providing consultancy services for the implementation of field projects, including advisory services for the establishment of conservation facilities in some countries. Details on the assistance to specific national programmes can be found in Sections II. B. and IV. B. This Section details joint FAO/IBPGR activities at the regional and international levels.

35. Following the recommendations of the FAO Commission, Council and Conference (1991) a joint FAO/IBPGR mission visited six countries in Central and Eastern Europe during June/July 1992, viz: Bulgaria, Czechoslovakia, Hungary, Poland, Russia and

Rumania, to identify any possible danger to the germplasm collections stored in the national genebanks. The mission reported that in the past (until 1990-91) in general, the national programmes on genetic resources were comparatively well funded, and there existed good links between national genebanks and crop breeding programmes. The mission also observed that the Council for Mutual Economic Assistance (COMECON) programme had not only helped to establish good collaborative links between participating national genetic resources programmes but also had contributed to ensuring that the national programmes were provided with sufficient support for plant genetic resource activities.

36. Following the recent changes, in most of the countries visited the support for agricultural research in general, and to the genetic resources work in particular, has been drastically reduced, in terms of both staffing and funding. In some cases, there has been a tendency to privatize agricultural research and this has had a negative impact on the continuation of funding for genebank activities and endangering the germplasm collections held by the national institutions. In some countries the situation is grave. For example, the genebank at Institute for Improvement and Plant Genetic Resources (IIPGR) at Sadovo, Bulgaria lacks funding necessary for the replacement of compressors for the genebank. In the case of Poland there was a drastic reduction in both human and financial resources for genetic resources work. In Russia, funds are insufficient to ensure the regeneration of germplasm and cold storage facilities are inadequate.

37. Using funds provided by the West African Economic Community (CEAO) to FAO, FAO jointly with IBPGR surveyed 11 countries in West Africa (Benin, Burkina Faso, Cape Verde, Chad, Côte d'Ivoire, Gambia, Guinee Bissau, Mali, Mauritania, Niger and Senegal) and identified gaps and needs in the field of conservation, management and use of plant genetic resources, with emphasis on local food and fodder crops. They prepared project documents to strengthen the national programmes and to establish a sub-regional network on conservation and sustainable utilization of genetic resources. Further details on assistance to other regional initiatives can be found in Sections II. and IV.

38. FAO and IBPGR have agreed to develop their training programmes in full consultation and cooperation. IBPGR organized a number of training courses and details can be found in Section III. B. During 1991-92 two regional training workshops, one each in Asia and Africa, were jointly sponsored by FAO and IBPGR. The first training workshop on "Conservation and Utilization of Genetic Resources of local crops of Importance in South Asia and Indo-China" was jointly organized by FAO, IBPGR and the National Bureau of Plant Genetic Resources (NBPGR) at New Delhi, India from 22 October to 11 November 1991 with a total of 18 participants from Bangladesh, Bhutan, Cambodia, India, Laos, Myanmar, Nepal, Sri Lanka and Viet Nam. The second training course on "Conservation and Utilization of Plant Genetic Resources" was co-sponsored by FAO, IBPGR and IITA. It was held at IITA, Ibadan, Nigeria from 21 September to 9 October 1992, and 14 participants from Benin, Burkina Faso, Ivory Coast, Lesotho, Mali, Nigeria, Rwanda, Sierra Leone, Tanzania and Uganda attended.

39. FAO and IBPGR have agreed to pursue and develop their cooperative programme aimed at facilitating the safe and expeditious transfer of germplasm, through the preparation of a series of crop-specific protocols and guidelines, describing disease indexing and other procedures for use by quarantine officials and scientists involved in the exchange of plant germplasm. During 1991 and 1992, guidelines were prepared and published for cassava, coconut, grapevine, sugarcane and vanilla. The guidelines for small fruits are under preparation.

40. In line with recommendations of the Commission, IBPGR, FAO and ICARDA co-organized in May 1992 a Workshop at ICARDA, Aleppo, Syria to establish WANANET (see para 37).

41. The Regional Committee on Plant Genetic Resources for Southeast Asia (RECSEA), which was established at a meeting jointly organized by IBPGR and FAO in November 1992 in Chiang Mai, Thailand, decided to become an autonomous intergovernmental body. The FAO Regional Office for Asia and Pacific (RAPA) have been requested to provide the interim Secretariat for RECSEA. Indonesia, Malaysia, Papua New Guinea, Philippines and Thailand are members of RECSEA and Singapore and Viet Nam attended the above meeting as observers.

42. A similar regional network has been proposed for the Meso-American region. The *Red Mesoamericana de Recursos Fitogeneticos* (REMARFI) will promote the conservation and, through plant breeding and biotechnology, the utilization of PGRFA in the region by: (i) supporting or establishing, as appropriate, national programmes; (ii) facilitating cooperation between them; and (iii) optimizing the use of facilities. A workshop to establish the network is being organized by CATIE, IICA, IBPGR and FAO for early 1993.

43. FAO and IBPGR, within the framework of the Memorandum of Understanding on Programme Cooperation initiated the work for the establishment of a World Information and Early Warning System. (see CPGR/93/5). FAO and IBPGR have continued to publish the quarterly FAO/IBPGR Plant Genetic Newsletter, under the guidance of a joint Editorial Committee. The standard of the articles has increased dramatically with the introduction of a review procedure.

44. Within the context of the Global System and guided by the Commission, FAO continues to develop the global network of *ex-situ* base collections including the agreements with countries and institutions to place designated germplasm under the auspices or jurisdiction of FAO. In line with the MOU, IBPGR is inviting genebanks with IBPGR designated international base collections to join the FAO network. Following the recommendations of the Fourth Session of CPGR a joint FAO/IBPGR

Expert Consultation was held in May 1992 which recommended genebank standards for endorsement by the Fifth Session of the Commission. Following an initiative from the government of Norway, FAO and IBPGR continued investigating the possibility of establishing an international seedbank under permfrost conditions in Svalbard (see CPGR/93/5). In addition IBPGR has also prepared a draft agreement for inclusion of CGIAR centres collections within the FAO international network of *ex-situ* base collections.

45. In line with the recommendations of the Fourth Session of the Commission, FAO in collaboration with IBPGR initiated discussions with the Islamic Republic of Iran for the development of strategies and programmes aimed at the conservation of genetic resources, with emphasis on *in situ* conservation. Subsequently a consultancy mission was fielded during November 1992 to Iran.

IV. IBPGR ACTIVITIES

46. The International Board for Plant Genetic Resources (IBPGR) was established in 1974 by the Consultative Group on International Agricultural Research (CGIAR). IBPGR, although operating as a CGIAR Institute, is housed in and supported by FAO.

47. In agreement with the CGIAR and FAO, action was initiated in 1990 for the establishment of the International Plant Genetic Resources Institute (IPGRI). The international status of IPGRI, which will be the legal successor to IBPGR, is conferred under an Establishment Agreement. IBPGR will continue to operate under the FAO/IBPGR MOU on Interim Financial and Administrative Arrangements until IPGRI's Headquarters Agreement with the Republic of Italy has been ratified by Italian Parliament. An Agreement between FAO, IBPGR and IPGRI has been developed to allow for the orderly administrative transition of IBPGR to IPGRI. Throughout this report, reference will be made to IBPGR for past and present activities, while the acronym IPGRI will be used for future activities.

48. IPGRI's Strategy for the future has been developed in consultation with national plant genetic resources programmes and FAO (for details, see CPGR/91/11). The Strategy of IPGRI, entitled: "Diversity for Development", outlines IPGRI's mandate, its mission and its four major objectives, which can be summarized as follows:

- IPGRI's mandate is to advance the conservation and use of plant genetic resources for the benefit of present and future generations.
- IPGRI's mission is to encourage, support and engage in activities to strengthen the conservation and use of plant genetic resources worldwide, with special emphasis on the needs of developing countries. It will work in partnership with other organizations and will undertake research, and training, and will provide scientific and technical advice, and information.
- IPGRI's four major objectives are as follows:
  a. to assist countries, particularly developing nations, to assess and meet their needs

for conservation of plant genetic resources, and to strengthen links to users of plant genetic resources.

b. to build international collaboration in the conservation and use of plant genetic resources.

c. to develop and promote improved strategies and technologies for plant genetic resources, and integrated methods of conservation.

d. to provide an information service to inform the world's genetic resources community of both practical and scientific developments in the field.

IBPGR's Activities in 1991-92

49. IBPGR has consolidated its regional activities into five Regional Groups: Sub-Saharan Africa; the Americas; Asia, the Pacific and Oceania; West Asia and North Africa; and Europe. In addition, three thematic Groups based at Headquarters: Genetic Diversity; Germplasm Maintenance and Use; and Documentation, Information and Training, provide specific expertise to the overall programme development and execution. A description of the highlights of the 1991/1992 activities of each of these eight Groups is provided in the following paragraphs.

50. In Sub-Saharan Africa numerous national plant genetic resources programmes were supported in establishing and/or expanding their national plant genetic resources infrastructure. This included, among others, assistance to Uganda and the Sudan in organizing national meetings and helping to build the facilities for the Zambian national programme. Major attention was given to supporting the regional effort in southern Africa to assist in the establishment of the Southern African Development Community (SADC, formerly SADCC) Regional Gene Bank (SRGB) in Zambia, through advice, training and collecting of plant genetic resources with the assistance of an IBPGR Collector. Another major effort was made to develop a regional programme for West Africa. In October 1992 was the CTA/IBPGR/KARI/UNEP Seminar on "Safeguarding the Genetic Basis of Africa's Traditional Crops" which set the scene for further research on "on-farm" conservation and traditional knowledge and for strengthened cooperation with NGO's.

51. For the Americas, as with other regional programmes, considerable support was extended to national plant genetic resources programmes, and in particular to Chile, Colombia, Venezuela, Peru and the countries of Central America. The Regional Office in 1991/1992 analyzed the status of plant genetic resources in Latin America and the Caribbean, and started the development of sub-regional plant genetic resources networks, which IBPGR has helped to establish under the umbrella of IICA: REMERFI (Central American Network of Plant Genetic Resources) to cover activities in Central America: Mexico, Belise, Guatemala, Nicaragua, El Salvador, Honduras, Costa Rica and Panama; REDARFIT (Andean Network of Plant Genetic Resources) to cover activities in

Bolivia, Colombia, Venezuela, Ecuador and Peru; and TROPIGEN (Amazonian Network of Plant Genetic Resources) to cover activities in the Amazon basin: Guyana, Surinam, Venezuela, Colombia, Ecuador, Peru, Bolivia and Brazil.

52. For West Asia and North Africa (WANA), in addition to assistance to national programmes, IBPGR was instrumental in the development, together with ICARDA and FAO, and establishment of the WANA Plant Genetic Resources Committee (WANA-PGRC) and the WANA Plant Genetic Resources Network (WANANET). WANA-PGRC will be the main regional forum for the identification of common problems and the formulation of specific activities to overcome them. It will open avenues of collaboration with other relevant networks, regionally and globally. The countries of the WANA region form a portion of a larger centre of crop origin and diversity, the Mediterranean basin. This presents an opportunity for linking programmes in these countries with those of the Mediterranean countries of Europe, which share agroecological conditions and genetic diversity but where resources and technologies tend to be more developed. WANA-PGRC approved the nomination of a Steering Committee on which IBPGR, ICARDA, FAO and the Arab League Centre for Studies in Arid Zones (ACSAD) will also be represented. The Steering Committee will assist six thematic Working Groups established by the network (cereals, horticulture crops, pasture and forages, food legumes, industrial crops and *in situ* conservation and biodiversity) to assess priorities, formulate projects, identify potential donors and monitor project implementation. The WANA Regional Office of IBPGR, in Aleppo, Syria, is serving as Secretariat to WANANET.

53. In Asia, assistance was provided to many national plant genetic resources programmes, including those of Bhutan, Cambodia, China, India, Indonesia, the Democratic People's Republic of Korea, Malaysia, Maldives, Mongolia, Myanmar, Nepal, the Philippines, Sri Lanka and Viet Nam. International workshops were held in China (under-utilized crops), India (okra network), Indonesia (coconut network) and Japan (buckwheat genetic resources) and sub-regional meetings were organized with national programme representatives of East Asia (in China), Southeast Asia (in Thailand) and South Asia (in Sri Lanka).

54. Since 1982, IBPGR has coordinated the European Cooperative Programme on Crop Genetic Resources Networks (ECP/GR), in which nearly all European countries cooperate through specialized crop Working Groups. All Working Groups met in the period 1990-1992 (Phase IV of ECP/GR) and continued the coordination based on centralized crop databases. In the middle of 1992, IBPGR appointed a Group Leader for the European Region, who has taken over the management of ECP/GR. A special effort was made to survey the status of genebanks in East Europe, in collaboration with FAO (for details, see Section II).

55. IBPGR's Genetic Diversity Group covers research on *in situ* and *ex situ* genetic diversity measurement, biogeography, collecting, ethnobotany and forest genetic resources. IBPGR, in collaboration with other institutes, is carrying out a number of

research projects in the genetic diversity area. During 1991 and 1992, IBPGR Collectors, and national programmes supported by IBPGR, collected approximately 10,000 samples from 20 countries. A scientific Collecting Manual, prepared in collaboration with FAO, IUCN and UNEP, will be published in early 1993. A major event, hosted by the Brazilian national programme, was the "Core Collection" Workshop in August 1992, which examined the scientific background and implications of the core collection concept. IBPGR also initiated some work, in collaboration with FAO and the Centre for International Forestry Research (CIFOR), to develop a research agenda and a database on forest genetic resources.

56. The Germplasm Maintenance and Use Group carries out research on conservation strategies and technologies, genebank management, *in vitro* conservation and plant pathology. Research on ultradry seed storage showed no harmful effects on seed of 12 species and this technique shows promise for future conservation. *In vitro* methods were successfully adapted for field collecting of citrus germplasm in Indonesia. Research continued on the development of cryopreservation methods. Work started on cryopreserving potato shoot culture. A simple, rapid procedure was developed for cryopreserving zygotic embryos of *Musa*. Immature and mature zygotic embryos of coconut, a recalcitrant seed producer, have been successfully cryopreserved. Promising results were obtained for cryopreservation of excised rubber and oil palm embryos. The FAO/IBPBR Joint Programme on the Safe Movement of Germplasm published cassava, coconut, grapevine, sugarcane and vanilla technical guidelines. A project on therapy and virus indexing on plants held *in vitro* developed two model systems for peach and strawberry diseases.

57. IBPGR's Documentation, Information and Training Group coordinates activities on germplasm documentation, library services, publications, public awareness, and training. IBPGR published 10 crop descriptor lists and updated versions of a number of directories of germplasm collections. A major effort was made in 1991 and 1992 to produce, in collaboration with the International Development Research Centre, Canada (IDRC) and the national genebanks of Kenya, Guatemala and Egypt, a self-teaching guidebook to genebank documentation with related software. which will be published in early 1993. The IBPGR Library continued to develop its collection and provide bibliographic services to staff and national programmes. An abstracts journal on plant genetic resources was started with CAB International from mid-1992. The CGIAR/IPS Latin American Public Awareness Project on Plant Genetic Resources concluded in 1991. IBPGR was given responsibility for public awareness activities for the CGIAR for the United Nations Conference on Environment and Development in 1992. Over 150,000 copies of 40 new publications were produced in 1991 and 1992 and distributed worldwide. During 1991 and 1992 approximately 100 scientists received training in plant genetic resources through a number of short courses and sponsorship of MSc Fellows. Training courses were held in several countries, including Colombia, the Democratic People's Republic of Korea, Nigeria, Russia, Turkey and Viet Nam.

V. REPORTS FROM OTHER ORGANIZATIONS, PROGRAMMES AND SPECIALIZED AGENCIES OF THE UNITED NATIONS

A. The UN Educational, Scientific and Cultural Organization (UNESCO)

The International Biosphere Reserve Network

58. Biosphere reserves are one of the various types of protected areas for *in situ* conservation and were first initiated in 1974 under the Man and the Biosphere (MAB) Programme of UNESCO. The three functions of biosphere reserves are in the *in situ* conservation of biodiversity, the long-term study of changes in ecosystems and the contribution to the sustainable development of local populations. The objective is to establish biosphere reserves in each of the major ecosystems or areas of origin of genetic resources of the world in order to ensure a maximum and systematic coverage of biodiversity.

59. As of October 1992, there are 300 biosphere reserves recognised in 75 countries. A further 13 sites located in 11 countries (of which 23 additional countries) are furthermore recommended and will be added to the network in November 1992. Many of these are important for their plant genetic resources. Examples include Changbai (China) for Korean Pine or Manatlan (Mexico) for perennial maize.

60. Biosphere reserves are proposed for international recognition by the countries in which they are located. It is the countries themselves which are responsible for protecting and managing their biosphere reserves under their own national legal and administrative arrangements. Some countries, such as Honduras, Germany, Guatemala and Mexico have found it useful to create special legislation for their biosphere reserves. There is an increasing tendency that biosphere reserves are created *ex nihilo* in areas of traditional use, thereby giving added protection to traditional cultivars and their associated weeds. Countries obviously retain full sovereignty over their biosphere reserves and accept the commitment for international cooperation and long term studies using these sites. At the request of the International Coordinating Council of the Man and the Biosphere (MAB) Programme, UNESCO is exploring how to enhance the legal status of the international biosphere reserve network, including the possibility of a UNESCO Recommendation or other form of international instrument.

61. Globally, biosphere reserves are united to form an international network - in fact the only operating network of protected areas on an intergovernmental basis - which facilitates cooperative research and monitoring, and sharing of experience. Today, with the new emphasis placed by countries to integrate environmental and developmental

concerns following the United Nations Conference on Environment and Development, the international biosphere reserve network provides a basic framework and tool for implementation of several areas of the Agenda 21. These include: cooperative studies to further knowledge on biodiversity, testing out different land management techniques and associated institutional mechanisms to attain sustainable development; monitoring changes in natural and semi-natural terrestrial and coastal ecosystems. Biosphere reserves could also be used as tools for the different studies and activities to be developed under the Convention on Biological Diversity.

62. The overall development of the international network is guided by the Action Plan for Biosphere Reserves adopted in 1986. Objective 3 on *in situ* conservation of key species and ecosystems in biosphere reserves specifically mentions the need for urgent measures for the *in situ* conservation of threatened or very important species, demonstration or management techniques for the *in situ* conservation of wild relatives of economic importance in biosphere reserves, and the need to promote exchanges of information with centres for *ex situ* conservation of selected organisms with biosphere reserves providing for their *in situ* conservation.

63. In 1990 the International Coordinating Council of the MAB programme decided to establish the Advisory Committee on Biosphere Reserves in order to consolidate the international biosphere reserve network at a time when the MAB Programme itself was under review. This Advisory Committee on Biosphere Reserves met for the first time in 27-29 April 1992; UNEP, FAO, IUCN and the International Council of Scientific Unions (ICSU) were invited to send representatives. The Advisory Committee's main recommendation was that a dual approach should be used to develop the international biosphere reserve network. On the one hand, UNESCO should continue to provide the leadership and guidance for all the biosphere reserves of the international network. On the other hand, selected suites of biosphere reserves should be used as "tools" for specific problem-oriented programmes implemented with outside IGO and NGO partners and with extrabudgetary sources. Two such programmes of relevance to plant genetic resources are described below.

64. *Diversitas*: UNESCO jointly with the International Union of Biological Sciences and the Scientific Committee on Problems of the Environment has launched this initiative to increase scientific knowledge on biodiversity, including on ecosystem function and on the origins and maintenance of biodiversity. The work on inventorying and monitoring of biodiversity is of particular interest to plant genetic resources and will be conducted in a pilot network made up mainly of biosphere reserves in selected biomes for which the operational phase is planned to start in 1993.

65. *People and Plants*: UNESCO, WWF-International and Kew Gardens have recently launched a programme to support ethnobotanists to work with local communities in tropical countries to record and study the use of wild and semi-cultivated plant resources and to promote the sustainable use of such plant resources.

66. In view of the above activities, UNESCO would like to express its willingness to cooperate with FAO in the field of plant genetic resources. To this end, it is proposed that biosphere reserves be considered as a key element in the establishment of the FAO network of *in situ* conservation areas for plant genetic resources and be incorporated in the FAO Global Plan of Action.

Plant Biotechnology

67.The UNESCO Programme on Plant Biotechnology, under the guidance of the Biotechnology Action Council (BAC), is characterised by the provision of high-level training through short-term fellowships, training courses and manuals of authenticated laboratory protocols. In 1992, the UNESCO/BAC professorship scheme was initiated for the developing and the least-developed countries. In 1992, three short-term training course in plant tissue culture and plant DNA recombinant technology were organised in Hungary, Nigeria and China. Unesco made a consultative mission to FAO in early 1992 to consolidate collaboration in the field of plant biotechnology and with the FAO-International Atomic Energy Authority (IAEA) laboratory in Vienna, at which two fellows funded by UNESCO are currently being trained.

Botany 2000

68. This joint UNESCO- International Union of Biological Sciences (IUBS) Programme will start in 1993 with the objective of facilitating the production of basal information sources in the botanical sciences through model initiatives, and to define the most appropriate mechanisms for making that information available to botanists world-wide, especially in developing countries, using innovative technology systems. Planned activities include the production of a "List of Species Names in Current Use" on the most economically important legumes and use or the latest computer technology for the delivery of taxonomic, bibliographic, descriptive, diagnostic and illustrative material to meet the needs of less developed countries.

B. United Nations Environment Programme (UNEP)

69. The World's Biological Diversity is a vast and undervalued resource. It comprises every form of life, from the tiniest microbe to the mightiest beast, and the ecosystems of which they are part. It provides humanity with a vast array of goods and services, from food, energy and materials to the genes which protect our crops and cure our diseases.

70. UNEP works both to protect individual species - and their genetic resources - and to conserve the habitats where they can continue to evolve and respond to a changing environment. The strategy adopted by UNEP is action-oriented. It calls for developing appropriate ways of maintaining maximum genetic diversity for improving agriculture,

forestry, health, industry and the environment. Special attention is paid to species with established socio-economic value.

71. In the mid-seventies, convinced that the future of humanity was bound up with the fate of the world's biological diversity in 1980, UNEP, IUCN and WWF launched the World Conservation Strategy - the first comprehensive policy statement of the link between living resource conservation and sustainable development. It became the most influential conservation document of the decade and has given birth to more than 40 national conservation strategies, integrated into national development plans. A new edition, *Caring for the world: A strategy for sustainability*, was launched in 1992. The second framework - the World Charter for Nature - was developed on the initiative of the Government of Zaire and adopted by the UN General Assembly in 1982.

72. In 1992, UNEP, jointly with the World Resources Institute (WRI) and IUCN, released the *Global Biodiversity Strategy*. The Strategy attempts to stimulate and implement action locally, nationally, and internationally, consistent with the principles, strategic elements and broad agenda for action contained in the Caring for the Earth, Agenda 21 and the Convention on Biological Diversity.

73. In 1991, UNEP initiated the preparation of national biodiversity country studies. The primary objective of the country studies is to assist national Governments to identify, in the light of social, economic, environmental and other objectives, the basic needs and levels for effective conservation, including rational use of national biological resources and necessary supportive measures and costs to meet those needs, as well as the benefits associated with the implementation of these measures. The country studies are also expected to: (a) provide an overview of the status of biological diversity, in terms of present knowledge, conservation efforts and future conservation needs and costs; (b) institutionalize national biodiversity conservation strategies and action plans to be carried out in concert with national, regional and international institutions, and within the framework of the Convention on Biological Diversity; (c) provide a basis for establishing priority areas of biological diversity conservation, and for national environmental planning and resource use; (d) identify or develop techniques and methodologies for estimating costs and benefits of biological diversity conservation; (e) enhance the national capacity to assess the direct and indirect benefits, investment costs and basic funding needs of biodiversity conservation and its rational use; (f) develop understanding among decision makers, educators, economists, social scientists and the general public of importance of safeguarding biological diversity and to engage their support in this area; and (g) secure additional parties to the recently concluded Convention on Biological Diversity and promote the effective implementation of other biodiversity-related international and regional agreements and action plans.

74. In 1992, the *Global Biodiversity: Status of the Earth's Living Resources* was compiled and published by the UNEP co-sponsored World Conservation Monitoring Center (WCMC) as a contribution to the joint UNEP/WRI/IUCN Biodiversity Programme.

The report represents a first comprehensive overview of the status, use and management of global biological resources.

75. UNEP supports the international programme for conservation of crop and tree genetic resources co-ordinated by International Board for Plant Genetic Resources (IBPGR). Their joint activities contributed to the development of training programmes at the University of Birmingham and the Vavilov All-Union Institute of Plant Industry, and to the establishment of a global network of genebanks in more than 30 countries, both developed and developing, which are co-ordinated by IBPGR and house the world's 40 base collections. More than 100 countries collaborate in this, and by 1991 over 200,000 plant samples had been collected, evaluated and deposited in the base collections. The germplasm, and information about it, is accessible to all UN member states for sustainable agricultural development.

76. The effective design and implementation of conservation programmes require a basic expertise in plant taxonomy and ancillary topics which, in the estimation of many of the international agencies concerned with conservation, has hitherto not been available through short-term training courses. With support form UNEP, a 3-month training programme is being offered for candidates from both developing and developed countries by the School of Plant Sciences, University of Reading, with contributions from the Department of Agriculture and from other departments in the University, as well as from nearby institutes. The aim of the course was to link theoretical aspects of conservation with practical applications.

77. With FAO, UNEP has undertook from the early 1980s up to 1987 pilot projects for the conservation of forest genetic resources - on site in Cameroon, Malaysia and Peru. It further supported, in collaboration with FAO, the establishment of a number of pilot off-site stands in Africa and Asia in the 1970s. UNEP concentrated particularly on the use of indigenous plant genes in rehabilitating arid and semi-arid lands. FAO and UNEP sponsor pilot projects for the conservation of endangered livestock genetic resources, focusing most of their activities on the needs and opportunities of developing countries. The two organizations have developed animal descriptor surveys, conservation methodologies and pilot genebanks, worked out training programmes, and set up databanks for genetic resources in Africa, Asia and Latin America.

78. UNEP is working with the South Pacific Regional Environment Programme (SPREP) to stop the loss of ecosystem and habitats and to protect endangered or threatened plant and animal species and to coordinate the South Pacific input into the process of developing a regional biodiversity programme. The aim, *inter alia*, is to increase awareness amongst the South Pacific countries of recent global and regional biological diversity conservation initiative and issues; develop a South Pacific consensus on the biological issues being addressed by the Convention on Biological Diversity; seek and review specific project proposals from SPREP member Governments for incorporation into and prioritization under the biological diversity conservation

programme; seek specific projects for incorporation into the Regional Avifauna Conservation Programme; and increase awareness of and seek comments on the Regional Marine Mammals Conservation Programme.

79. In conserving habitats, UNEP works closely with UNESCO's Man and the Biosphere (MAB) programme to establish a worldwide network of biosphere reserves, representing different biogeographic provinces. These reserves combine a core area of strict protection with 'buffer zones' for research, monitoring, management, education and training, and for sustainable use of natural resources. By 1991, the UNESCO-UNEP network included 286 biosphere reserves in 72 countries.

80. In Latin America and the Caribbean, UNEP and FAO have had considerable success with a project on wildlands, protected areas and wildlife management, involving 19 countries in hosting workshops, seminars and training courses. The project established a Latin American network for the exchange of information. UNEP works closely with the African Ministerial Conferences on the Environments for the establishment of an African Biodiversity Network. UNEP has helped Uganda to assess its natural resources and identify its environmental problems, and is advising Mauritius on how to save its few remaining indigenous forest and endemic plants, which are being destroyed by animals introduced from overseas.

81. The Earth's priceless reservoir of biological diversity can only be saved through international co-operation and funding, based on the implementation and introduction of a suitable new international legal instrument. Following decisions of UNEP, Governing Council, a Convention on Biological Diversity was concluded and signed by 160 countries and the European Community. UNEP provides the interim secretariat for the Convention and continued to provide secretariat services to the Ecosystem Conservation Group (ECG), comprising, besides UNEP, also FAO, UNESCO, IUCN, WWF and UNDP with the World Bank, WCMC, IBPGR and WRI as observers. Since its establishment, the Group has provided a forum for co-operation and coordination among the major United Nations and other international organizations dealing with the problems of nature conservation and national resources management and has helped to reduce duplication of effort. A total of nineteen general meetings have so far been held in addition to number of specialized meetings on sustainable agricultural development.

82. The world trade in wildlife and its products is worth billions of dollars a year and has put thousands of species at risk. UNEP provides the secretariat for the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), which entered into force in 1975 and prohibits or regulates trade in some 20,000 endangered species. By mid-1990 106 countries had joined CITES, forming a tightening chain of national and scientific management authorities. The UNEP/CITES secretariat works closely with customs officials and has published an identification manual for endangered species. In October 1989, the parties to CITES took a major step in protecting the African elephant by banning the international ivory trade.

C. United Nations Industrial Development Organization (UNIDO)

Developing medicinal and aromatic plants

83. Most of the developing countries have rich resources of diverse flora. Medicinal and aromatic plants have been traditionally used as therapeutic agents and cosmetics for long years. As a result of indiscriminate harvesting of the spontaneous flora, some species are now in danger of extinction.

84. Development of industrial utilization of medicinal and aromatic plants in developing countries was pioneered by the United Nations Industrial Development Organization (UNIDO) in the early eighties. UNIDO is currently the leading international agency; with an extensive technical assistance programme in this sector.

85. The use of plants on an industrial scale becomes viable only if raw materials are available continuously and in the required quantities. Total dependence for raw material on spontaneous flora will be detrimental to biodiversity conservation. This aspect of exploitation of forests, both by the local populace and exporters to foreign companies, was taken into consideration in developing the UNIDO programme. Projects in this sector, therefore, contained a package including systematic cultivation, domestication of wild species, genetic improvement, processing technologies and quality improvement.

86. In many developing countries where UNIDO projects had been developed, there was very little information available on the abundance of authentic identification of medicinal plants. UNIDO therefore organized mobile exploratory missions for gathering data on spontaneous flora, authenticating in making inventories or national database on indigenous medicinal and aromatic plants. Such missions were carried out in Botswana, Burundi, Rwanda and Tanzania. Turkey has developed a database on Medicinal and Aromatic Plants which is accessible to other countries. In Afghanistan and Nepal economic mapping of medicinal and aromatic plants was conducted to obtain an assessment of the number of plant species that could be profitably utilized and their relative abundance in each geographical area. The assessment of data gathered lead to identification of plants to be cultivated for industrial use and those that are endangered.

87. Systematic cultivation of selected and aromatic plant species was introduced in order to conserve spontaneous flora and the forests. A major problem was production of propagation material. As cultivation of wild flora does not yield plants having similar morphological and physiological characteristics and chemical composition, domestication of wild species had to be undertaken as a research and development activity. High yielding and disease resistant varieties were developed using macro and micro propagation methods including genetic improvement. The project in Guatemala has made a major contribution in this area. The propagation material is provided

through seed banks and nurseries that have been established in most of the developing countries with UNIDO projects.

88. UNIDO was also associated with the setting up of gardens for medicinal plants to assist conservation of useful medicinal and aromatic plants including endangered species. The counterpart institute of our project in Thailand has successfully assisted the establishment of a garden for medicinal plants.

89. In some projects, especially where yields are very important such as aromatic plants, new high yielding varieties have been introduced from abroad. This resulted in considerable increases in export earnings of Viet Nam and Tanzania. The plant materials were obtained from India and Rumania. Many of the on-going projects carry out R & D on high yielding and disease resistant varieties in order to produce the germplasm needed for systematic cultivation. Introduction of foreign improved varieties are also being encouraged.

90. Pipeline projects in Nepal and Bhutan are being planned for joint implementation with the Food and Agriculture Organization of the United Nations (FAO), the FAO will be responsible for systematic cultivation and biodiversity conservation, and UNIDO for the processing and quality assessment aspects.

91. UNIDO has taken appropriate and necessary steps to conserve spontaneous flora and biodiversity in executing its programme on industrial utilization of medicinal and aromatic plants and in accordance with the Chang Mai declaration of 1988 fully supported the slogan "Save plants that save lives".

Biotechnology

92. UNIDO recognizes that advances in biotechnology have considerable impact on the conservation and use of plant genetic resources which form an important component of global biodiversity. Modern biotechnology provides a number of techniques which facilitate this process in many ways, among which are:

1. accurate identification of the characteristics of the plant species;
2. detection of desirable characteristics in existing species, screening and selection of the most valuable of these for conservation;
3. *in situ* and *ex situ* conservation and preservation; storage of NDA libraries;
4. evolving novel biological species with superior qualities.

93. It is vital that developing countries being gene-rich should acquire competence in using these technologies to conserve and use appropriately their plant genetic resources.

94. UNIDO, through its International Centre for Genetic engineering and Biotechnology

(ICGEB) and its affiliated centres is engaged in human resources development in these frontier technologies. The ICGEB is also involving itself, through its collaborative research projects and training activities in work relating to molecular approaches to biodiversity and for promoting necessary interaction with and between affiliated centres.

95. As part of its programme on marine biotechnology, the Organization has a programme to offer technical advice to developing countries on identification, conservation and industrial and commercial opportunities in marine plants of their region.

96. UNIDO plans to assist in strengthening developing countries in utilization of bioresources in environmentally sustainable manner through its Biosafety Information Network and Advisory Services.

Other work

97. The Organization aims to facilitate access of information on global biodiversity by contributing in evolving multiple information networks on biodiversity.

98. UNIDO regularly participates in the meetings on biodiversity concerning plant genetic resources. The Organization indeed made active contributions to the biodiversity convention of UNEP.

VI. REPORTS FROM INTERNATIONAL NON-GOVERNMENTAL ORGANIZATIONS

A. The World Conservation Union (IUCN)

99. The conservation of plant genetic resources was recognized by IUCN as one of the major themes of its Plant Conservation Programme.

100. Major activities have included:

1. Field studies of crop gene pools such as *Mangifera* (mango) in Kalimantan, Sabah and Sarawak and *Phaseolus* in Central America, in collaboration with IBPGR.
2. Preparation of a major handbook, on the world's principal Centres of Plant Diversity, financed by the UK ODA, the EC and WWF, consisting of 15 regional overviews and over 250 detailed data sheets for individual sites of high plant diversity, including information on genetic resources. The work will be published by Oxford University Press.
3. Contribution to the preparation of the Global Biodiversity Strategy and drafting of

the chapters covering genetic resource conservation.

4. Development of a strategy for the conservation of genetic resources of medicinal plants and cooperation with WHO and WWF in developing Guidelines for Medicinal Plant Conservation.
5. Preparation of Report on Species and Global Change, including a section on plant genetic resources.
6. In association with Botanic Gardens Conservation International (BGCI), development of a strategy for the conservation of germplasm of wild species.
7. In association with IBPGR and WWF, preparation of a booklet, Conserving the Wild Relatives of Crops.
8. Contribution to the preparation of the booklet Plant Genetic Resources (FAO, 1989) as a member of the Ecosystems Conservation Group *ad hoc* Committee on *in situ* conservation of plant genetic resources.
9. Participation in the work of the Council of Europe Group of Specialists on Biodiversity and Biosubsistence and in the organization of a Workshop on Conserving the Wild Progenitors of Crop Species in Europe.
10. Participation in the organization of the Congress *Etnobotánica '92*.
11. Presentation by the Chief Scientist, Plant Conservation, IUCN, of keynote addresses on various plant genetic resource topics at international congresses and other meetings, including the role of botanic gardens in the exchange of plant genetic resources (*Etnobotánica '92*), broadening the basis of plant resources conservation (Stadler Genetics Symposium), conservation of germplasm of wild species (Roros symposium).
12. Participation in the Keystone International Dialogues Series on Plant Genetic Resources.
13. Co-organizer of an international symposium on Plant Resources in North Africa (Rabat 1987) and co-editor of the Proceedings "*Conservation des Ressources Végétales* (1991)".
14. Organizer of a Workshop on Managing Protected Areas to Conserve Genetic Resources, at the IV World Congress on National parks and Protected Areas and drafting an outline series of guidelines on the in situ conservation of genetic resources.
15. Participation of the Steering Group for establishing the Consortium for Plant Resources of the Americas (COPRA).
16. Cooperation with BGCI in development of policies and practices for the conservation of genetic resources of wild plants *ex situ*.
17. Preparation of Recovery Plans for selected plant species (IUCN Species Survival Commission Specialist Groups).
18. Chairing the Group of Experts on Plants for the Berne Convention and preparing guidelines for species recovery plans.

B. The World Wide Fund for Nature (WWF)

101. WWF seeks to promote the conservation and sustainable use of plants (annual, perennial, wild and cultivated) through practical field programs and policy work.

Field programme in plant conservation
(Africa, Asia, Latin America and Europe)

102. The priority themes are:

i) Conservation of plants in sites of high plant diversity (Plants provide a good index of overall high biodiversity). Activities may include: identification of sites; strengthening of management; land-use zonation; active *in situ* and related *ex situ* measure; databases.

ii) Sustainable use of wild plant resources: Activities may include: ethnobotanical surveys; identification of cases of exploitation; development of sustainable means of exploitation; cultivation.

iii)Control of invasive plant species.

iv)Germplasm conservation of economically important plants, notably in situ conservation of wild crop relatives and, with lower emphasis, medicinal plants and species useful for land reclamation and agroforestry.

103. Through partnership with both international organisations (e.g. UNESCO) and national bodies (e.g. ministry of environment) WWF's program aims to bring together plant scientists and local communities to document plant resources, identify conservation problems and work together to seek solutions. WWF wishes to draw local people who use wild plants more fully into conservation and development debates and the planning of land use.

Policy activities

104. Practical issues of concern to local people are a priority but WWF recognizes that some local knowledge is potentially of wider commercial interest. Indeed as genetic resources *per se* increasingly acquire potential commercial value with advances in biotechnology, the issues of ownership and control over genetic resources and technology transfer must be fairly addressed by legal systems and by codes of conducts for plant collectors. WWF is, therefore, preparing a code of ethical conduct for ethnobotanists (including organisations that sponsor and benefit from plant collection expeditions). WWF has also commissioned research on intellectual property rights and the just compensation of indigenous/rural people. "Compensation" for the use of local people's knowledge (farmers, herders, healers, fisherfolk...) and their cultural products (e.g. crops varieties, medicinal plants, technological innovations...) can be constructed in two different ways:

- as counter-intellectual property rights invested in either local communities or individuals

- as socio-economic rights that combine human and environmental rights with

development rights

105. WWF's research will review the different legal instruments that can be used to support each of these options and will examine their potential for compensation of indigenous/rural people.

106. Lastly, WWF has undertaken a joint research program with the International Institute for Environment and Development (IIED) to examine the importance of wild plants and other wild foods (e.g. fungi, edible insects, bushmeat) in different agricultural systems. Conventional agricultural and forestry research tends to focus on major crops (e.g. maize, rice, potatoes, timber etc.) without assessing the role of other foods within complex agroecosystems - let alone the importance of conserving these resources for present and future use. Yet, these hidden resources often significantly contribute to the welfare of poorer social groups through cash income or meeting dietary needs.

107. Implications for common property resource management, biodiversity conservation and food security for vulnerable groups (especially women, who often gather and market wild products) will be drawn out by case studies undertaken in Africa, Asia, and Eastern Europe. The research will highlight the importance of the "Hidden Harvest", and the need to conserve diverse wild resources, in the context of agricultural research and development.

VII. REPORTS FROM THE INTERNATIONAL AGRICULTURAL RESEARCH CENTRES

A. The International Centre for Agricultural Research in Dry Areas (ICARDA)

Rationale

108. The West Asia and North Africa (WANA) region is the center of origin and primary diversity of some of the world's major food crops, including those under ICARDA's mandate - wheat, barley, chickpea, lentil and faba bean, as well as several important natural pasture and forage legume species. The genetic resources originating form WANA region have a global importance for crop improvement and related research and for providing basic material for the development of improved germplasm adapted to the farming systems in the region. Due to several factors, the genetic diversity of these plants is endangered. Conserving the indigenous germplasm and evaluating its usefulness is an important task for ICARDA.

Goal

109. To collect, acquire, conserve, evaluate, document and promote the use of the genetic resources of barley, wheat, lentil, chickpea, faba bean and pasture and forage legume species originating in the WANA region.

Achievements

110. The number of plant accessions now held at ICARDA totals 90 000. Of these, some 60 000 originate from the WANA region and 17 000 have been collected in 50 missions organized by the Center. Germplasm has been characterized and evaluated for a number of descriptors, and catalogs for barley, durum wheat, lentil, faba bean and chickpea have been published. In 1989 new cold storage facilities became operational for the both the medium-term active collection and the long-term base collection. By the end of 1992 the whole active collections and 50 000 accessions of the base collection will have been transferred to new cold stores. All passport information have been computerized and a data base management system (DBMS) for running the databases on PCs has been developed and introduced. Safety duplications have been made for wheat, barley and their wild relatives at CIMMYT, for kabuli chickpea at ICRISAT, for faba bean at the Federal Institute of Agrobiology, Austria, and for lentil at NBPGR, India. The utilization of the genetic resources held at ICARDA has been enhanced through closer interaction with national programs in the region. In 1991, some 24 000 seed samples were distributed, of these 8 000 to the users at the national programs in the WANA region.

Future Approaches

111. The emphasis in germplasm work will gradually shift away from collection and conservation to characterization and evaluation. The focus will continue to be on ICARDA's mandate crops, and on germplasm indigenous to West Asia and North Africa, with special emphasis on areas where key stresses are experienced, and on landraces, wild relative and primitive forms of crops. An important initiative will be to 'repatriate' to the region and the national programs germplasm collections made in WANA in the past and now held in other parts of the world. Another initiative will be to assess the feasibility of different conservation strategies, with special emphasis on *in situ* conservation.

112. Close collaboration with IBPGR and FAO Commission on Plant Genetic Resources will be maintained to coordinate activities and develop joint ones as appropriate.

B. International Centre for Research in Agroforestry (ICRAF)

113. The Multipurpose Tree Germplasm Resource Centre (MPT-GRC) is a new development at ICRAF whose objective is "to explore, collect, document and conserve germplasm of priority species and facilitate the supply and exchange of research quantities of germplasm to collaborating institutions". ICRAF became a member of the CGIAR system in May 1991.

114. In 1991 ICRAF identified a need for a focal point to address MPT germplasm requirement for agroforestry research. In June 1992 ICRAF organised a consultative meeting to discuss plans for the development of an MPT-GRC. This meeting included representatives from IARCS, regional seed centres, NARS and donors. These stakeholders strongly recommended collaboration with relevant national, regional and international centres in germplasm acquisition and training. They supported the GRC's proposed role in germplasm collection, *ex situ* conservation, information, training and genetic research on MPTs.

115. Staff and Facilities: The MPT-GRC has started slowly with one international and one national staff member. Facilities for the MPT-GRC are expected to be complete by the end of 1995.

116. Operations: The MPT-GRC collaborates with other scientists within the ICRAF-MPT improvement programme to organise collections of priority MPTs. World-wide over 20 MPT species have been tentatively identified and collections will commence with *Sesbania sesban*, in southern Africa, mid-1993. The Centre currently facilitates seed acquisition for ICRAF staff and collaborators (for research purposes). ICRAF staff in Nigeria are collaborating with IITA and the MPT-GRC to secure research samples of priority indigenous MPTs. The MPT database, a descriptive database on about 1000 MRT species is also currently housed administratively within the MPT-GRC.

C. The International Centre for Tropical Agriculture (CIAT)

117. The International Center for Tropical Agriculture (CIAT) is dedicated to the alleviation of hunger and poverty in developing countries of the tropics by applying science to agriculture to increase production while sustaining the natural resource base. Germplasm conservation is a key element for CIAT's mission.

118. The network of CGIAR Centers has assigned CIAT the responsibility of preserving the germplasm of *Phaseolus* beans, cassava (genus *Manihot*), and tropical forages, which include a wide range of legume and grass species adapted to low fertility, acid soils.

119. *The germplasm collection.* CIAT has achieved its mission of assembling the world's

largest, most comprehensive collection of germplasm of the crops for which it has assumed responsibility. The collections are managed under the concept of trusteeship with national programs. CIAT serves as a custodian of the world collection. Consultation with FAO is under way to formalize the custodian/trusteeship status.

120. The *Phaseolus* bean collection consists of about 36,000 accessions. Of those, 26,851 accessions, including 5 domesticated and 22 wild species, are available for distribution. CIAT has preserved more than 20,000 forage accessions of more than 750 wild legume and grass species. Two-thirds of these accessions are now available for distribution. Most are from regions with acidic, low-fertility soils. The 5,500 cassava accessions are mostly cultivated clones of *Manihot esculenta*, collected in primary centers of genetic diversity in South and Central America. CIAT conserves cassava germplasm both in the field and as an *in-vitro* collection.

121. *Germplasm distribution.* Making germplasm available to users upon their request, worldwide, is a major CIAT goal. More than 65,000 bean seed samples have been distributed in 83 countries. At least 27,000 samples of forage germplasm have been sent to 71 countries. More than 4,000 cassava clones have been distributed to support national programs in 52 countries. In addition to making basic germplasm available to national programs, CIAT also served to back up those countries who, for various reasons, have lost their collections and need to recover them. CIAT's Germplasm Development Programs for beans, cassava and tropical forages use these collections to enhance germplasm for improved value, in collaboration with national program partners, to support cultivar development activities in national programs.

122. Partners in national programs have used CIAT derived germplasm to develop at least 115 bean, 39 forage, and 29 cassava improved varieties/cultivars.

123. *Enhancing use of the collections.* CIAT emphasizes a better understanding of the genetic diversity of the germplasm collections. Intensive research is under way in areas such as the origin of crops, improved observation methods, numerical taxomony of key species, use of isozymes to study genetic structures, and molecular and biochemical finger printing. Core collections recently established for *Phaseolus vulgaris* and *Manihot esculenta* may enhance our understanding, and lead to better use of the collection.

D. The International Centre for Maize and Wheat Improvement (CIMMYT)

124. CIMMYT collects, evaluates documents and maintains maize and wheat genetic resources for future and current use by agricultural researchers in developing countries and elsewhere. Each year we ship some 18,000 packets of maize and wheat seed, upon request, to scientists worldwide. Our activities are conducted in coordination with IBPGR (now IPGRI) and follow guidelines established by the FAO Commission on Plant Genetic Resources.

125. *Maize* - Maize genebank holdings, including nearly 11,000 landrace accessions, are maintained in base (i.e. long-term) and active collections. We have implemented a computerized system for storing, updating, and reporting data on these holdings. This database is available to scientists in a CD-ROM version that includes query software, allowing them to frame precise requests for samples. To facilitate the utilization and regeneration of collections of major races, we are forming "core" subsets composed of representative accessions. We are also identifying new, superior heterotic groups among landraces. Finally, maize breeders draw on bank collections for a range of useful traits, including resistance to major insect pests, drought tolerance, low nitrogen tolerance, and early maturity.

126. CIMMYT staff monitor populations of landraces and teosinte (a wild relative of maize) through regular visits to farmers' fields and natural habitats in Mexico and Guatemala. Some 1,500 accessions of another wild relative, *Tripsacum*, have been collected and are maintained on a CIMMYT experiment station in Mexico. The genetic diversity of the collections is being studied using molecular analyses to locate genome segments associated with desirable traits. CIMMYT is also coordinating a collaborative project with germplasm banks throughout Latin America and the Caribbean to regenerate important maize collections they hold and establish backup sets of the regenerated accessions.

127. *Wheat*- The wheat germplasm bank contains just over 100,000 accessions of bread, durum wheat, triticale, barley, rye, and wild relatives, representing more than 50 years of breeding and collection activities. Presently, it is an active collection, but we will soon add long-term storage facilities and develop base collections of bread wheat and triticale. All wheat genetic resources work is coordinated with the International Center for Agricultural Research in the Dry Areas (ICARDA) and IBPGR.

128. When desirable traits are found in accessions that have poor agronomic type or are very susceptible to important diseases, germplasm bank staff develop parental material suitable for the breeding programs. This "pre-breeding" normally involves intraspecific or interspecific hybrids where special techniques, such as embryo rescue, are not needed. Wide crossing adds new variability to the wheat genepool by introgressing alien genetic material through intergeneric and interspecific hybrids. In this case, embryo rescue and other special techniques are normally required and products are passed to the mainstream breeding programs in CIMMYT and in national programs. The active collection of the bank thus supports breeding at CIMMYT and in other institutions.

E. The International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)

129. The Genetic Resources Unit was established in 1979 by pooling together all the

germplasm activities and resources that existed in the crops improvement programs. The main objectives are the collection, assembly, maintenance, evaluation, documentation, conservation and distribution of the germplasm of world collections of mandate crops of ICRISAT for present and future utilization in crop genetic improvement programs. ICRISAT acts as a world repository for the genetic resources of sorghum, pearl millet, chickpea, pigeonpea, groundnut, and minor millets.

130. The progress made in germplasm activities is summarized hereunder:

	SORGHUM	PEARL	CHICKPEA	PIGEONPEA	GROUND-NUT	MINOR MILLET
Accessions assembled	33108	23862	16443	12024	13234	7144
Countries represented	88	44	42	56	90	42
Accessions evaluated:						
at ICRISAT:	29262	21231	15500	10791	12160	5077
Multiloca-tion	21534	9473	4600	5899	2500	--
Accessions documented	29262	12431	15940	10699	10000	4924
Seed samples distributed:						
at ICRISAT:						
in India:	224828	27606	119547	60710	52682	
abroad:	104481	52766	46663	32094	34087	18290
	121698	31274	48164	14941	28918	15040

131. Consistent with the high priority that the Consultative Group on International Agricultural Research (CGIAR) has placed on international collaboration on plant genetic resources, GRU liaises and collaborates in genetic resources research with NARs, the Food and Agriculture Organization of the United Nations (FAO), FAO Commission on Plant Genetic Resources, and other International Agricultural Research Centers (IARCs), particularly the International Board for Plant Genetic Resources (IBPGR).

Present Situation and Future Implications

132. The collection of germplasm from priority areas, maintenance, evaluation, documentation, conservation and distribution will continue to be the important activities of GRU. However, as we make progress in the assembly of the world's diversity of our crops, less emphasis will be given to collections aimed at securing sources for specific agronomic traits. The present and future activities of GRU will continue to have national, regional and global implications. The conserved material has a long term strategic value as long as it is maintained in a viable and dynamic state.

Impact

133. The assembly and conservation of world collections of our mandate crops is a source of continuing and long-term impact in the availability of germplasm material for crop improvement in NARSs. The ICRISAT genebank has become a reliable source of diverse germplasm of mandate crops to all who need them for utilization in crop improvement programs. Some countries such as Botswana, Cameroon, Ethiopia, Kenya, Niger, Nigeria, Somalia and Zambia have requested ICRISAT to send their entire germplasm accessions of specific crops that were conserved at ICRISAT Centre. This is a unique service, and the impact of ICRISAT genebank in replenishing national programs with their vanishing germplasm is now a reality.

134. A more visible impact can be seen in the direct contribution of landraces in improving the productivity of the mandate crops. In some cases, many germplasm accessions have been tested and released directly as superior varieties in different countries. A pigeonpea landrace (ICP 11284) collected from Nepal was released in that country as a variety "Bageswari". Three pigeonpea germplasm selections from ICP 9106, ICP 11916, and ICP 13829 are presently being considered for release in Venezuela. One of the ICRISAT sorghum germplasm lines, IS 9830, has been released in Sudan as a *Striga*-resistant variety under the name Mugawim Buda.

135. Also, many of our germplasm accessions have been used as the building blocks for numerous varieties and hybrids that are being cultivated in many parts of the world.

Future Trends and Development

136. So far, top priority has been given to the collection and assembly of germplasm of mandate crops. Presently, much emphasis is given to systematic characterization, evaluation, classification, documentation, screening, and continued maintenance and conservation. Though we must continue to collect and evaluate germplasm from remote priority areas, future emphasis will be on germplasm maintenance, long-term conservation, duplicate (base) conservation, diversification, enhancement, the search for new and desirable traits, and utilization of the conserved landraces and their wild relatives.

F. The International Institute for Tropical Agriculture (IITA)

137. The institute deals with three different groups of plant genetic resources (see also Table on next page):

i) crop species for which IITA has a specific crop improvement mandate and their wild relatives - cowpea, yams, maize, cassava, plantain and soybeans. Rice and sweet potato are also maintained even though their improvement mandate have been

transferred to WARDA and CIP respectively;

ii) african indigenous food legumes, although not within IITA's crop improvement mandate, are collected and preserved - barbara groundnut, African yam bean, Kersting's groundnut and other miscellaneous minor legumes important to Africa;

iii) cover crops, shrubs, and multipurpose tree species for use in farming systems or agroforestry research - such as *Mucuna puriens, Gliricida sepium, Cajanaus cajan, Leucaena sp., Acacia sp.* and many others.

138. Since the early 1970s, IITA has collected and evaluated germplasm for use in crop improvement. In the late 1970s, it began to collect tree and shrub species for use in alley cropping and improved fallow systems for sustaining food production. IITA's Genetic Resources Unit was established in 1975 to consolidate efforts to obtain, use and conserve such germplasm.

139. In tune with its evolving mandate within the CG system, IITA has over the past 15 years worked in close collaboration with other CG centres, particularly IBPGR, IRRI, WARDA, ICRISAT, the International Council for Research in Agroforestry (ICRAF) and CIAT as well as a few regional organizations such as the Tropical Agriculture Research Institute, France (IRAT) and the French Institute of Scientific Research for Development and Cooperation (ORSTOM). It has also collaborated with FAO and IBPGR in training national scientists and research technicians on plant genetic resources collection, use and management. Even though IITA has transferred its crop improvement mandate for sweet potato to CIP, and for rice to WARDA, it continues to conserve the germplasm of those species, in accordance with agreements reached in each case. The collection and conservation efforts have involved close cooperation with many African national programs and with national institutions in several donor countries, particularly Italy, Japan, United States and Germany. Since 1976, IITA scientists made 62 plant exploration missions to more than 30 African countries and to Brazil, always in cooperation with national programs.

140. Collections are preserved in IITA's seed bank, which was expanded and completely refurbished according to standards recommended by the IBPGR/FAO advisory committee on seed storage, during 1986-1987, with funding from the Italian Government, and in tissue culture laboratories and fields (for vegetatively propagated root and tuber crops, banana, and plantain), including arboreta (for agroforestry species). The accessions are freely available to researchers worldwide. Between 1978 and 1991, over 46,000 samples of various crop species and their wild relatives were distributed to some 80 countries worldwide. About 100,000 samples of germpasm were also provided for use by scientists within IITA.

Table: Germplasm Collections at IITA, 1992

Crop	Species	Number of accessions or samples
Major collections:		
Cowpea	*Vigna unguiculata*	15,200
Asian rice	*Orza sativa*	9,451
West African rice	*O. glaberrima*	2,600
Yams	*Dioscorea spp.*	2,500
Bambara groundnut	*V. subterranea*	2,000
Cassava	*Manihot esculenta*	1,700
Soybean	*Glycine max*	1,448
Maize	*Zea Mays*	1,200
Sweet potato	*Ipomoea batatas*	1,000
African yam bean	*Spenostylis stenocarpa*	123
Plantain and banana	*Musa spp.*	450
Crop wild relatives:		
Vigna	*Vigna (50 spp.)*	1,100
Cowpea	*V. unguiculata*	490
Rice	*Oryza*	270
Cassava	*Manihot (24 spp.)*	42
Minor collections:		
Green gram	*V. radiata*	115
Trees and shrubs	*Agroforestry species (over 100 spp.)*	300
Winged bean	*Psophocarpus tetragonobus*	27
Pigeon pea	*Cajans cajan*	25
Lima bean	*Phaseolus lunata*	24
Lablab bean	*Lablab purpures*	23
French bean	*Phaseolus vulgaris*	20
Mung bean	*Vigna mungo*	7
Jack bean	*Canavalia ensiformis*	5
Sword bean	*Canavalia gladiata*	4
Mucuna	*Mucuna puriens*	3
Mexican yam bean	*Pachyrhizus tuberosus*	3
Rice bean	*V. Umbellata*	1
Total		41,131

141. The available plant genetic resources at IITA have been successfully used for crop enhancement, IITA's improved varieties include cassava clones resistant to cassava mosaic disease and bacterial blight, maize varieties resistant to the maize streak virus, cowpeas that are extra early maturing and resistant to multiple diseases, soybean varieties with good seed storability and have promiscuous nodulation as well as resistance to bacterial pustule and lodging and plantain hybrids with resistance to black sigatoka. Among other examples that could be cited, are high-yielding, long-grained rice with resistance to *Diopsis* stem borer and rice yellow mottle virus, and sweet potato varieties with resistance to a virus disease complex and sweet potato weevil. Research on alley cropping and improved fallow systems have identified various multipurpose tree species, particularly *Gliricida sepium* and *Leucanea Luecocephala* and shrub species such as *Cajanus cajan* and *Tephrosia candida* with potential for sustaining crop production.

142. In addition, numerous sources of resistance to pests and disease have been identified from the existing germplasm collection, and they are available to national research programs.

143. IITA will continue to collect, use and preserve plant genetic resources of its mandated crops species and their wild relatives. Further expansion of the Institute's genetic resources activities to cover plant species of eco-regional importance which are beyond its current mandate will depend on resources available.

G. The International Livestock Centre for Africa (ILCA)

144. The International Livestock Centre for Africa (ILCA) has chosen to work on the conservation of biodiversity to support sustainable development and increase productivity of livestock by protecting and studying indigenous plants and livestock and using these resources in ways that do not diminish the genetic diversity of species nor harm the environment.

145. ILCA has been working with the acquisition, maintenance, characterisation and distribution of forage germplasm for over ten years and currently holds the largest collection of forage germplasm in Africa, with over 12000 accessions belonging to about 1000 species of grasses, legumes and browse. The seeds are stored at 5% moisture content and 8°C in the active genebank. Seeds of the original germplasm collected by ILCA in sub-Saharan Africa are stored at sub-zero temperatures for long-term security storage. ILCA follows the CGIAR Policy on Plant Genetic Resources and small research quantities of seeds are available free of charge from the active collection for forage research and development. About 4000 samples of seeds are distributed every year, mostly to national programmes in sub-Saharan Africa.

146. Strategic research is carried out to solve problems associated with germplasm

management, seed production and characterization of forage species. In vitro techniques have been developed for collection, conservation, multiplication and dissemination of the forage grasses *Cynodon aethiopicus, C. dactylion* and *Digitaria decumbens* and for rapid clonal multiplication of the browse species *Leucaena leucocephala, Sesbania sesban, Faidherbia albida* and *Erythrina brucei*. Research on breeding systems, floral biology and seed production capacity of *Sesbania* is in progress and interspecific hybrids have been formed between the woody species *S. sesban, S. goetzei* and *S. keniensis*.

147. ILCA has an active programme in training and dissemination of information for national programme scientists. Training is provided for up to four scientists from these programmes in germplasm management at ILCA every year and ILCA staff assist in national training courses and genetic resources planning workshops.

148. More recently ILCA began working with the characterization and conservation of indigenous African animal genetic resources in collaboration with FAO. This project is involved with the documentation of indigenous livestock breeds and the characterization of their physical, biological and adaptive attributes to develop a data base on available animal genetic resources. Many of these indigenous breeds are very well adapted to endemic diseases and environmental stress and will form an essential genepool for selection and breeding for use in improving productivity of livestock in sub-Saharan Africa for the future.

H. The International Potato Centre (CIP)

Collection

149. Potato collecting activities in Peru included two expeditions to Northern Peru. In the Department of Cajamarca, 73 accessions were obtained which comprised 5 different wild potato species. A joint collecting expedition involving the US and CIP genebanks was also carried out in SE areas of Arizona and New Mexico in the US. From the 32 accessions collected, 22 were classified as *S. fendleri* and 10 as *S. jamesii*.

150. The sweet potato collection was increased with 995 additional accessions. From these, 205 were obtained from new collecting activities in Cuba, Ecuador, Mexico, Paraguay and Peru. Another 177 accessions were donated by collaborating NARS in Paraguay, Argentina and Saint Vincent. Additionally, 613 accessions were received *in vitro* culture from the Asia Vegetable Research Development Center sweet potato collection maintained in Taiwan.

151. Other Andean root and tuber crops also were collected in collaboration with Peruvian NARS and NGOs. These comprised 128 accessions: *Oxalis tuberosa*, 42; *Ullucus tuberosum*, 26; *Tropaeolum tuberosum*, 19: *Polymnia sonchifolia*, 12; *Arracacia*

xanthorrhiza, 17; *Canna edulis*, 9; and *Mirabilis expansa*, 3.

Conservation

152. High priority has been assigned to increase the seed stock of accessions in the wild potato collection. More than 800,000 seeds were produced with the collaboration of the University of Cuzco and CIP's experiment stations at Huancayo and La Molina in Peru and in Quito, Ecuador. The collections of all the other crops under CIP's mandate continue being conserved in Peru with duplicate sets in Venezuela and Ecuador.

Evaluation

153. Studies of genetic diversity in the Andean potatoes have continued by isozyme analyses of 1,011 accessions of *Solanum tuberosum* spp. *andigena* and 178 accessions of cultivars of *S. stenotomum*. The data obtained will be used to select a Core collection of Andean potato cultivars.

154. Screening for resistance to potato tuber moth was made using tubers of 215 accessions of 42 different wild potato species. Preliminary data showed some resistance in 21% of the species studied and 71% of them had moderate resistance.

155. Duplicate identification within the 1,458 accessions of Peruvian sweet potato cultivars that remain in the collection has continued. A total of 215 accessions were clustered within 72 new groups of 2 to 9 accessions each on the basis of their morphological characters.

156. Progress has been made to characterize the sweet potato collections maintained in Saint Vincent, Jamaica, Paraguay and Argentina. These collections were obtained in these countries by joint CIP-NARS collecting expeditions.

157. Screening the sweet potato collection to identify sources of resistance to race 3 of *Meloidogyne incognita* has continued. A total of 446 accessions from 17 countries were evaluated. In addition to those reported last year, 3 resistant and 8 moderately resistant cultivars were identified. Re-evaluations on 3 resistant Peruvian cultivars to *Fusarium oxysporum* reported last year confirmed that the accessions DLP 1139 and RCB IN-95 are resistant whereas DLP 144 showed only moderate resistance. Another set of 101 accessions were also evaluated for their reaction to *Fusarium oxysporum* and *F. solani* and 14 cultivars showed resistance to both pathogens. From 186 other accessions that were screened for their reaction to *Diplodia gossypina*, only one showed a resistant reaction.

Distribution

158. Wild potato germplasm was distributed to 7 countries; cultivated Andean potato germplasm was sent to 18 countries; and *Ipomoea* species were distributed to 7 countries.

159. The sweet potato base collection maintained at CIP has been once ore useful to restore germplasm lost in national or institutional collections. Thus, this year 105 potato and 186 sweet potato cultivars were returned to the University of Ayacucho to restore collections that were severely affected by natural and man-made disasters. This university donated to the base collections at CIP, its potato collection in 1982 and its sweet potato collections in 1985.

Documentation

160. A third meeting of representatives of the potato genebanks at Braunschweig (Germany), Sturgeon Bay (Wisconsin, USA) and CIP took place in Germany in June 1992. Progress to create an "Intergenebank Potato Database" (IPD) has continued. Standardization for evaluation data on potato germplasm was accomplished and final arrangements have also been made to produce a common database with all the passport data of living materials conserved in these genebanks.

I. The International Rice Research Institute (IRRI)

Background

161. Planning for the germplasm bank at IRRI started in 1960, and the first 266 accessions were assembled in 1961. By 1970, the collection had grown to 13,000 accessions. A planning session during the 1971 Rice Breeding Symposium led to extensive collection of rices in 1972 funded by the Rockerfeller Foundation in collaboration with rice workers in germplasm-rich countries. IRRI was mandated to collect, preserve, characterize and disseminate rices from all over the world for research and crop improvement.

162. In 1977, during the inauguration of the Rice Genetic Resources Laboratory, a 5 year plan was developed by participating rice scientists at the IRRI-IBPGR Workshop on the Genetic Conservation of Rice to provide further collaboration for field collection of germplasm in targeted areas.

163. In April 1983, the International Rice Germplasm Center (IRGC) at IRRI was established. The total collection of IRGC today stands at 74,381 accessions of *O. sativa*, 2,196 of wild species and related genera, and 1,354 accessions of *O. glaberrima*. In 1991, IRGC became part of the Genetic Resources Center, along with the International Network for the Genetic Evaluation of Rice (INGER).

Germplasm collecting and acquisition

164. IRRI's direct participation in collecting during 1972-1980 in seven countries increased the IRGC collection by more than 10,150 samples. National centers and volunteer workers added more than 21,650 samples, with almost 2,500 of these coming from India during 1978. Donations of germplasm for duplicate storage in IRGC continue.

165. Exploration activities in the late 1970s by IITA, WARDA, ORSTOM, IRAT, and FAO/UNDP in collaboration with national programs increased IRGC's holdings of African germplasm. IRGC received 4,118 seed samples of *O. sativa*, 861 samples of *O. glaberrima* and 109 wild taxa of African origin.

166. The second IRRI-IBPGR Rice Germplasm Conservation Workshop was held in 1983 to identify priority collection areas, and formulate a second 5-year plan (1983-1987). IRRI continued to provide assistance in field collection and training to national germplasm scientists.

167. From the mid-1980s, IRGC germplasm collecting activities have focused on the wild species and related genera.

Conservation

168. In 1991, the genetic resources program was upgraded to meet international standards of genetic conservation, to accelerate the processing of rice germplasm into the Base Collection. Germplasm rejuvenation or multiplication is now carried out only during the dry season in Los Banos, since pest and disease pressures are low, and the quality of harvested seeds is high during this season.

169. Seed drying will be significantly enhanced in 1993 when a custom-built drying room at 15°C and 15% RH is completed. Newly-harvested seeds will equilibrate to about 6% moisture content under these conditions, ready for processing for long-term storage. Seed health and viability are constantly monitored.

170. The Base Collection will be maintained at -20°C once renovation to the genebank is completed in 1993. Approximately 100 g of rice germplasm (about 3,000 to 5,000 seeds) sealed in two aluminium cans are conserved in the Base Collection. The Active Collection is maintained at +2°C. A single 500g bulk sample per accession is sealed in an aluminium foil packet, and 10g samples are pre-packed ready for distribution.

171. Almost 60% of the IRGC collection is under "black box" duplicate safety storage at the National Seed Storage Laboratory (NSSL), Fort Collins, Colorado, U.S.A.

Documentation

172. Computerization of data started in 1976-78. A computerized data retrieval system was developed in 1976 in collaboration with IRRI's Statistics Department. Today, IRGC is using an ORACLE based information system to facilitate the storage and retrieval of information on the accessions in the genebank.

173. Complete passport data are available for 1,734 wild species accessions, 1,016 *O. glaberrima* and about 20,000 accessions of *O. sativa*. Complete characterization data on 45 morpho-agronomic traits are available for more than 36,000 accessions, while about 32,000 accessions lack information on two or more traits. The remainder have not yet been characterized.

174. Many accessions have been evaluated by IRRI scientists for reaction to 17 biotic stresses, seven abiotic stresses and grain quality. For example, more than 44,000 accessions have been screened for resistance to brown plant hopper, and almost 50,000 to bacterial blight.

Germplasm dissemination

175. From 1986 to October 1992, IRGC distributed to NARS and other international centers over 52,400 samples of *O. sativa*, 675 samples of *O. glaberrima*, and 6,650 samples of wild species. About 1,135 samples of *O. sativa*, one *O. glaberrima*, and 63 wild species were sent on request to private or commercial institutions. For IRRI's own use, we have distributed almost 226,000 samples of *O. sativa*, 227 *O. glaberrima* and 1,527 samples of wild species. National collections have been repatriated to seven countries.

176. IRGC continues to provide free access to conserved germplasm and information for research and crop improvement purposes, in accordance with stated CGIAR policy. Private and commercial institutions are required to sign a rice germplasm transfer agreement which specifies the use of the materials.

J. West Africa Rice Development Association (WARDA)

177. Before moving its headquarters from Liberia to Côte d'Ivoire in 1988, WARDA had established a Germplasm Resources Unit (GRU) in Fendall, Liberia, that included approximately 5500 rice accessions. The WARDA GRU facilities in Fendall, together with its entire germplasm collection, were destroyed in mid-1990 during civil disorders

in Liberia. Fortunately, through collaborative arrangements with the International Rice Research Institute (IRRI) in the Philippines and the International Institute for Tropical Agriculture (IITA) in Nigeria, approximately 80 percent of the WARDA collection can be recovered through duplicates maintained in collections at these other institutes.

178. In a Tripartite Memorandum of Understanding between WARDA, IRRI and IITA, it was specified that the current IITA rice germplasm collection, which currently contains approximately 12,000 accessions, will be transferred to WARDA as soon as WARDA develops the full capacity to maintain that collection. When this has been accomplished, it was agreed that the responsibility for rice GRU activities in Africa would shift entirely from IITA to WARDA.

179. WARDA has included provision for complete GRU facilities in the plan of its new main research center (MRC) in Bouake, Côte d'Ivoire. With assistance from the head of IITA's GRU, provisional plans have been developed for the construction of short, medium and long-term cold room facilities along with adequate office, computer, and seed handling space. The proposed facilities would support the storage of 22,000 samples in long-term storage (below 0- 10°C, 30% relative humidity), 10,000 samples in medium-term storage (4°C+1, 40% relative humidity), and adequate capacity to handle short-term storage requirements.

180. WARDA has approached donors to develop a three to five year plan for collaboration in rice germplasm resources beginning in 1993. Collaborative activities would initially include the design and installation of complete germplasm resource facilities at WARDA's new main research center, as well as the reconstitution, evaluation and maintenance of a complete collection of rice germplasm within WARDA. The collection will include all available African germplasm as well as a sufficient collection of non-African germplasm to adequately serve breeders within the Africa. A key component of the program is the training of national scientists in methods of germplasm conservation and the provision of technical assistance to strengthen national GRU capabilities.

181. Until the permanent GRU facilities are developed, WARDA's conservation activities will be limited to maintenance of working collections in support of WARDA breeders. Facilities to maintain working collections have already been established in Bouake, Côte d'Ivoire. In December 1992, the collection contained 5,000 accessions (19°C+1, 25% relative humidity).