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REPORTS FROM INTERNATIONAL ORGANIZATIONS ON THEIR POLICIES, PROGRAMMES AND ACTIVITIESON AGRICULTURAL BIOLOGICAL DIVERSITY

PART II: INTERNATIONAL AGRICULTURAL RESEARCH CENTRES OF THE CONSULTATIVE GROUP ON INTERNATIONAL AGRICULTURAL RESEARCH (CGIAR)

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1. Introduction

1. The Commission regularly receives reports from international organizations, including FAO, on their policies, programmes and activities for the conservation and use of plant and animal genetic resources. The Commission considers such reports to be of value, both for it and for the organizations, which are able to acquaint countries with their objectives and programmes, and benefit from their comments.

2. FAO's own activities are reported in documents CGRFA-9/02/14.1, CGRFA-9/02/14.2 and CGRFA-9/02/14.3.

3. Reports from United Nations and other Inter-governmental Organizations are contained in document CGRFA-9/02/15.1, and reports from International Non-governmental Organizations are contained in document CGRFA-9/02/15.3. This report presents an overview of the activities of the genetic resources programmes of the Centres of the CGIAR over the last three years. In the case of reports from other organizations, FAO has limited itself to compiling the reports, as submitted. Each report is fully the responsibility of the organization submitting it.

4. This is a consolidated report, reflecting input from the individual Centres, prepared on behalf of the Centres by the Secretariat of the CGIAR System-wide Genetic Resources Programme (SGRP). The System aims to contribute to global efforts to conserve genetic resources for use in agriculture, forestry and fisheries through combining the strengths of the CGIAR Centres. It encompasses crop, forage, livestock, aquatic and forest genetic resources, and facilitates cooperation among the Centres and collaboration with national agricultural research systems (NARS) and other partners, in the areas of public awareness, policy, information, knowledge and technology development, capacity-building and the conservation, sharing and restoration of genetic resources.

5. The report is in four sections: plant genetic resources for food and agriculture, farm animal genetic resources, aquatic genetic resources and forest genetic resources.

2. Plant Genetic Resources for Food and Agriculture

6. The CGIAR Genetic Resources Policy Committee and Centres welcome the adoption of the International Treaty on Plant Genetic Resources for Food and Agriculture. They note with pleasure the clear and important role the Centres have in the implementation of the Treaty, in particular with regard to the collections of plant genetic resources that they hold in trust for the world community. The Centres look forward to working in partnership with national programmes, FAO and other organizations to further the objectives and implementation of the Treaty.

7. The Centres are pleased that they were able to support the Treaty negotiations with technical assistance and inputs, represented by IPGRI. They will continue to offer technical support, in coordination with FAO, to assist national programmes with the process of ratifying and

implementing the Treaty. Centre management met with the CGIAR Secretariat and Genetic Resources Policy Committee in February 2002 to discuss implementation of the Treaty and the requirements for agreements concerning the in-trust collections. Reports emanating from these discussions and subsequent consultations with FAO, are presented in document CGRFA/MIC-1/02/8.

8. The report on the current agreements between the Centres and FAO governing the in-trust plant collections, including the status of germplasm designated under the agreements and implementation of the material transfer agreement, is provided in CGRFA-9/02/20. The present report provides an overview of developments in the plant genetic resources programmes of the Centres since 1999. It gives examples of the Centres' management of the in-trust collections and their research and support to national and international efforts in the conservation and use of plant genetic resources for sustainable agriculture and food security.

2.1 Conservation and distribution of germplasm

9. The long-term conservation of the in-trust plant collections and the supply of healthy and viable germplasm for conservation and use in research, breeding and training, constitute the primary work of the CGIAR genebanks. CIP has a new Biodiversity Complex with state-of-the-art facilities for *in vitro* conservation of potato, sweet potato and Andean roots and tubers, cold rooms for seed storage of wild potato and laboratories for germplasm processing and research, including cryopreservation. The new medium-term conservation facility at WARDA is scheduled to be operational by the end of 2002. IITA will continue to provide the long-term storage of the WARDA collection.

10. Centre scientists reviewed progress in cryopreservation technology at a workshop convened by the SGRP in 2001. IPGRI/INIBAP has embarked on its routine use of the *Musa* collection it holds, with 55 accessions cryopreserved to date. CIAT has successfully cryopreserved 280 cassava clones, with the long-term conservation of the cassava core collection as its initial objective. The continuing research needs and funds required for wide application of the technique to genebank collections led workshop participants to propose a project for large-scale testing of cryopreservation on root and tuber crop collections, and the compilation of existing protocols into a technical manual for national programmes. Research by IPGRI and partners is developing protocols for a wide range of vegetatively propagated and recalcitrant seed species, including taro, pineapple, mango and coffee.

11. The Centres are engaged in research to develop improved procedures for maintaining the integrity and quality of the genebank accessions, as well as addressing on-going requirements to monitor accession viability and health and regenerate the in-trust collections. For example, over the past two years, ICRISAT has monitored the viability of more than 100,000 accessions of sorghum, pearl millet, chickpea, pigeonpea, groundnut and finger millet, and regenerated a total of 25,789 accessions. Adjustments to the growth media for maintaining cassava *in vitro* have enabled CIAT to reduce the sub-culturing interval by 50% with a 40% saving in the cost of conserving the collection.

12. Ensuring that germplasm is free of disease is important for safe distribution and especially critical in the case of vegetative material. CIP has improved the efficiency of procedures to eliminate viruses and 66% of the in-trust collection of potato is now clean and available for distribution. Fifty-eight percent of the cassava collection at CIAT is certified as clear of viruses of quarantine importance. The *Musa* collection at IPGRI/INIBAP has been cleaned of endogenous bacterial infection and virus indexing of the entire collection should be complete by the end of 2002. CIMMYT has completed the process to clean the entire wheat collection of Karnal Bunt.

13. The SGRP has supported Centre efforts to improve the quality of records on past transfers of germplasm samples and make the information available through the System-wide Information Network for Genetic Resources (SINGER). Analysis of data on over 1 million samples distributed to users since the 1980s, - between 40,000 to 50,000 per year - shows that 80% of the recipients have been national programmes in developing countries. The genebanks also supply Centre research and crop improvement programmes, which accounts for an additional 50,000 samples a year. A considerable multiplication effort is required to meet the demand for germplasm, and this is especially costly in the case of open pollinated species and *in vitro* cultures. In 2001, IRRI distributed 16,000 samples to 31 countries and since 1999 ICRISAT has distributed 34,500 samples to 55 countries and ICARDA, 65,000 samples to 48 countries. CIP has supplied 6,630 *in vitro* samples of potato and sweet potato to over 100 countries since 1999, and distributions from IITA included 35,000 yam minitubers to countries in Africa.

14. The costs of operating the genebanks and providing an international service in germplasm distribution around the world are largely borne by core funding sources that for all Centres have fallen by 50% since 1994. This has not yet compromised the maintenance of the collections, but has prompted investigation of the costs of the genebank operations and their effectiveness in meeting the standards expected under the agreements with FAO. Studies conducted by IFPRI for SGRP have calculated the costs of managing the different crop collections held by the Centres. The in-perpetuity costs for just conserving and distributing the germplasm currently held in Centre genebanks is estimated at US $5.7 million a year. This estimate does not include the costs of fully characterizing and evaluating the germplasm to facilitate its use, nor of implementing improvements in the maintenance of the collections such as cryopreservation and better health and regeneration standards.

2.2 Germplasm acquisition, collecting and survey

15. Additions to the in-trust collections have resulted from collecting missions as well as donations from national programmes and other sources. CIAT and ILRI have received portions of the collection of the Australian Tropical Forage Genetic Resources Centre, CSIRO, to hold in the public domain. ICRAF has agreed to manage and distribute more than 4,000 accessions previously held by the Oxford Forest Institute, UK. Through a cooperative project on the regeneration of Latin American maize germplasm, CIMMYT acquired 1,321 accessions of that crop in 2000 and 1,237 in 2001, bringing the holdings of Latin American maize at CIMMYT to nearly 20,000. ICARDA received a valuable set of landraces of bread wheat, durum wheat, chickpea, lentil, faba bean and pea (3,611 accessions) donated by the Vavilov Institute, St. Petersburg, Russia. This germplasm was mostly collected before World War II by Vavilov himself, and colleagues, in the former USSR and West Asia and North Africa region.

16. CIP, IPGRI/INIBAP, IITA, IRRI, ICRISAT and WARDA have also received additions to the in-trust collections. In the case of ICRISAT this was in part from collecting missions in Mali and Tanzania. Since 1999 ICARDA has collaborated in 10 collecting missions with national programmes of the Central Asia and Caucasus region, Syria and Oman, and CIP has assisted collecting efforts for wild potato species in Peru, Honduras, Ecuador and Panama. ICRAF and national partners have made collections of a range of agroforestry species. Geographic Information Systems (GIS) tools developed with CIP have been used by IPGRI to plan collecting missions and to model and predict areas at risk of genetic erosion. They have also been used to study the possible effect of global climate change on the distributions of individual species and species diversity within crop genepools, as in the case of groundnut.

2.3 Germplasm evaluation and use

17. General agro-morphological characterization and evaluation of the in-trust collections are major on-going activities of the genebanks. This is complemented by specific evaluations carried out with Centre breeding programmes, with NARS and through international networks such as the International Network for Genetic Evaluation of Rice. Pest and disease resistance and tolerance to environmental stresses such as drought are the major focus of evaluations, with increasing attention now being paid to nutritional characters for biofortification programmes. GIS tools have been used by ICARDA to identify potential donors of abiotic stress tolerance in populations of *Triticum* and *Aegilops*. Through INGER, WARDA identified lines of the NERICA *Oryza sativa x glaberrima* cross with tolerance to acidity, iron toxicity, cold, drought and salinity.

18. Molecular and genetic characterization of the collections is increasing. CIMMYT is undertaking large-scale fingerprinting of wheat and maize. Statistical methods that combine genetic markers and phenotypic data have been developed and new data storage and analysis tools allow access to the large amounts of data that are generated. Several Centres use molecular methods to define core collections and assess the diversity and evolutionary relationships in genepools to guide breeding efforts. For example, CIP has established a new core collection of *S. tuberosum subsp. andigena*, consisting of 474 genotypes using microsatellite markers. ICRAF has studied the molecular diversity in a number of agroforestry species and ICARDA has explored the evolutionary relationships in wild wheats. ILRI has shown that genotypic difference in forages is more closely associated with rainfall regime than grazing pressure, indicating that rainfall has the greater impact on biodiversity. IPGRI found a similar relationship between intra-specific molecular diversity in wild rice and rainfall regimes in East and Southern Africa.

19. A workshop in 1999, organized by IRRI and ISNAR for SGRP, examined the application of comparative genetics for enhancing the use of genebank collections. Genome synteny provides the opportunity to more efficiently locate genes with potentially useful traits, and in particular to exploit knowledge of well characterized genomes such as rice for the improvement of minor and lesser-studied crops like millet. The Centres are developing partnerships with national programmes and specialist institutions to apply genomic and bioinformatics techniques for more effective and efficient use of genetic resources in crop improvement. In 2001, IPGRI launched the Global *Musa* Genomics Consortium to strengthen sustainable improvement of *Musa* through both targeted conventional breeding and genetic transformation.

2.4 Supporting in situ *and on-farm conservation and the sustainable use of plant genetic resources*

20. *In situ* conservation and the on-farm management and improvement of plant genetic resources are expanding areas in the programmes of most Centres. Activities encompass research on the *in situ* conservation of wild crop relatives, farmer management of landraces, farmer-participatory breeding and the introduction of new and additional diversity into farming systems.

21. IPGRI and national programmes in South America have conducted inventories of crop wild relatives and used GIS tools to map species distribution and diversity to guide decisions on protecting these resources *in situ*. ICARDA and partners in Syria have shown that regulated sheep grazing enhances the maintenance of wild *Triticum* species and annual forage legumes in semi-natural ecosystems. ICRISAT has measured the geneflow between pigeonpea and compatible wild relatives in traditional production systems in India. Geneflow was observed to be unidirectional from wild relatives to pigeonpea and contained by isolating the populations and intercropping with sorghum. These results indicate that in the event of the introduction of transgenics, the chances of an escape of transgenes into non-target organisms are remote and the risks containable by farming practices. Studies by IITA of wild yam populations in a forest reserve found no significant changes in the gene frequency for a number of morphological traits, suggesting that the reserve and locations with similar environmental conditions, would be suitable for the *in situ* conservation of wild yams.

22. A number of Centres are engaged in projects that investigate farmer practices in maintaining and managing crop diversity, and aspects of the economic, social, policy and institutional context in which on-farm conservation occurs. CIP has projects on sweetpotato in Irian Jaya, Indonesia and Andean root and tuber crops in Bolivia and Peru. In the latter project, markets and consumer demands for the crops are important aspects in sustaining the diversity in production. ICARDA coordinates a project funded by the Global Environment Facility that is investigating and supporting community-based *in situ* management of landraces and their wild relatives in Jordan, Lebanon, Syria and the Palestinian Authority. IPGRI is also involved in this project. IPGRI and partners in Guatemala, Cuba, Venezuela, Vietnam, Ghana, Ethiopia and Nepal have documented how farmers manage and use home gardens. The studies have revealed the importance of home gardens as multipurpose systems, havens of biodiversity in agriculture and active breeding grounds, and have begun to establish a clear link between home garden diversity and household livelihoods and food security. CIMMYT is continuing its research in the Oaxaca region of Mexico on farmer management and improvement of maize. A new project is looking at the structure and function of farmers' networks, in particular regarding social relations and transactions, and how this affects access to varietal diversity and seed flows, and in turn, relates to the evolution and conservation of maize genetic diversity.

23. IPGRI is working with rural communities, researchers and extension agents in nine countries to develop and refine participatory methods to understand the environmental, biological, cultural and socioeconomic factors influencing a farmer's decision to select, maintain or discard a particular crop variety. This has implications not only for the conservation of plant genetic diversity, but also for ecosystem health, human well-being and the reinforcement of cultural values. The project has been instrumental in putting *in situ* conservation onto the policy agendas in Burkina Faso, Vietnam, Morocco and Nepal. National institutions, agricultural extension workers, local communities and consumers are being sensitized to the value of local crop varieties. In 2001, IPGRI published *A Training Guide for* In situ *Conservation On-Farm* to provide national programmes with the basic skills and tools to build the institutional capacities and partnerships needed to implement an on-farm conservation programme. At a workshop in 2001, organized by CIP for the Swiss Development Cooperation and SGRP, Centre scientists, FAO and other experts, reviewed the lessons learnt from on-farm conservation research to date and identified the key policy, institutional and technical issues in providing a supportive environment for on-farm conservation and sustainable use of agricultural biodiversity.

24. Since 1999, WARDA, in collaboration with development agencies, has trained more than 1,000 rice farmers in West Africa in community-based seed production and conservation techniques. This together with the new participatory varietal selection scheme used by WARDA, is aimed at promoting on-farm conservation and use of rice germplasm. ICARDA is involved in farmer participatory breeding in seven countries (Syria, Yemen, Eritrea, Egypt, Jordan, Tunisia and Morocco). With farmers' involvement, their knowledge of the crop and their needs, breeding for specific adaptations has been more effective. ICRAF is involved in participatory tree domestication using indigenous species in 15 countries in Latin America, South East Asia and Africa. In October 2002, a workshop co-organized by the System-wide Programmes on Participatory Research and Gender Analysis for Technology Development (PRGA) and Genetic Resources (SGRP), will assess advances in the social and biological sciences shaping participatory plant breeding practice, evaluate the impacts of participatory approaches and identify key next steps for advancing the practice.

25. ILRI is promoting the adoption of forage grass, legume and fodder tree accessions for use in a range of agroecological zones and farming systems. Germplasm of more than 40 species of agroforestry trees were sourced by ICRAF and provided to farmers and nursery operators in Kenya and Uganda to broaden the tree species diversity on farm. IITA is multiplying the bambara groundnut collection it holds to enable promotion of the use of this underused and neglected crop. CIP has provided 1,329 disease-free native potato cultivars to eleven communities in the central and southern Andes. IPGRI has projects on local leafy vegetables in Africa and local fruits in the Americas and Asia that address conservation through expanding use in a sustainable manner.

IPGRI has published directories, descriptor lists and monographs on a wide range of underused food crops.

2.5 Strengthening national capacity and international cooperation in plant genetic resources conservation and use

26. The Centres provide training in all aspects of the conservation and use of genetic resources. Over the past three years, they have organized a range of workshops, regional and international courses on *ex situ* conservation, germplasm evaluation and documentation, and on-farm conservation. Numerous opportunities were provided to PhD and visiting scientists to undertake research or receive hands-on training. For example, ILRI has trained seventy scientists and technicians in genebank management, germplasm health and forage seed production, since 1999 and IPGRI has provided training to over 300 scientists. The Centres also develop training curricular and manuals, many of which are available on their Web sites. IPGRI and ISNAR are producing for SGRP a training module on law and policy relating to plant genetic resources for leaders of national programmes.

27. The Centres also support the development of national capacity through the provision of technical assistance. For example, ICARDA helped develop national infrastructure in countries of central Asia and assisted with their collecting, conservation, characterization and documentation activities through special projects and seed money under the CGIAR Program for Central Asia and the Caucasus. IPGRI has contributed to the establishment of a genebank in Libya and ICRISAT and IRRI have transferred technology for genebank management systems to national partners. Through the facilitation of national and regional workshops, IPGRI assists in national priority setting and planning, and the development of institutional arrangements for genetic resources conservation.

28. IPGRI works extensively with all the regional plant genetic resources networks. The institute was instrumental in the establishment of the network in the Pacific in 2001 and contributed with ICARDA to the creation of a network for the Central Asia and Caucasus region. IPGRI provides the coordinating secretariat for several networks, for example, the European crop genetic resources network (ECP/GR) and the recently established Genetic Resources Network for West and Central Africa (GRENWECA). Other Centres also participate in the regional plant genetic resources networks, but are primarily involved with the crop-specific networks that are focused on research and breeding. IPGRI provides secretariat or coordination support for two *Musa* networks in Africa and the networks in Asia and the Americas, and facilitates the coordination of the international network on coconut genetic resources, COGENT.

29. In their support to national and international efforts in the conservation and sustainable use of plant genetic resources, the Centres are guided by the Global Plan of Action. Over the past three years, IPGRI has assisted FAO with the development of proposed instruments for monitoring implementation of the Global Plan and all the Centres are committed to contributing to the development of the second State of the World Report. As trustees of plant genetic resources collections and major players in the promotion and development of *ex situ* conservation, the Centres are concerned about the sustainability of the estimated 6 million accessions conserved worldwide. This has led to consultations with FAO and other stakeholders on the feasibility of establishing an endowment fund to build and sustain a rational global system of *ex situ* collections, as called for in the Global Plan and Treaty.

2.6. Contributing to global information sharing on plant genetic resources

30. The System-wide Information Network for Genetic Resources (SINGER) joins the genetic resources information systems of the individual Centres, allowing them to be cross-searched through a single entry point. Available on the World Wide Web and CD-Rom since 1997, SINGER contains data on the identity, source, characteristics and distribution of the 530,000

accessions of plant genetic resources held in trust by the Centres. Over the past three years, improvements in the range and quality of passport, characterization and distribution data available, and in the functions for querying and retrieving the data (mapping, graphic and statistical features) have greatly increased SINGER's use and usability. Today, SINGER is recording, on average, more than 10,000 query sessions a month, increasingly from the breeding community.

31. Within the CGIAR, SINGER has been a leader in networking dispersed databases and setting standards and protocols to allow data exchange across different database platforms. Efforts are now in hand to integrate data generated through improvement programmes on the pedigrees and performance of germplasm. SINGER expects to play a key role in the development of comprehensive crop information systems that bring together molecular, phenotypic and performance data on genetic resources and their use.

32. The SINGER model, expertise, tools and infrastructure are increasingly being called on by groups outside of the CGIAR. SINGER has been contracted to implement the European catalogue of plant genetic resources - EURISCO - and asked by other institutions and groups to advise on the development of their information systems. A number of Centre-led pilot projects are underway to develop crop and region-based information networking, and further SINGER's objective of being a major contributor to global genetic resources information systems.

3. Farm Animal Genetic Resources

33. ILRI has worked closely with FAO over the years and its research programmes complement and support the development of the Global Strategy for the Management of Farm Animal Genetic Resources and the process for preparing the first Report on the State of the World's Animal Genetic Resources. ILRI has assisted FAO in a number of its training workshops for the Report process and FAO has assisted ILRI in the design and application of training and building partnerships to undertake research on animal genetic resources.

34. ILRI's research addresses the major tasks faced in improving the genetic potential and management of livestock in developing countries. These tasks include: quantifying the genetic diversity in indigenous farm animals and identifying which breeds are endowed with traits of potential; characterizing breeds and traits and developing strategies for the conservation of the traits and the animals carrying them; and, improving the precision and efficiency with which animals carrying desired traits can be identified and used in breeding programmes.

35. In collaboration with the UNDP/FAO/SADC project on animal genetic resources, protocols for the design, execution and analysis of on-farm breed surveys have been developed and tested in Zimbabwe. The results are being documented and these will be reproduced by FAO in the form of "Guidelines" for countries to use in surveying the characteristics and status of breeds on-farm. Training in survey methodologies was given to participants from 12 SADC counties in February 2001. Further testing of the survey protocols under different sets of circumstances is now underway in Ethiopia.

36. ILRI has identified, optimized and applied sets of DNA microsatellite markers for the characterization of a number of livestock species: cattle, sheep, goats, yak, dromedary camel and bacterial camel. Markers for assessing the genetic diversity in the chicken are under development. In collaboration with Trinity College, Dublin, ILRI has recently used the cattle microsatellite markers to unravel the history of, and evolutionary relationships amongst, African cattle breeds. This has provided the first hard genetic evidence for an African centre of cattle domestication. Genetic diversity studies of African sheep and goats are currently being documented and work on the dromedary (African) and bactrian (Asian) camel is underway.

37. ILRI has developed the Domestic Animal Genetic Resources Information System (DAGRIS) to store technical information on indigenous breeds, including bibliographic sources, to support research efforts in developing countries. In January 2002, ILRI released a prototype version on African breeds. Plans are underway to expand the system into a comprehensive decision-support tool, incorporating analytical engines that can use the stored data together with additional user-defined parameters to guide activities on farm animal genetic resources conservation and use. An agreement between ILRI and FAO outlines the complementary functions and developments of DAGRIS and the FAO DADIS, including their linkage to serve the intergovernmental, policy and research needs of the global community

38. In 2000, ILRI initiated research on methods for the valuation of farm animal genetic resources, which was identified as high priority at a joint FAO/ILRI workshop. The overall premise is that an economic assessment of the impact of genetic diversity loss may provide a basis for estimating the potential future benefits of conserving animal genetic resources and will add rationality to the biological arguments for conservation. In addition, such an assessment will help identify approaches or options for conservation and guide research and development activities. To date case studies to field- test a range of valuation methods have been conducted in Africa (Kenya, Nigeria, Burkina Faso and Côte d'Ivoire) and Latin America (Mexico). Preliminary results suggest that there are economic valuation methodologies that can be successfully applied to farm animal genetic resources and that results generated can be useful in orienting policy on conservation and use.

39. ICARDA is engaged in the characterization of small ruminant genetic resources in the regions of West Asia and North Africa (WANA) and Central Asia and the Caucasus (CAC). A workshop with FAO and ILRI, in the context of the Global Strategy helped launch this work. Records of breed characterization on-station are being compiled and analysed in eight countries in the CAC region and 11 countries of the WANA region. This work, supported in part by SGRP, is showing that the disruptions of markets, breeding schemes and production organizations in the economic transition of CAC, is leading to the loss of breeds and breed integrity. In WANA, the situation is more stable, although the intensification of production and markets is threatening some indigenous breeds.

40. ICARDA is also pursuing breed characterization on-farm in the CAC region in projects supported by USDA and the CGIAR System-wide Livestock Program, in collaboration with ILRI. It involves the monitoring of native breeds through three production seasons. The findings of these studies and the on-station research indicate that farmers in both WANA and CAC need access to new sources of diversity for the traits to cope with the intensification of markets and production.

4. Aquatic Genetic Resources

41. ICLARM pursues activities on aquatic genetic resources research, training and information through three programmes: *Genetic Enhancement and Breeding, Improvement of Freshwater Aquaculture,* and *Coastal Aquaculture and Stock Enhancement*. Through extensive partnerships and networks, ICLARM is studying the genetic resources of farmed and fished species with respect to their sustainable use and conservation, the genetic implications of stock enhancement of marine invertebrates, the population genetics of coral reef species and the dispersal of their larvae, as well as the establishment and management of marine protected areas. ICLARM is the Member Coordinator of the International Network on Genetics in Aquaculture (INGA), which has 13 developing-country members and 11 associated institute members. ICLARM hosts two global databases with information on living aquatic resources: FishBase, a biological database covering 25,465 fish species and ReefBase, covering the world's coral reefs.

42. Genetic enhancement research is focused on selective breeding methods for tilapia and carp species. ICLARM has transferred some of the work on the genetic improvement of Nile tilapia

from the Philippines to Malaysia in collaboration with national partners and a parallel programme for Nile tilapia is being carried out at ICLARM's Abbassa station in Egypt. By developing national breeding plans for Nile tilapia in Côte d'Ivoire, Egypt and Ghana, and for indigenous tilapia (*Oreochromis shiranus*) in Malawi, the transfer of technology for genetically improved farmed tilapia (GIFT) to Africa has been initiated. In Asia, six countries collaborated in a project to evaluate the local carp genetic resources that has also provided a socio-economic evaluation of the species and traits for priority attention in future enhancement programmes. In February 2002, ICLARM held an expert consultation involving national and international organizations on 'Biosafety and Environmental Impact of Genetic Enhancement and Introduction of Improved Strains/Exotics in Africa' in Nairobi, Kenya.

43. ICLARM does not undertake activities for which the collection of germplasm is a major goal or output and the institute has not established germplasm collections, except transiently to support individual research activities. Through INGA, ICLARM has facilitated germplasm transfers of improved tilapia (GIFT) and carp species within Asia and of local Nile tilapia strains between African countries. GIFT tilapia stocks for further germplasm improvement are maintained in Malaysia through collaboration with the national partner. The establishment of hatchery procedures for the conservation and stock enhancement purposes of invertebrate species (giant clams, sea cucumbers) has involved the collection of broodstock and their maintenance in land-based hatcheries. Experimental procedures for the collecting of juvenile reef fish are underway to examine grow-out techniques and of adult reef fish for genetic studies.

5. Forest Genetic Resources

44. Three CGIAR Centres, CIFOR, ICRAF and IPGRI, are engaged in activities concerning forest genetic resources. CIFOR's programme is directed to the sustainable management of forests and forestlands. ICRAF is concerned with agroforestry systems and the use and domestication of agroforestry species. IPGRI's activities emphasize the conservation and sustainable use of the genetic diversity of forest species.

45. CIFOR and IPGRI have collaborated in research on the sustainable management of forest genetic diversity. The impact of human activities on the genetic resources of tropical forest species has been investigated in projects in India, Malaysia, and Thailand. Supported in part by the SGRP, this research has shown that only the heaviest logging activities severely reduced genetic diversity and the relative level of impact depended upon the reproductive ecology of the species in question. CIFOR and the national partners are preparing a series of papers on the findings of this work. Currently, IPGRI and CIFOR are collaborating with partners in Brazil and Argentina to investigate the genetic, ecological and socio-economic aspects in the conservation and sustainable use of forest genetic resources, timber and non-timber. Findings to date are revealing how the tenure over resources of different stakeholders contributes to forest management.

46. ICRAF and IPGRI collaborate in supporting the activities of the recently created network for forest genetic resources in Africa, SAFORGEN. ICRAF also contributes to various tree seed networks. In 2001, ICRAF co-sponsored with FAO an international workshop on tree germplasm demand and supply. Version 2.0 of the Tree Seed Suppliers Directory containing information on more than 5,900 tree taxa was co-published with FAO. Together with FAO, IPGRI and national partners, status reports on forest genetic resources were developed for east African and Sahelian countries.

47. IPGRI provides the secretariat of the European forest genetic resources network, EUFORGEN. Through the network, technical guidelines on forest genetic resources management have been produced for 10 species. IPGRI has also been involved in the production of distribution maps and databases for 13 broadleaved species occurring in four countries of southeastern Europe. Activities with SAFORGEN include the organization of a meeting on medicinal trees that established a list of priority species for attention and the development of

conservation strategies for priority fodder species in Benin, food tree species in Kenya and medicinal species in Togo.

48. IPGRI is working with partners to develop and implement optimal forest tree seed handling and storage methods with the objective of ensuring the availability of a greater species diversity to foresters. With more than 20 partners from Africa, Asia and the Americas, IPGRI works to screen the desiccation tolerance and storage behaviour of selected tropical forest tree species. Three regional workshops have been organized to provide training in the screening protocol.