IPGRI

Thematic Report 2000–2001

International Plant Genetic Resources Institute

Contents

Credits

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Foreword

IPGRI's programme is complex, with many related activities going on in different parts of the world, in different projects, and on different crops. This report brings together some of these activities under selected 'themes'. Our aim is to give the reader a clearer picture of how aspects of IPGRI's diverse programme link and build more generalized understanding of issues in the conservation and use of plant genetic resources. The six stories focus on issues as diverse as cryopreservation and *in vitro* conservation of 'problem' crops, *in situ* and on-farm conservation and the policy environment that shapes the world of PGR conservation efforts. Each article provides an overview of work in the area by IPGRI and its partners: boxes, reading lists and names of contact persons provide opportunities for the reader to explore the topics further.

This volume also provides brief descriptions of achievements of all the individual activities of the IPGRI programme, and is thus a one-stop reference to the Institute's work.

The work presented here is not that of IPGRI alone, but of our many partners around the world. We wish to take this opportunity to acknowledge the contribution of our many colleagues and partners around the world: their dedication to the goal of conserving and using plant genetic resources in support of human development inspires our efforts. We also wish to acknowledge our gratitude to our many supporters, especially the donors who invest in our efforts.

Together, we are building a food-secure future on a solid foundation of plant genetic resources conservation and use.

Coosje Hoogendoorn

Deputy Director General, Programmes

Geoffrey Hawtin

Director General

Dealing with difficult plants—the role of cryopreservation and *in vitro* approaches

If all crop plants were as obliging as wheat, millet or rice, then it would just be a matter of time before their genetic resources were safely stored in a seedbank. Cereal crops—and perhaps more than 80% of all other flowering plants—produce 'orthodox' seeds that can be dried and stored in a deep freeze. For the remainder, conservation is a tougher proposition. Some species have 'recalcitrant' seeds, which can't tolerate any drying. These include many economically important tropical crops such as cocoa and rubber, mango and mahogany. Others produce seeds with intermediate behaviour: they can stand some drying but die when chilled. This group also contains valuable tropical crops, such as coffee and oil palm.

These seeds remain viable for only a few days or weeks, maybe a few months for intermediate species. Their brief lifespan hampers collecting trips and restricts the options for conserving their genetic resources. Conventional seedbanking is out of the question, leaving a choice between culturing plantlets or tissue *in vitro* and growing plants in field genebanks. The first is costly. The second leaves collections exposed to the vagaries of the weather and attack by pests and diseases.

Similar problems hinder attempts to collect and conserve seedless crops—such as most bananas—and vegetatively propagated plants, such as potatoes and many other tuberous crops. Vegetative samples are fragile and like recalcitrant seeds they may deteriorate before they reach the genebank. They are often contaminated with pathogens. Here too the choice is between *in vitro* culture and field genebanks.

Most of the problem plants are tropical and subtropical species. And with so many economically important crops and forest trees falling into this category, IPGRI has made research into better ways to collect and conserve these groups a top priority. IPGRI's partners use a range of *in vitro* techniques for culturing and growing these species, some of which are suitable for short-term conservation. But only one technology—cryopreservation—offers a safe and cost-effective means of long term storage.

Collecting plant genetic resources

Collecting trips to gather plant genetic resources can be long and arduous. If the target plants fall into the problem categories, the difficulties multiply. For the past 20 years, IPGRI and its partners have investigated *in vitro* techniques for collection.

A project coordinated by the International Coconut Genetic Resources Network (COGENT) illustrates how much can be achieved simply by refining existing techniques. Coconut is a key species in tropical regions. But its nuts are both cumbersome and recalcitrant, and much of the species' genetic diversity is scattered on remote oceanic islands. Getting germplasm safely home poses major logistical problems.

Over the past decade, several coconut research institutes established protocols for collecting embryos. The basic procedure is to open the nut, remove a plug of endosperm containing the embryo, sterilize it and then inoculate the embryo onto a suitable growth medium. The individual protocols varied in how much equipment and expertise collectors required. They all worked, but there was room for improvement. For the past four years, IPGRI and COGENT have worked to develop a standardized and improved protocol that is accessible to all. Participating labs compared the efficiency of each step in the established methods and identified the best parts of each one. They then created a 'hybrid' protocol that has doubled the efficiency of embryo culture.

Developing new strategies for *in vitro* collection is only a first step. Collectors must be familiar with the technologies and procedures and be able to adapt them to local needs. In 2001, IPGRI published a Technical Bulletin outlining methods that have proved their worth in the field. Some are cheap and simple; others are more sophisticated. Together they should allow local staff to tailor techniques to their own target species.

Coconuts following removal of a plug of endosperm containing the embryo.

Conservation: cryopreservation

Cryopreservation, in which seeds or tissue are stored in liquid nitrogen at –196°C, is the most promising strategy for conserving problem species. IPGRI promotes the technology because eventually it will offer a simple and reliable method for storing genetic resources that can't be banked the traditional way. Techniques are significantly more advanced for vegetatively propagated plants, but research with recalcitrant seeds is beginning to produce good results. In the past two years, the technology has finally begun to move from the lab to the genebank.

The International Network for the Improvement of Banana and Plantain (INIBAP) is a leader in cryopreservation. INIBAP maintains a collection of 1100 banana cultivars at the Katholieke Universiteit Leuven. For medium-term storage, staff culture sterile plantlets on a nutrient medium. Kept

under dim lights at low temperatures (16°C) these grow so slowly they need subculturing only once a year.

But for long-term storage, KU Leuven is relying on cryopreservation. When tissue is kept in liquid nitrogen, all metabolic processes essentially stop. In theory, these plant cells can be stored almost indefinitely. The challenge is to find the right procedures for cooling different tissues and cultivars. What works for one can be fatal to another.

Before plunging tissue or cells into liquid nitrogen, they must first be dehydrated to prevent damaging ice crystals forming inside the cells. Older methods relied on slow freezing to induce dehydration. Newer ones are based on 'vitrification', a treatment that transforms the cell contents into a glassy solid with the aid of special solutions that draw water from the cell. This method gives better results with a wider range of tissue types, especially embryos or shoot tips, which contain a mixture of cell types.

Coconut palm nursery.

In 2000 and 2001, the team at KU Leuven had some notable successes. The first was to successfully cryopreserve embryogenic cell suspensions from 12 banana cultivars. These cultures are the only single cells that can be reliably turned back into banana plants. They are essential for genetic engineering of banana so it is vitally important to put them into safe long-term storage. However, this type of culture can take two years to prepare and so it's not a practical proposition for conserving all 1100 accessions in the collection.

For the bulk of the cultivars, cryopreservation of meristematic tissues is a better option. They are simpler to work with and such organized tissues maintain their genetic integrity more reliably than others. Experiments with meristems cut from the shoot tips of rooted plantlets showed that simply speeding up the rate of freezing improved the regeneration rate after thawing by 50%. Unfortunately, snipping out tiny meristems is very time consuming and it would take a well-trained technician a year to cryopreserve about 30 accessions.

A quicker alternative is to work with clumps of proliferating meristems—essentially little clusters of tiny shoots. The procedure is more complicated but a skilled technician could freeze around 50 or 60 accessions a year this way, making it the most efficient method so far. By lengthening the dehydration phase, speeding up the freezing, and switching to a new growth regulator, the researchers increased the regeneration rate with this technique by some 16%.

The search for methods to conserve recalcitrant and intermediate seeds is at an earlier stage. Since 1997, IPGRI's partners at the University of Natal in Durban have been investigating whether it is possible to cryopreserve the seeds of tropical forest trees, many of which fall into the problem categories. For most of these trees nothing is known about the biology or behaviour of their seeds. So the team has been systematically screening seeds to find out exactly how sensitive they are to drying and cooling. As the researchers build up data on an increasing number of species, they hope to discover something of the biochemical mechanisms underlying recalcitrance.

Once the Durban team has identified a recalcitrant seed, the next step is to find a cryopreservation protocol that works for either the whole seed or the embryo. They have had promising results with tea, neem and papaya.

Basic research like this paves the way for more dramatic breakthroughs of the kind achieved with coffee. Two-thirds of the world's coffee production comes from one species—*Coffea arabica*. Its seeds fall into the intermediate category: they can be kept for several months before they lose their viability, but until now long-term conservation depended on field genebanks. Now, in part as a result of IPGRI sponsored research at the Institut de recherche pour le développement (IRD) in Montpellier, the world's first coffee 'cryobank' is in place at the Centro Agronómico Tropical de Investigación y Enseñanza (CATIE) in Costa Rica.

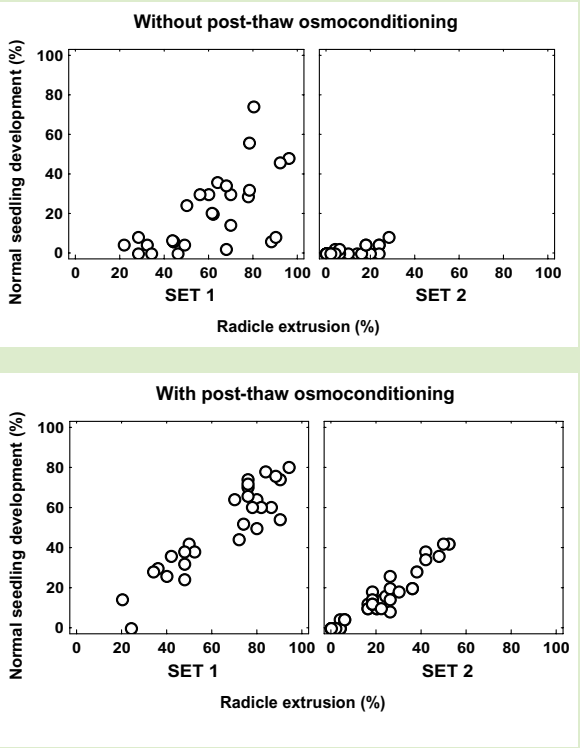
One problem the IRD scientists faced was that the coffee embryo and its nutrient reserve, the endosperm, have different sensitivities to chilling and both had to survive the procedure. After several years of experiment, the IRD's researchers had a technique that worked. The first step is to dry the seeds until they contain only 20% water by leaving them for three weeks at 78% relative humidity. Next, the seeds are slowly cooled—at 1°C a minute until they reach –50°C, at which point they are quickly immersed in liquid nitrogen. Precision is required at every step.

The key to the IRD's success, however, was the discovery that thawed seeds won't germinate if they are rehydrated too quickly. The sudden influx of water sets off the processes of germination before the seed has had time to repair damage caused by its exposure to extreme low temperature. The IRD researchers found they could control the rate of rehydration by immersing the seeds in a series of solutions of different strengths. By absorbing water in stages, the seeds can complete their repairs before germination begins.

Study provides lessons for cryoconservation of coffee (*Coffea arabica* L.) seed core collection

A recent study of a core collection of 67 coffee (*Coffea arabica*) accessions has demonstrated for the first time great intraspecific variation in tolerance of seeds to cryopreservation. The same study found no such variation in tolerance of embryos to exposure to liquid nitrogen, indicating that the damage to the seeds was only to the endosperm.

Seed from the 67 accessions were treated in two sets, consisting of 30 and 37 accesssions. Seed of Set 1 were treated immediately on receipt at the laboratory, while those in Set 2 were stored under 100% relative humidity at room temperature for six months prior to treatment. Seeds were desiccated for 3 weeks to around 0.22 g dw/g H_2O under 78% relative humidity, hermetically sealed in 15 ml polypropylene tubes, precooled to –50ºC, then immersed in liquid nitrogen. They were stored at –196ºC for at least one week before being thawed by plunging the tubes into a water bath at 40ºC for 4 minutes. After thawing seeds were either placed directly under germination conditions or osmoconditioned (controlled rehydration treatment with a –1.25 MPa polyethylene glycol solution) for 6 weeks before being transferred to germination conditions. Zygotic embryos were extracted from desiccated seeds either before or after freezing and cultured for survival assessments.



Relationship between the proportion of frozen seeds showing radicle and hypocotyl extrusion and that of seeds showing radicle and hypocotyl extrusion and then developing into normal seedlings, without or with post-thaw seed osmoconditioning, within accessions of Set 1 (no storage prior to desiccation) and Set 2 (6-months storage under 100%RH and room temperature prior to desiccation).

Exposure to liquid nitrogen had an overall detrimental effect on whole seed viability. However, a very high intraspecific variability in seed sensitivity to liquid nitrogen exposure was observed: seed viability, expressed in percentage of the desiccation controls, varied from 0 to 100% among the accessions studied and was not correlated to seed size, seed water content after desiccation, or seed and embryo viability after desiccation. By contrast, no variability was found between the genotypes studied for embryo viability after exposure to liquid nitrogen. Viability of embryos after cryopreservation was always very high, indicating that, when occurring, the decline or loss of seed viability after LN exposure was due to damages to the endosperm only.

Osmoconditioning dramatically increased viability of frozen seeds (see figure). The beneficial effect of the osmoconditioning treatment was mainly due to an increase in the proportion of germinated seeds that continued their development into normal seedlings after extrusion of the radicle and of the hypocotyl.

The technology was immediately transferred to CATIE, where 79 of the 1810 accessions are now stored in liquid nitrogen. These 79 accessions form a core collection that represents the genetic diversity of the whole field genebank. The regeneration rate from these cooled seeds is as good as from fresh seed, at between 60 and 97%.

In vitro culture and cryopreservation offer many advantages over more traditional methods of collecting and storing germplasm. Once a culture is established, the germplasm is safe—for the short term. Cultures also make exchange of genetic material safer and easier. Unlike cuttings, cultures are small and easy to ship and they are less likely to carry pathogens. For long-term conservation, cryopreservation may prove the best option even for species that don't fall into the problem categories. It is likely to prove especially useful in developing countries with limited resources. The costs are low, the samples take up little space and they require very little maintenance other than topping up the liquid nitrogen occasionally.

Selected reading:

***In vitro* collecting**

Pence V. C., Sandoval J., Villalobos V. and Engelmann F. (eds.). 2002. *In vitro* germplasm collecting techniques. IPGRI Technical Bulletin No. 6. IPGRI, Rome, Italy.

Cryopreservation

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Network for the Improvement of Banana and Plantain, Montpellier, France: 44 pp. (http://www.inibap.org/publications/technicalguidelines/guideline5_eng.pdf)

Recalcitrant seeds

Berjak P., Walker M., Mycock D.J., Wesley-Smith J., Watt P. and Pammenter N.W. 2000. Cryopreservation of recalcitrant zygotic embryos. Pp. 140-155 in Engelmann F. and Takagi H. (eds), Cryopreservation of Tropical Plant Germplasm —– Current Research Progress and Applications. JIRCAS, Tsukuba, Japan, and IPGRI, Rome, Italy.

Coffee

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Targeting PGR activities with GIS

Conserving the world's dwindling biodiversity is an urgent task—some estimates suggest that a quarter of plant genetic diversity could be lost in the next 20 years—yet time and resources are limited. But help is at hand, thanks to the recent development of computer software that really is user-friendly. Now at last conservationists around the globe can begin to focus their efforts on the areas most in need of urgent interventions, with the help of 'geographical information systems'—or GIS. These are simply tools for linking the 'what' to the 'where'—for managing information of any kind by where it is located. Using GIS, conservationists can identify biodiversity hotspots, and prioritize regions for conservation action.

The power of GIS is remarkable, but often overlooked. It can assemble, store, manipulate and analyse any information that comes with a spatial location attached, i.e. 'geo-referenced data'. A genebank, for instance, can use GIS to make sense of all its passport and other data, linking each germplasm accession and its associated characterization and evaluation data with a particular spot on the globe. Fed into a GIS, these data can dramatically transform the daunting task of planning collecting programmes or deciding where to site *in situ* reserves.

But GIS are far more than digital filing cabinets. In fact, they make it possible to integrate complex spatial information from many different sources, and then analyse and model the data in various ways to reveal spatial patterns, relationships and future scenarios. When it comes to managing and understanding the large and complex datasets associated with plant genetic resources, a GIS is an invaluable resource.

David Williams, IPGRI

Collecting wild peanut in Bolivia.

GIS study investigates implications of global warming for conservation of African wild rice

A study was conducted in 2001 to map the spatial distribution of molecular diversity in *Oryza longistaminata* and investigate its relationship with ecogeographic variables, particularly climate and vegetation in East and Southern Africa. A combination of GIS software packages (ArchView® 3.1 and AutoCAD Map 2000 Release 4) was used to map the geographic distribution of genetic variation in *Oryza longistaminata*, as determined using AFLP molecular markers (Figure 1) The association of genetic diversity with environmental variables was assessed through hierarchical cluster analysis of climate data using FloraMap.

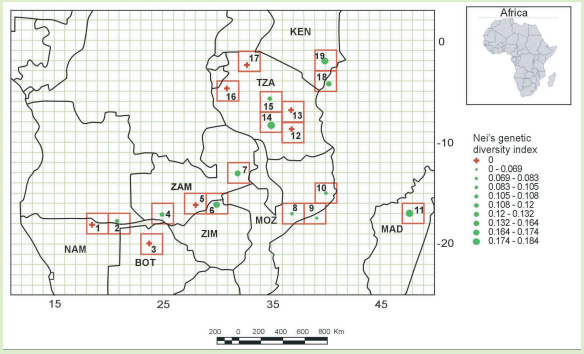


Figure 1. The geographical distribution of AFLP variation among populations of *O. longistaminata* in 19 sub-regions using Nei's genetic diversity indices. Graduated circles represent the amount of diversity in each sub-region.

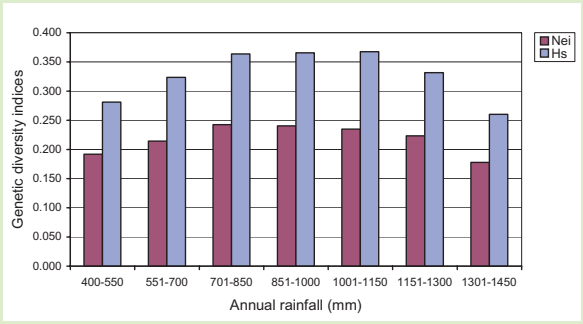


Figure 2. The relationship between genetic diversity and annual rainfall.

The study found sharp geographical differentiation over short distances, which may partly be associated with restricted gene flow and selection at the micro-geographical level. This diversity between populations is unrelated to geographic distance, which rules out simple isolation-by-distance models and suggests intense local differentiation. The analysis of diversity over sub-regions clearly indicated that the total amount of genetic diversity in a given set of germplasm accessions or geographic locations does not necessarily depend on the number of populations but more on the environmental conditions in which they are found or were collected. The study found a curvilinear relationship between rainfall and diversity, in which diversity is lowest in the extremes of a rainfall gradient running from 400 mm to 1450 mm and highest in the intermediate level (Figure 2) This indicates that climate change, especially rainfall fluctuations, associated with global warming may lead to losses of diversity of the order of approximately 25% if genetic adaptation among populations is not able to keep pace with climate change. The results suggest, for instance, that if annual rainfall in southern Tanzania increased from its optimal value for diversity (851–1000 mm) to the maximum for the distribution of *Oryza longistaminata* in Africa (1301–1450 mm) diversity would decrease by 25.8% (Nei's diversity index of 0.062). For regions where the annual rainfall might fall by 50%, we can predict a loss of diversity of at least 20% (Nei's diversity value of 0.048)

To help to spread the use of this valuable tool, IPGRI is helping to develop and promote easy-to-use, specialized software tools that can be readily applied to the challenges facing the plant genetics resources community. One such program, developed by the International Center for Tropical Agriculture (CIAT) with input from IPGRI scientists, is called FloraMap. This computer tool predicts the potential distribution of a plant species, or indeed any organism, when little is known of its physiological requirements. It maps the collection points of specimens in a genebank or herbarium, and then assigns a climate probability model to each collection point, based on data extracted from an independent climate database. The 'probability surface'—or predicted distribution—that results can then be overlaid with other information on soils, natural vegetation or human interventions, for instance.

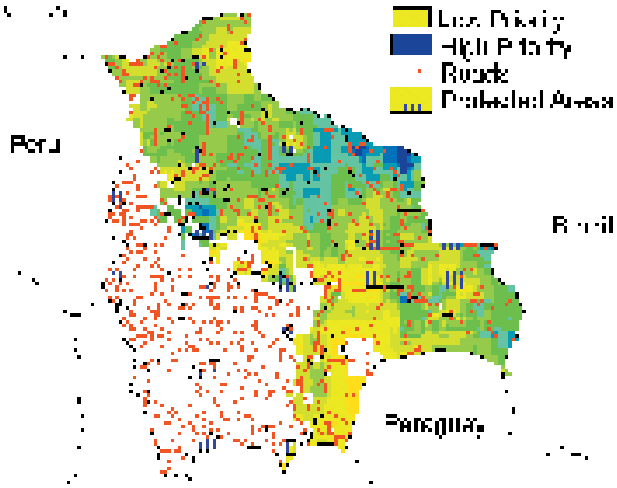
Recently, FloraMap has been used by IPGRI and its partners to map the predicted range of five important tropical fruit species in the genus *Passiflora*. The software's 'cluster tool' identified differences in climatic adaptation that were also reflected in documented variation in genetic makeup.

FloraMap has also enabled Dionysus Kiambi, a researcher at IPGRI's sub-Saharan Africa office in Nairobi, to target the best places to expand the search for species of wild rice (*Oryza*) from east and southern Africa that are under-represented in global collections. He and his colleagues entered the exact collection locations of some 700 herbarium and gene bank accessions, and let FloraMap tap into its store of topological and climate data from 7000 meteorological stations. Kiambi asked the software to reveal places that ought to contain particular species but that had not, so far, yielded any accessions. The maps predicted that the area around Vanga, a coastal town in Kenya near the border with Tanzania, ought to be a good place to look for *Oryza punctata*. With the help of local farmers, researchers did indeed find sparse patches growing in small rice paddies.

In a further study, FloraMap in combination with molecular markers helped researchers to understand the relationship between genetic diversity in *Oryza longistaminata* and environmental variables using the climate data available in FloraMap. In the study, a clear relationship between rainfall and genetic diversity was evident. The study showed that there is a 'curvilinear' relationship between

rainfall and genetic diversity in a rainfall gradient running from 450 mm to 1450 mm. In this relationship, genetic diversity is highest at the mid-range and is lowest in the rainfall extremes.

Another powerful software tool, developed by IPGRI and the International Potato Centre (CIP), is called DIVA-GIS. It uses spatial analysis to identify areas of high diversity, and can also extract climate data for all locations on Earth, as FloraMap does. Already, it has been used by germplasm curators to provide 'retro-classifications' of the environment at the collecting sites of material in the genebanks of the Andean root and tuber crop network. In Paraguay and Bolivia, national programme partners are using DIVA-GIS and FloraMap to develop atlases of the wild relatives of crops, charting the distribution of genetic diversity among wild peanuts, for example.



GIS is helping prioritize collecting work on peanuts in Bolivia.

Karen Williams, USDA-ARS

Wild peanut relative, Paraguay.

A case study in Ecuador on landraces of the peanut *Arachis hypogaea*—the most widely cultivated grain legume in the world and one of the five most important oilseeds—is using GIS to identify those variables most closely correlated with the diversity of cultivated peanuts. Two USDA-funded explorations carried out by the Ecuadorian national programme and IPGRI have sampled the range of genetic diversity across the country, and the idea is now to map these data together with socieconomic and environmental information. A similar study is under way in Guatemala, where the extent and distribution of native peanut diversity is still largely unknown. Here, researchers are hoping to use the results of the Ecuador study to predict areas in Guatemala where the greatest diversity of cultivated peanuts will lie. DIVA-GIS now contains a facility for doing such cross-country predictions.

Wild relatives of cultivated peanuts—69 species are known, all endemic to South America—are a valuable source of traits for improving cultivated varieties. The domesticated peanut is susceptible to many diseases and pests, and few good sources of resistance have been found within the crop species itself, yet many of the related wild species screened for those same diseases show high levels of resistance. It's not surprising, then, that wild peanuts are high on the international agenda for conservation.

Using DIVA-GIS and other software to analyse diversity patterns from genebanks and herbaria, Luigi Guarino and David Williams of IPGRI and Andy Jarvis from CIAT in Cali, Colombia, with colleagues in the USA and Bolivia, found a hotspot of richness and diversity among wild peanuts in Mato Grosso do Sol in Brazil. They went on to use FloraMap to assess the potential impact of climate change, based on the Hadley model. By 2055, this model predicts that the distribution range of wild peanuts will be highly fragmented and confined to southern Brazil. Only three species can be considered stable in their distribution under this model of climate change.

Such data, while necessarily speculative, has many uses. For a start, it can help researchers to prioritize those species most threatened with extinction in the wild in the wake of climate change. It can also help conservationists to identify potential refugia for wild species, and target sites for *in situ* conservation. Rescue efforts to collect germplasm from the most endangered species can also be initiated, as presently under-conserved hotspots are identified with the help of GIS. These models may even help researchers to identify suitable areas for the relocation of vulnerable species, to ensure their long-term survival in the wild.

The building of a new gas pipeline in eastern Bolivia alerted local conservationists to its possible implications for populations of wild *Arachis* in the region. This inspired the researchers to use GIS to identify high priority areas for conservation. Risk of genetic erosion was calculated on the basis of human population density, level of soil degradation and proximity to roads, new gas pipelines and urban development. The result was a map of high priority areas for conservation, combining high diversity with a high risk of genetic erosion.

This study has helped conservationists to target their efforts with remarkable precision, given that wild peanuts potentially grow over 328 000 square kilometres, a quarter of the total land mass of Boliva. Luigi Guarino, David Williams, Andy Jarvis and their colleagues in the Bolivian national programme conclude that the highest priority areas for germplasm collecting and/or *in situ* conservation efforts lie along the Santa Cruz–Puerto Suarez road around the towns of San Jose de Chiquitos and Puerto Suarez itself.

These are just a few of the case studies now under way. For instance, IPGRI scientists in the regional office for CWANA have been collaborating with national programmes to study patterns of variation in wild wheat in Cyprus and wild almonds in Syria, as well as forest and fruit trees in Lebanon and Syria. Research in Syria and Morocco has also pinpointed genetic erosion among traditional vegetables. Most prone to genetic erosion are areas north of the Atlas Mountains, near the city of Marrakech, where market demand favours commercial vegetable varieties over local traditional cultivars.

All these case studies, together with IPGRI's presentations and training events, are building awareness of the potential of GIS. Using these PGR-specific GIS tools, national programmes can now begin to develop precise conservation strategies for priority genepools based on their genetic diversity data. At the regional level, plant genetic resources networks can play a pivotal role in adopting GIS. GIS provides an ideal environment within which to unite data from many countries in a common framework, and thus to develop both regional and national conservation strategies based on the broadest vision of the challenges and opportunities that lie ahead.

Suggested reading:

Guarino L., Jarvis A., Hijmans R.J. and Maxted N. 2002. Geographic Information Systems (GIS) and the conservation and use of plant genetic resources. Pp. 387-404 in Managing Plant Genetic Diversity (J.M.M. Engels, V. Ramanatha Rao, A.H.D. Brown and M.T. Jackson, eds.). CABI Publishing, Wallingford, UK.

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Diversity down on the farm: *in situ* conservation of agricultural biodiversity

Throughout the world, new, improved cultivars of staple crops have replaced thousands of traditional varieties in farmers' fields. While modern varieties have unquestionably helped feed the world's people, the resulting loss of genetic diversity—and the valuable agricultural traits that follow from it—continues to be a matter of great concern for many reasons.

Traditional cultivars are often locally adapted, and so are able to grow in difficult conditions, or fulfil special needs. Locally adapted material can also support the health of agro-ecosystems by reducing the need for fertilizers and pesticides. As long as farmers' fields still foster such crop varieties, adaptation can continue, so ensuring that new genetic material is passed to future generations. Just as importantly, on-farm conservation can help to improve poor farmers' livelihoods and increase the control and access that farmers and communities have over local crop resources. Without access to a diverse range of cultivars, coping with economic, political or climate change may be far more difficult.

IPGRI is actively involved in major projects designed to understand, support and encourage *in situ* conservation of traditional cultivars throughout the world.

Devra Jarvis, IPGRI

Oasis farming systems are rich in plant biodiversity.

Conservation through utilization of bananas and plantains in the Great Lakes region of East Africa

Bananas and plantains of the Great Lakes region of East Africa are the focus of a three-year collaboration funded by Canada's International Development Research Centre (IDRC), in partnership with INIBAP and government agricultural experts in Uganda and Tanzania. In the East African Highlands, farmers have, at one time or another, made use of 145 varieties of cooking banana and a further 88 varieties of beer-making bananas. Today, perhaps as many as one hundred varieties are still cultivated there. This extraordinary diversity is the legacy of hundreds of years of careful selection, as farmers chose cultivars with desirable characteristics. Here, bananas are a staple food—the region is the world's leading consumer of this versatile and culturally important crop—and sales in local markets provide an important source of income.

Over the past 20 years, however, banana farming has been threatened by pests, diseases, natural disasters and civil strife, leading to declines in production. At the same time, the local varieties of bananas that farmers have maintained for centuries are disappearing at an alarming rate. *Musa* conservation strategies based on *ex situ* genebanks, while important, have their limitations: expensive to maintain, they can never replicate the complex interactions between environment, farmer and crop. To ensure both sustainable food security and environmental protection in the banana-based agro-ecosystems of Eastern Africa, farmers need support in their efforts to maintain their banana genetic resources.

At the end of the project's third year, participating farmers and technical staff at each of the four benchmark sites in Tanzania and Uganda have developed a strong interest in maintaining the diversity of cultivars and combating genetic erosion. As a result, groups in Chanika in Tanzania and Bushenyi in Uganda have formed biodiversity conservation associations of their own. Farmer-exchange visits between Uganda and Tanzania have circulated local technologies and expertise, and farmers have been able to acquire 'lost' cultivars from national collections.

On average, farmers grow 15 varieties, but recently those with lower market value have tended to be lost from cultivation, in response to drives to commercialize agricultural production. Farmers suggest a variety of possible solutions, and stress the importance of finding new markets, especially through post-harvest processing. Utilization is an integral part of long-term conservation; cultivars that nobody wants to use are inevitably lost. Farmers also identify pests and declining soil fertility as powerful driving forces in the erosion of diversity, as susceptible cultivars are removed from cultivation.

Solutions to many of these challenges emerged during the farmer-exchange visits and are helping to protect genetic diversity in the farming systems. For example, at Ibwera, the lower-altitude Tanzanian site, farmers face more problems with pests such as weevils, and have developed ways of dealing with them—a combination of neem powder, clean tools and planting material, mulch, pest-traps and planting *Tephrosia* as a barrier crop. In remote Chanika in Tanzania, farmers have found ways of dealing with excess harvest through producing banana wine, chips, flour, bread, biscuits and cakes. In Uganda, Masaka farmers emphasize their focus on marketing, while farmers in more densely populated Bushenyi have developed their abilities to improve soil fertility through composting, intercropping and mulching.

The IPGRI home gardens project

In Vietnam, it's not unusual to find up to seven varieties of taro, all growing in the small plot that is somebody's home garden. Each variety is valued for its unique qualities: the taste of its starchy root, the texture of its leaf or stalk, or how it cooks. The people who tend this cornucopia of genetic diversity do so because they know how to make use of the particular qualities that each variety offers.

To understand and support such 'conservation through use', IPGRI with support from BMZ, Germany carried out a research project focusing on home gardens around the world. Case studies in Africa, Asia, Latin America and the Caribbean assessed their importance as repositories of agricultural biodiversity. Researchers documented a rich array of useful crop varieties maintained within this human-created micro-environment. This project provides a global framework to investigate similarities and differences between home gardens in the three continents. It is producing practical information on how home gardens can contribute to the conservation of diversity in agro-ecosystems.

Pablo Eyzaguirre, IPGRI

Home gardens often contain more biodiversity than neighbouring agricultural systems.

What's in a name?

A study by IPGRI and its partners in Zimbabwe and Mali is examining factors influencing the maintenance of genetic diversity by farmers. One of the aspects that the study is looking into is the information available to farmers. One such piece of information is variety names. These have proved not to be a reliable indicator of either genetic similarity or of genetic diversity.

Preliminary analysis of data on 22 morphological characters for sorghum in Zimbabwe indicates that, while a farmer variety name generally implies the presence of one to three clearly defined traits, a variety with the same name held by a different farmer may differ very considerably (Figure 1). A survey of farmers in Mali also indicated that most were not aware that material with the same name could differ morphologically and genetically. This seriously limits farmers' ability to exchange information, experience and seed, compounding the problems of access to seed.

Further analysis indicated that the number of farmer variety names found in a region was also a poor indicator of the overall morphological and genetic diversity in sorghum in Zimbabwe (Figure 2).

In Mali and Zimbabwe, additional socio economic and varietal data are being gathered to determine how these findings affect maintenance of genetic diversity.

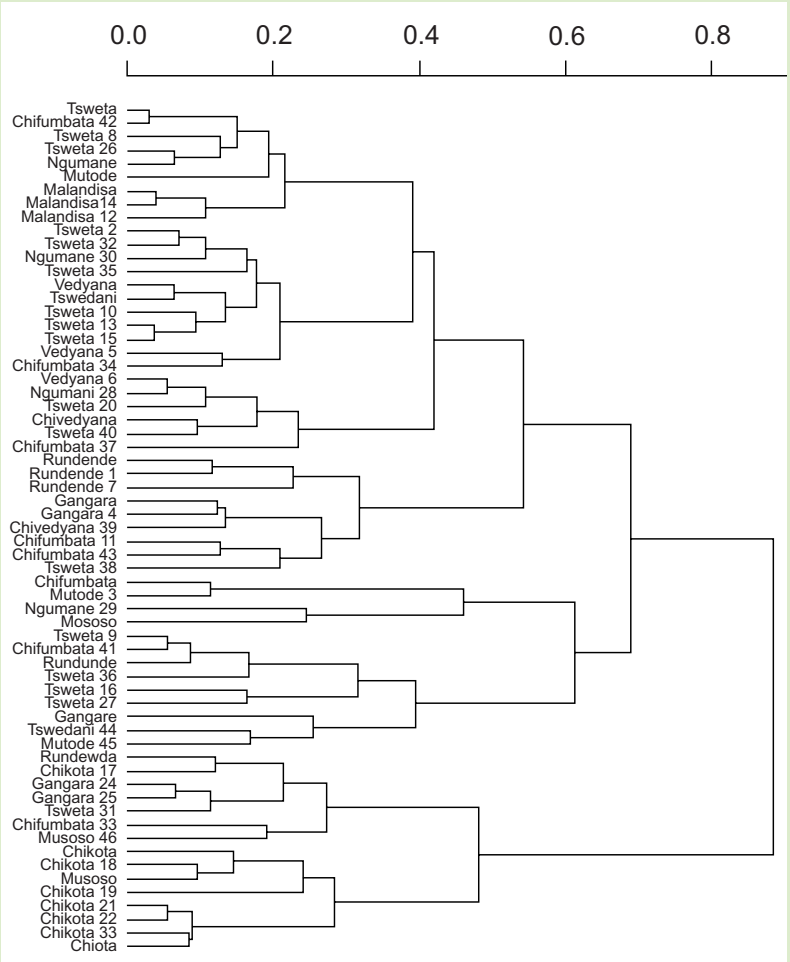

Figure 1. Dendrogram of farmer variety names for sorghum in Zimbabwe based on morphological characterization, using Gower's similarity index and Ward's method of agglomeration. Note that the same farmer name may appear in many different morphological groups.

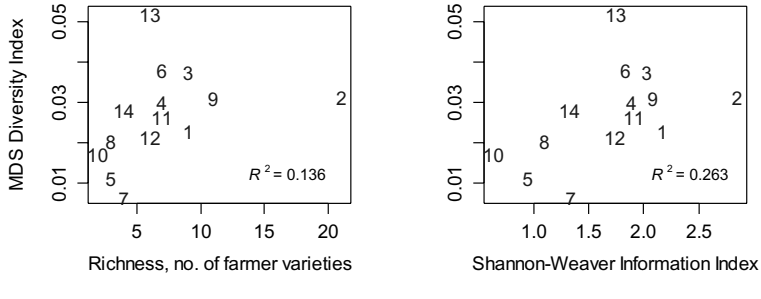

Figure 2. Plots showing the correlation between the number of farmer variety names/Shannon–Weaver index based on farmer variety names in an area and overall morphological diversity.

The project's findings underline the importance of these domestic patches. Rural or urban, home gardens are often the focal point of a household's social interactions within the family and with visitors. In them, children learn about the varieties and their uses. Home gardens are also havens for diversity, typically supporting a wider range of crop species and varieties than are found in the surrounding fields or plantations. In Cuban home gardens, increasingly rare fruits such as traditional banana varieties and mamey (Sapote) are still found. In all countries, they serve as refuges for the heirloom crop varieties that are valued and maintained in the family but have little place in commercial markets.

Devra Jarvis, IPGRI

Rural women hold much of the knowledge on plant genetic resources.

The home garden is also a way of providing diversified sources of income, nutrition and resilience to household livelihoods. Home gardens are found in practically every household where local plant products contribute to income, and are used for food, fuel, medicine, fodder, building material, as well as social and religious celebrations. Many of the plants cultivated are multi-purpose; coconut trees, for instance, can produce fuel wood, timber, animal feed and food. In Indonesia, bananas aren't just grown for their fruits: the leaves alone contribute a quarter of the income made from the trees. In Vietnam, home gardeners tend distinctive varieties of bananas ignored by commercial plantations; some are dried and pickled for medicinal uses, others play ceremonial roles in Tet shrines.

Often it is women who tend these gardens, just as women are typically engaged in the harvest of wild vegetables and fruits. Some of these gathered wild species find their permanent place in home gardens, after an initial step of experimentation. Close to the house, it's a convenient place to experiment with plants and domesticate new strains. In northeastern Thailand, one study found non-domesticated plants in 88% of home gardens managed by women—providing the first step, perhaps, to new cultivars. In both Nepalese and Vietnamese home gardens, the vigour of root crops such as taro, sweet potato and yams is regularly renewed by injections of ruderal material from the wild.

This constant tinkering with the kinds, numbers and mix of species gives home gardens flexibility, dynamism and above all resilience. They can function as nurseries—for seedlings to transplant to agricultural plots, or for native species with which to reforest—linking home gardens with the surrounding natural and agricultural ecosystems. Home gardens, the researchers discovered, are also often refuges for wild species that are threatened in the wild by deforestation and urbanisation.

Home gardens are also places where parents can transmit knowledge of these plants to their children. But in some countries such as Thailand, Malaysia and Mexico, modern culture and development agencies regard traditional home gardening practices as old-fashioned, with a consequent decline in the transfer of practical knowledge. The project is combating such trends by fostering a greater public awareness of the importance of the traditional home garden. Television programmes in Ghana, visits by leading policy-makers from the Ministry of Environment in Guatemala, linking home gardens to Man and Biosphere Reserves and ecotourism in Cuba, and the support of national home garden associations in Vietnam are just a few of the high-profile initiatives launched so far. Increasingly appreciated for their contributions to livelihoods and agrobiodiversity, home gardens are gaining ground as vital components in national strategies for development and the conservation of biodiversity.

Programme for the development of strategies for *in situ* conservation and utilization of plant genetic resources in desert-prone areas of Africa

This collaborative programme involves IFAD, IPGRI, FAO and national institutions in Mali and Zimbabwe. Its aim is to halt the genetic erosion of traditional varieties and promote community-based ways of promoting the sustainability of traditional production and seed supply systems in the desert margins. Farmers need secure access to their traditionally preferred genetic stock, which could otherwise be wiped out by droughts.

Interviews with farmers in villages in Mali and Zimbabwe suggest that farmers in marginal areas particularly value crop diversity. Access to a wide variety of local varieties enables them to cope with unpredictability, to optimize the use of micro-environments on their farms, and to grow varieties that are useful in different ways. In Tsholotsho, Zimbabwe, for instance, particular varieties of sorghum are good for making porridge, for brewing beer, have stalks that are good for chewing or are ideal for fodder, while still more are grown specifically for the market.

The project is testing a number of community-based activities that aim to strengthen grass-roots organizations to mitigate the impact of temporary drought-induced conditions. Seed diversity fairs, for instance, facilitate seed exchange between farmers and communities and ensure access to a diversity of seed. They are also an opportunity for farmers to share knowledge about local crops and varieties. Over the past 10 years, seed diversity fairs have been growing in popularity, and they

seem to be working. In Mali, an increase in diversity of farmers' fields was apparent just a year after the fair. Four of the 10 farmers interviewed had tested new material obtained at the fair and would continue growing it. The presence of women at the fairs proved particularly important: men gave material only to other men at the fair, while women farmers gave seed to both men and women. Further initiatives—such as Farmer Field Schools in Zimbabwe and Farmer Schools on Biodiversity in Mali—are also encouraging on-farm experimentation.

Strengthening the scientific basis of *in situ* conservation of agricultural biodiversity

This global project focusing on a range of crops was IPGRI's first major initiative exploring the maintenance of traditional varieties by farmers (on-farm conservation). Over the last 6 years IPGRI, together with nine partner countries—Burkina Faso, Ethiopia, Hungary, Mexico, Morocco, Nepal, Peru, Turkey and Vietnam—has been investigating four key issues: how much genetic diversity is maintained by farmers, how the diversity is maintained, who maintains it and what factors influence its maintenance. The project is also exploring ways of linking farmers and communities to national conservation efforts and seeking to ensure that traditional local varieties contribute to sustainable development.

Devra Jarvis, IPGRI

Diverse rice varieties in the market.

How much diversity is there?

Marked differences are apparent even within national boundaries. For instance, in Nepal, at Begnas Kaski, farmers grow a total of 63 varieties of rice, at Jumla Talium 21 varieties, and in Kachorwa Bara 33. Nepalese farmers stress that certain varieties are good for special sites, such as a patch of badly drained land. Only a very few varieties—between 3 and 8—are widely cultivated. Most are grown only by one or two farmers on a single plot. In Vietnam, too, farmers still grow many varieties of rice, but in Morocco, far fewer varieties of barley, faba bean and alfalfa are kept in cultivation by local farmers.

How is it maintained?

How farmers acquire seed influences crop diversity. In Mexico, the project has found that farmers tend to keep their own seeds for as long as 20 years. When they do exchange seeds, it is usually with members of their own village. They more commonly lose and acquire seeds of early maturing varieties so these are more diverse than late maturing ones. In upland Talium Jumla in Nepal, one of the two barley varieties grown is maintained within the village while the other is always obtained from another village further up the mountain.

Who maintains it?

Answers vary from place to place. In Burkina Faso, women play the key role in maintaining diversity of a number of local crops, including okra, peanut, bambara groundnut, sesame and hibiscus, which they tend in their own plots. The cash generated by the sale of these crops funds household essentials. In Begnas Kaski in Nepal, by contrast, it is the rich and middle-income farmers who consistently maintain a larger number of varieties than poor farmers—perhaps because they own more land and have access to greater resources.

What factors influence its maintenance?

There's no simple, universal answer. Poorer, more isolated communities may sometimes maintain greater levels of crop diversity, but communities with access to good quality land and a range of inputs may still maintain traditional local varieties because they are suited to challenging spots, such as waterlogged land, or because they have found market niches for their high value or flavour. Other varieties may be maintained because they have a role in social ceremonies.

New national frameworks, linking government and non-governmental sectors, have been created to put *in situ* conservation into practice, by working together in teams with farmers so that all can benefit from on farm conservation. More women have become involved in the work, enhancing gender awareness within the project.

IPGRI

Farmers everywhere are the custodians of the world's plant genetic resources and associated knowledge.

In many places, farmers now have better access to local cultivars through seed networks, diversity fairs and community-maintained registers of local cultivars. Plant breeding has become less centralized and more participatory using local cultivars.

At the same time, the knowledge base needed to support on-farm conservation is steadily growing. A revised and updated training guide for on-farm conservation is now available, to help participants to collect, analyse and use information on genetic diversity, as well as the processes and people involved in maintaining it. Over 160 papers and publications have so far resulted from the global project.

Conservation and use, hand in hand

These are just few of the projects around the world contributing to a greater understanding of how the world's invaluable diversity of crop varieties can best be maintained and fostered on the farms themselves. In the future, the major challenge will be to go beyond relatively small projects to develop effective national programmes throughout the world. Commitment on many levels is needed to transform experimental and investigative projects into programmes that embrace all crops and all production systems. How to achieve this major step is the next issue on the agenda of on-farm conservation.

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Conservation through utilization of bananas and plantains in the Great Lakes region of East Africa: Suzanne Sharrock (s.sharrock@cgiar.org)

The IPGRI home gardens project: Pablo Eyzaguirre (p.eyzaguirre@cgiar.org)

Programme for the development of strategies for *in situ* conservation and utilization of plant genetic resources in desert-prone areas of Africa: Mikkel Grum (m.grum@cgiar.org)

Strengthening the scientific basis of *in situ* conservation of agricultural biodiversity: Devra Jarvis (d.jarvis@cgiar.org)

The crucial role of forest genetic resources

Forests are vital to both the subsistence of local people and the economies of nations. In addition to timber, they provide foodstuffs, animal fodder, medicines, fuel wood, fibres and more. Forests also protect two of the most basic needs of people—water and soil—and play a critical role globally by locking up carbon, so helping to counter climate change.

Yet the world's forests continue to shrink at an alarming rate—and as they disappear so too does the genetic diversity vital to the health of forest ecosystems and the future livelihoods of many millions of people. Logging, clearance for agriculture and ranching and the spread of towns and cities are responsible for the biggest losses. But these are not the only threats: pollution, changing climate and the spread of introduced invasive species all contribute to the loss of genetic resources. As forests shrink, populations—even whole species—of trees slide towards extinction. The extent of people's dependence on forest products and the speed at which they are disappearing has made conservation of forest genetic resources an urgent priority for IPGRI.

The task is a daunting one. Any programme of conservation must reconcile people's needs with maintenance of a diverse gene pool to allow continued evolution of forest species. Without the capacity to evolve, valuable species may fail to adapt changing conditions and disappear.

IPGRI

***Araucaria* trees in southern Argentina.**

Conservation strategies must be based on a sound scientific knowledge of the habitat, the needs of the people and the scale of threats. Over the past two years, IPGRI has worked with partners from many tropical countries to build a clearer picture of tropical forests: which species grow where, what natural processes control genetic diversity and how human activities disrupt these processes. New molecular techniques are providing practical tools for assessing diversity and the processes that affect its distribution. Other studies are investigating the ways in which people use the forest: which species they harvest and how this exploitation affects their genetic diversity. This knowledge is crucial if anything is to be done to slow or halt the loss of genes.

An ambitious project, begun in 1999 and funded by the German Ministry of Foreign Affairs, is trying to answer all these questions through detailed study of four forest ecosystems in Brazil and Argentina. The project takes an innovative approach, combining research into local economics and land use with basic ecological and genetics studies. The aim is to understand how and why people exploit the forests the way they do and the implications for genetic diversity before identifying better strategies for managing local resources.

The project focuses on four forest types of differing complexity. The two most complicated are the hugely species-rich Amazonian rainforest and the highly fragmented Atlantic forest of Brazil's eastern seaboard, a habitat now reduced to about 4% of its former range. The simpler ecosystems are the southern *Araucaria* forests, habitats dominated by Parana pine in the uplands of southern Brazil, and by the monkey puzzle in the far south of Argentina.

Studies now in train range from genetic tests to assess the extent of variation to an investigation of how pollinators cope with the fragmentation of their habitat—and how that interferes with the reproduction of tree species. The same sort of complexity applies to the way people exploit forest resources. At this stage of the programme, an important achievement has been the establishment of close relationships between the research teams and the many different groups who make use of the forest, a process that has also made clear how much local people can contribute to the project. In Acre, for instance, rubber tappers are now working closely with scientists to improve their management practices, including selecting trees that could be used as sources of seed for breeding programmes.

Bamboos and rattans—sustainable products from forests

Bamboos and rattans are two of the most valuable forest products in Asia after timber. World trade in bamboo and rattan is estimated to be worth several billion dollars a year and there are more than 1500 traditional uses for these plants. Recent growth in demand for these products, especially for the paper and pulp industry, has led to massive overextraction in some regions. In India, for example, paper and pulp mills have been forced to close in the face of declining bamboo and rattan stocks. Increasing pressure on stocks is driving some species

Kirsten Thomsen

Processing tree seeds for storage.

towards extinction. Yet, properly managed or cultivated, several rattans and bamboos have the potential to provide a steady income for many of the world's poorest people.

Since 1993, the Japanese government has funded an IPGRI programme on conservation of bamboo and rattan genetic resources. Projects carried out through partner institutions in South and East Asia are producing results that are already providing benefits for national resource management and conservation programmes.

There are about 1000 species of bamboo and 600 rattans, the vast majority growing in the Asia Pacific region. In just one small patch of forest, 30 or more species of rattan may grow side by side, although only an expert taxonomist might be able to tell them apart. One of the project's main aims is to identify priority species—the most valuable or those with future economic potential and those in most critical need of conservation. With so little known about the distribution of species, let alone the distribution of genetic variation within a species, IPGRI's efforts have focused on mapping distributions, estimating the scale of threat and developing tools for measuring genetic variation within species.

In 2000, inventories were completed for Vietnam, and a guide to Indonesia's economically useful species was published in the Indonesian language, so the local people are able to make use of the information. An investigation in Karnataka, India, completed in 2001, revealed that after three decades of overextraction, fewer people now make a living from bamboo. This reflects the steady loss of this resource. One knock-on effect is that traditional skills in working bamboo are beginning to disappear. The project identified some remedial measures that the forest department could take to reduce the losses.

Scientists are making good progress in developing and using tests to measure the genetic diversity of rattans. An analysis based on comparison of isoenzymes in three species of *Calamus* in the Andaman and Nicobar Islands showed significant variation in genes from one site to another. A 'sex test' for rattans, developed with the National University in Singapore, will, when perfected, prove extremely helpful in selecting plants for conservation schemes for these 'single-sex' (dioecious) plants.

As part of a scheme to encourage sustainable development of bamboo resources in China, the Kunming Institute of Botany has established a 2-hectare grove of 20 native bamboo species in central Yunnan. Staff trained 30 local farmers how to cultivate, propagate, prune and harvest the shoots and poles, and exploit the differences between and within species, i.e. at genetic level, based on phenotypic differences.

Recalcitrant seeds make life difficult for foresters

One of IPGRI's most successful projects in 2000 and 2001 has been the programme to study the physiology of the seeds of tropical trees and identify ways to prolong their life in storage. Tropical trees often produce seed with high water content. Many are assumed to be 'recalcitrant'—they will not survive drying and are sensitive to cold. Such seeds lose viability very quickly, limiting the possibilities of using them in planting programmes or other conservation projects. Unfortunately, practically nothing is known about the seed physiology of individual species, and whether it is indeed true that most tree seeds are recalcitrant. To remedy this, in 1996 IPGRI joined with the Danida Forest Seed Centre in Denmark to develop a standard procedure for testing a seed's sensitivity to drying. This would allow national forestry institutes to test the species most important to them and devise suitable storage methods.

With the protocol established in the first phase of the project, in 2000 and 2001 IPGRI's priority was to train staff from tropical forestry institutes to apply the protocol and start screening locally important species. Workshops held on three continents brought together research and technical staff from across each region. The workshops provided practical training in seed handling techniques, but also enabled people to discuss problems and share experiences with each other. Partners from Costa Rica, for example, pointed out that it was wise to test seed samples to the limit. After accidentally drying some *Astronium graveolens* seeds until they contained just 1.44% water—less than half the level for normal seed banking—they discovered this was optimal for storage of this species.

The success of the workshops exceeded all expectations with 53 people from 32 institutions participating—double the projected number. With more people from an increasing number of countries joining the programme, the project also surpassed its target of screening 30 species. Despite some hitches—in one case vervet monkeys made off with fruits collected for screening—the project tested an extra nine species.

Some seeds proved undoubtedly recalcitrant, much as suspected. Vietnamese scientists showed that the seeds

Reproductive biology of the dry forest tree *Enterolobium cyclocarpum* (Guanacaste) in Costa Rica: a comparison between trees left in pastures and trees in continuous forest[1]

Rate of pollen deposition, likelihood of fruit production, the number of seeds per fruit, outcrossing rate, and progeny vigour of an important tropical dry-forest tree (*Enterolobium cyclocarpum*) were compared for individuals in pastures versus individuals in continuous forest, in the region of Guanacaste (Costa Rica). It was found that flowers from trees growing in continuous forests were more likely to have pollen deposited on their stigmas than flowers from trees in pastures (52.1 vs. 32.3%, respectively). It was also discovered that trees from continuous forests were almost six times more likely to set fruits and produce more seeds per fruit than trees in pastures. Moreover, progeny from trees in continuous forests were, on average, more vigorous than the progeny from trees in pastures, as indicated by 12 of 16 indicators of plant vigour. However, there was no significant difference in the multilocus estimate of the outcrossing rate between the two groups of trees (t_m = 1.00 and 0.99 for trees from continuous forest and trees from pastures, respectively). Differences were found in the correlation of paternity between the progeny of two groups. The progeny of trees in pastures showed a lower correlation of paternity than the progeny of trees from continuous forests (r_p = 0.104 and r_p = 0.189, respectively). It was therefore argued that the mechanisms that regulate progeny vigor are disrupted in trees from pastures. This supports the hypothesis that fragmentation is a major threat to the maintenance of genetic diversity of tropical forest species.

Barbara Vinceti, IPGRI

Guanacaste forest ecosystem, Costa Rica.

Breeding estimates for the 47 maternal families of *Enterolobium cyclocarpum* considered in this study. (A) Outcrossing and correlated mating estimates for trees from pastures and continuous forest. (B) Gene frequencies estimates for pollen and ovules of the five polymorphic loci. Numbers in parentheses indicate standard errors.

(A)

Population	t_m	t_s	$t_m - t_s$	r_p
Trees from pastures	0.999 (0.055)	0.980 (0.067)	0.019 (0.026)	0.104 (0.036)
Trees from forest	1.000 (0.035)	0.981 (0.036)	0.019 (0.026)	0.189 (0.068)

(B)

	Alleles				
All trees	ST-1	GPI-1	PGM-1	IDH-1	DIA-1
Pollen	0.478 (0.031)	0.821 (0.020)	0.583 (0.031)	0.772 (0.025)	0.075 (0.013)
Ovule	0.543 (0.054)	0.809 (0.034)	0.596 (0.053)	0.734 (0.041)	0.084 (0.029)
Test for heterogeneity in pollen and ovule frequencies	***	NS	NS	*	NS
Test for heterogeneity in pollen frequencies among families	***	***	***	***	***

*Note: NS = $p > 0.05$; * $p < 0.05$; ** $p < 0.01$, *** $p < 0.001$.*

[1] *Adapted from O.J. Rocha and G. Aguilar (2001). American Journal of Botany 88(9):1607–1614.*

of *Cinnamomum cassia*, source of the spice cinnamon, lose their ability to germinate after the slightest loss of moisture. Other valuable trees including *Madhuca indica*, from India, and several *Shorea* species from Asia have equally recalcitrant seeds.

Other species proved very tolerant of drying—improving their prospects for long-term storage. These included two useful African dryland species—*Dovyalis caffra*, planted to form impenetrable hedges and for its fruits, and *Strychnos cocculoides*, source of strychnine which is used both as a medicine (to counter mamba bites) and as a poison.

The results of screening so far show that 40% of the tree seeds can be dried and chilled the standard way. About 10% proved intermediate in their storage behaviour: removing some water prolonged the life of these seeds. The neem tree, *Azadirachta indica*, falls into this group.

Protecting resources for future generations

IPGRI's ultimate goal is to ensure forest resources continue to be available to future generations. But with time running short, so many species at risk and limited resources for research and conservation in the developing world, one of the hardest tasks is to set priorities for conservation: which species and which areas need most urgent attention and what will be the best way of achieving sustainable conservation. IPGRI and its partners are now generating a flow of information that is helping decision-makers to make the right choices.

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Policy—foundation of global PGR efforts

November 2001 saw a major landmark in the policy environment facing plant genetic resources—the adoption by the FAO Conference of the International Treaty on Plant Genetic Resources for Food and Agriculture (PGRFA). The International Treaty creates a transparent, low cost, mechanism with minimal bureaucracy to facilitate the international exchange of germplasm of a specified list of 60 genera covering some 35 of the world's major food crops—from wheat to citrus fruits—and many forages. By providing a solid foundation for the exchange, conservation and use of this diversity of crops and forages, this mechanism, called the multilateral system of exchange (MLS), should ultimately result in the improvement of the yield, disease resistance and adaptation to local farming conditions of these crops and forages.

Until recently the seeds and plants used for food and agriculture could be moved freely around the world. With some exceptions, such as Brazil's famous 19th century ban on the export of rubber trees, the plants and seeds needed to grow crops were seen as part of our common heritage. There has, however, been a significant rise in claims for controls over the movement of genetic resources for food and agriculture in recent years. These claims have been supported, either directly or indirectly, by developments in international and national laws. For example, at the conclusion of the Uruguay Round of trade negotiations under the GATT (which culminated in the creation of the World Trade Organization) negotiating countries agreed to be bound by the Agreement on Trade Related Aspects of Intellectual Property Rights (TRIPS) which sets minimum standards of protection for, among other things, improved biologically based materials, including plant varieties, in all member states. Intellectual property rights represent forms of private control over the access to protected material. By way of a second example, the Convention on Biological Diversity (CBD), which came into force in 1993, affirms the right of all countries to regulate access to genetic resources within their borders. It does not, however, prescribe specific approaches to regulating access to genetic resources; in fact, it commits countries to facilitating access. Nonetheless there are signs that the CBD is having the effect, in some cases, of reducing flows of PGRFA, at least as long as uncertainty exists about how to implement efficient national regulatory frameworks. Governments and other bodies are often using these and other forms of control to restrict access to, and exchanges of, germplasm. As understandable as these actions often are, particularly in the current highly-charged political environment, it has to be acknowledged that they do hinder the movement of genetic resources that are used in conservation and breeding programmes. It is against this background that IPGRI engages in its policy work, striving in national, regional and international fora to strike a balance that recognizes the legitimate rights of all parties in ways that support the maximum conservation, use and exchanges of PGRFA in support of food security, poverty alleviation and environmental sustainability.

Analysing IPGRI's influence on the International Treaty on Plant Genetic Resources for Food and Agriculture

While international organizations are often assumed to be influential in international meetings and summits, their influence is rarely subjected to a thorough assessment. In 2001 IPGRI conducted a study to address this empirical gap by examining the influence exerted by the Institute in the international negotiations pertaining to the revision of the International Undertaking for Plant Genetic Resources. The study both assessed the level of influence attained by IPGRI in the negotiations and investigated the general processes by which the Institute exerts influence.

The study employed a methodological framework developed to assess the influence exerted by international non-governmental organizations in the framing of the Climate Change and Biological Diversity Conventions. This method draws conclusions from different sources of evidence to assess influence in complex decision-making. The study obtained evidence from IPGRI staff members who were involved in the negotiations about the expected ways and means by which IPGRI was thought to have been influential — the so-called 'ego-perception'. These perceptions were then either validated or refuted by gathering other players' perceptions of the Institute's influence ('alter-perception'). In this case, the alter-perception was provided by national delegates and by members of the secretariat of the FAO Commission on Genetic Resources for Food and Agriculture, which managed the negotiation process. Finally, the validity of these perceptions was checked through document analysis ('researcher's analysis'). Empirical results relating to IPGRI's influence were subsequently linked to a theoretical framework that provided a basis upon which to explain IPGRI's capacity to exert influence.

The results indicate that the provision of timely and relevant technical input, i.e. input directly linked to IPGRI's area of expertise, was the means by which IPGRI had most influence in the International Undertaking negotiations. However, other factors also enabled or constrained IPGRI in its ability to influence the negotiations. While neutrality and reliability were seen as factors that enhanced IPGRI's ability to influence the process, it was clear that IPGRI, as any international organization, lacks the resources or formal rights that endow states.

As the world's largest institute dedicated to the conservation of plant genetic resources, IPGRI is well placed to do this kind of work. It has years of technical expertise in collecting, conserving and exchanging genetic resources. It has the legal and policy skills to contribute to international negotiations and to the formulation of national laws. It exploits this expertise, working with other International Agricultural Research Centres, civil society, industrial organizations and national and international policy makers to identify and analyse policy options in support of the creation of sound genetic resources policies.

International Treaty negotiations

IPGRI's participation in the negotiations of the International Treaty provides an excellent example of the way it approaches policy issues. In 2000 IPGRI analysed transfer of material from IARC genebanks over the last 20 years. This study represented, in the eyes of many, a breakthrough in the negotiations of the International Treaty. The results confirmed that historically the flow of PGRFA was generally from southern to northern countries. The study further acknowledged that this fact raised concerns for negotiators from developing countries that the International Treaty might entrench that pattern of exchange. However, the IPGRI study also revealed that in more recent times, the flow of genetic materials out of IARC genebanks had been largely reversed, with the vast majority of material leaving the genebanks going to southern countries. For example, over 90% of the transfers of pigeon peas and chickpeas, and close to 100% of the groundnuts, went to developing countries. The percentage was the lowest for maize and barley; nevertheless, over 60% of the samples distributed for each crop went to developing countries. The study also highlighted the role that genebanks have played in restoring germplasm in countries that have been devastated by natural disasters and civil war, such as Mozambique and Somalia.

Through this study, IPGRI contributed to an easing of tensions between developing and developed country negotiators by making the case that both northern and southern countries would benefit from the institutionalisation of a multilateral system of exchange. By demonstrating that current flows are benefiting developing countries, the study allowed negotiators from those countries to feel more confident about expanding the list of materials to be included in the multilateral system.

A comprehensive review of the negotiations concluded that IPGRI "was the leading source of the scientific and technical information that provided the foundations of a multilateral system." Most of the negotiators thought that IPGRI was neutral, independent and that its information was reliable. The review found that although IPGRI lacked the votes of national delegations it was instrumental in creating a workable multilateral system.

Intellectual property rights

The use of intellectual property rights to claim rights over genetic resources has long been controversial. Through the TRIPS agreement, the WTO administers the world's most comprehensive international agreement on intellectual property rights. The inclusion of intellectual property in the Uruguay Round of trade negotiations under the GATT (that eventually lead to the TRIPS agreement) was generally driven by industrialized countries. Most developing and least developed countries are either members of the WTO or aspiring to become members. IPGRI recognizes that in many cases, however, the laws used by industrialized countries to implement TRIPS may not be appropriate in all aspects for developing countries. (This much is recognized by the UK's Commission on

Intellectual Property Rights in its 2002 report Integrating Intellectual Property Rights and Development Policy.) To that end, IPGRI has conducted a number of studies of options for national intellectual property laws that are both in harmony with TRIPS and responsive to needs and realities of developing countries.

Many see the CBD and the new International Treaty as having a balancing effect on the TRIPS agreement, in as much as they provide room to encourage conservation, uses and innovations of local communities and farmers that could not be protected by TRIPS-style IPR laws. The CBD has been engaged in creating voluntary guidelines that address, among other things, the interface of access laws and intellectual property rights. IPGRI has participated in these efforts, effectively lobbying (along with FAO and others) for recognition that PGRFA deserve special consideration in light of the historical interdependency of countries' use of them and their importance to global food security. For example, IPGRI supported the explicit recognition of the International Treaty in the voluntary guidelines (called the Bonn Guidelines) for national access laws adopted by the Sixth Conference of the Parties of the CBD (COP VI) in May 2002. IPGRI also supported the COP VI's recommendations that member states should investigate national legal means by which applicants for IPRs over biological inventions and/or plant varieties could be encouraged, under various circumstances, to disclose the countries, and maybe even communities, from which they obtained the materials that they used in their creative activities.

IPGRI has also taken part in many fora addressing the issue of traditional knowledge and intellectual property rights. For example, IPGRI representatives attended meetings of the Intergovernmental Committee on Intellectual Property, Genetic Resources, Traditional Knowledge and Folklore in 2001 and 2002. The issues the Intergovernmental Committee is considering, such as the scope of the concept of 'traditional knowledge', could eventually have far reaching consequences. As embodiments of farmers' innovation, farmers' varieties may be included with the concept of traditional knowledge. Many countries in the Intergovernmental Committee are calling for the development of international agreements regarding the protection of traditional knowledge.

IPGRI will continue to attend the Committee meetings to contribute technical expertise and to support equitable outcomes that simultaneously improve farmers' livelihoods and contribute to the optimum use, conservation and exchange of PGRFA. IPGRI's presence has kept the issue of genetic resources, as a subject with its own significance, independent of traditional knowledge on the table. At one of these meetings, IPGRI provided details to the Intergovernmental Committee regarding one of its projects dedicated to examining the role of the public domain in genetic resources and the importance of producing international public goods. WIPO has agreed to provide a resource person to the Advisory Committee to that project.

National legislation

While IPGRI does not contribute directly to new legislation, it works to layout the options and the issues so individual countries can develop laws suited to their own particular needs. The Crucible II round of talks illustrated this approach. The Crucible group began as an ad hoc group of concerned scientists, policy makers and business executives, who got together in 1993 to assess the implications of evolving intellectual property rights for farmers, rural societies and biodiversity conservation and use.

Their original report was published in 1994 but in 1998 the group decided to re-examine the issues. More than 45 people from 25 countries took part in the Crucible II round, as it became known. Volume 1 of their report, Seeding Solutions, which IPGRI co-published in 2000, outlines the political and technological developments regarding genetic resources since the group's 1994 report. Volume 2, published in 2001, provides 'menus' of options for national laws concerning the control and management of genetic resources and biological innovations.

Under its Genetic Resources Policy Initiative (GRPI), working jointly with IDRC, IPGRI supports Crucible Group-style approaches—i.e. multi-sectoral, multi-stakeholder—in national and sub-regional fora. In its first year, pilot stage, GRPI is supporting the creation of multi-stakeholder genetic resources policy committees in six countries and three regions around the world. From its global coordinating office in Nairobi, Kenya, GRPI will also coordinate the communication and information sharing between the national and regional committees in order to 'ratchet up' lessons learned to a global level.

Working with the CGIAR's System-wide Genetic Resources Programme (SGRP) and with the International Service for National Agricultural Research (ISNAR), IPGRI has helped develop a training course/module on genetic resources policy and law. This course aims to make national plant genetic resources programme managers aware of the many policy and legal issues that are relevant to the management, distribution, and use of plant genetic resources. The training module focuses on options that exist for national programme managers in light of the international laws (i.e. CBD, WTO/TRIPS, International Treaty and the Cartegena Protocol on Biosafety), agro-economics, historical patterns in the conservation and use of genetic resources, and so on.

A resource for humankind

The CGIAR holds as much as 40% of the world's germplasm diversity for major food crops. Since 1994 these collections have been legally held 'in trust' under agreements with FAO—for the benefit of the international community, particularly developing countries. One of IPGRI's most pressing concerns in recent years has been coordinating this in-trust agreement with FAO. IPGRI, working through SGRP, is the main source of legal/policy advice for the CGIAR. IPGRI helps to draw up policies, and related legal instruments, such as the Material

Transfer Agreements that govern the movement of germplasm from genebanks to researchers and breeders.

One of the chief reasons for setting up the SGRP in 1994 was to ensure that genebanks preserved their collections efficiently. But a review of the genebanks' work pinpointed their desperate lack of an adequate and secure funding base. In 2000 the SGRP and IPGRI commissioned a study from professional fundraisers on how best to support the genebanks' work. As a result of this study the CGIAR approved a fundraising campaign, to be led by IPGRI, to set up a Global Conservation Trust, with an endowment of US$260 million.

Several governments and companies have already expressed support for the campaign. The impact of a successful campaign will be far reaching. The trust will help centres to meet their obligations to maintain their genebank collections. It will also set up an effective worldwide network of centres, sharing their collections and collaborating in maintaining them.

Suggested reading

Crucible II Group. 2000. Seeding Solutions. Volume 1. Policy options for genetic resources: *People, Plants and Patents* revisited. International Development Research Centre, Ottawa, Canada, International Plant Genetic Resources Institute, Rome, Italy, and Dag Hammarskjøld Foundation, Uppsala, Sweden. 121 pp.

Crucible II Group. 2001. Seeding Solutions. Volume 2. Options for national laws governing control over genetic resources and biological innovations. International Development Research Centre, Ottawa, Canada, International Plant Genetic Resources Institute, Rome, Italy, and Dag Hammarskjøld Foundation, Uppsala, Sweden. 243 pp.

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Training, a cornerstone of IPGRI's strategy

Training is a cornerstone of IPGRI's strategy, and more than 5000 scientists around the world have been trained by the institute since 1996. The effort put into the training programme reflects the importance of the human contribution to conserving plant diversity and the urgent need in many countries to build up a local pool of expertise. There has been an explosive growth in the number of people IPGRI has trained. Between 1998 and 2001 the number of trainees doubled. But even so, many developing countries still point to the lack of trained staff as a major factor holding back their efforts to conserve the genetic diversity of plants.

Although IPGRI has a global mandate, the Institute concentrates its capacity building activities on training people in developing countries. This is partly because developing countries are more likely to lack expertise than developed countries and partly because they have a greater amount of agricultural biodiversity at risk. The ultimate aim of the training strategy is to build up local skills—so that national programmes for conserving plant diversity become self-sufficient.

But the emphasis of IPGRI's training strategy is changing. There are three underlying reasons for this change. First, it reflects a shift in the philosophy of plant conservation. In the mid-1990s IPGRI concentrated largely on training people in techniques to take samples of valuable germplasm and to conserve it *ex situ* in national genebanks. The current portfolio includes training people to conserve plants *in situ*—in the fields and ecosystems in which they originated.

Secondly, the training programme is evolving to capitalize on the opportunities created by new technologies. Mapping biodiversity with data from remote sensing satellites or using molecular markers to identify particular characteristics in plants are becoming increasing important in PGR. And people must be trained in these new

MSc students at the University of the Philippines at Los Baños.

Distance learning

One of the most exciting opportunities offered by new technology is open and distance learning, in which students and teachers are in different places. Many of the people who would gain most from genetic diversity courses at universities are already working in national genebanks and other institutions. Residential courses away from home are expensive and many institutions can't afford to release a valued member of their small staff for two years to take a degree.

But technologies such as e-mail, multimedia computing and even video conferencing have made it far easier for teachers and students to stay in touch. The University of the Philippines at Los Baños, in collaboration with IPGRI, conducted a feasibility study on distance learning in 2001 in the Asia, Pacific and Oceania region. In September 2001 IPGRI organized a meeting of academic institutions from Malaysia, the Philippines, Sri Lanka and the UK at Serdang in Malaysia, to discuss better academic networking and the prospects for distance learning in Master of Science courses in plant genetic resources conservation and use. The Proceedings of this regional meeting were published in 2002 (Burke L., Oliver J.T., Ramanatha Rao V. and Sajise P.E. (eds.) 2002. Collaboration in PGR Education. Proceedings of the Meeting on Post Graduate Education in Plant Genetics Resources Networking. IPGRI, Serdang, Malaysia. 67 pp.).

The University of the Philippines Open University already uses distance learning widely and has the infrastructure to run these courses. As a result of the Serdang meeting the University of the Philippines at Los Baños, drawing on the Open University's expertise, will test a PGR policy course by distance learning as part of its Master of Science degree. An existing IPGRI policy course will be adapted for this pilot study, which is currently under discussion between IPGRI, UPLB and the UP Open University.

Existing courses need substantial changes if they are to be used for distance learning. Group work, for example, may not be practical when students are a long way from the institution they are attached to. If the institution has the technology the course could be supplemented by video conferencing. But many institutions do not have the technology and other solutions will have to be developed. Despite these drawbacks more and more institutions think distance learning is the way ahead and it is certain to grow. IPGRI's Central and West Asia and North Africa network, for example, recently made an agreement with the American University of Beirut and a multimedia provider in Egypt (RITSEC) to adapt existing residential PGR courses at the university for distance learning. Similar opportunities are being sought with regional PGR networks and academic partner institutes in the Americas, Europe and sub-Saharan Africa. It is expected that converting the Master of Science PGR degree programmes for distance learning will allow more people to take advantage of this educational opportunity, resulting in more qualified professionals and ultimately more sustainable conservation and use of PGR and agrobiodiversity.

techniques. The use of email, the Web and multimedia is also creating new opportunities for training, for example making distance learning far more attractive (see Box).

Thirdly, IPGRI's reviews of the training programme have identified some weaknesses that the strategic action plan sets out to remedy, principally the lack of monitoring of trainees and training programmes. Monitoring can only be done properly if the courses include 'beacons' that can later be used to measure the impact of the course on the trainee and his/her organization. During the last two years this has become a standard approach in IPGRI's short courses.

Training is inevitably time-consuming and expensive. So IPGRI is moving away from training people directly and instead concentrating on training the trainers and supporting institutions that train people in PGR. IPGRI still provides courses for genebank managers, for example, in cutting edge science such as new methods of preserving genetic resources, e.g. cryopreservation and molecular characterization. But many of the more established courses are being handed over to regional centres of expertise, or local institutions, with IPGRI giving practical and financial support. By producing high-quality trainers IPGRI aims to harness the 'multiplier effect', with the trainers teaching more people when they return home.

One of IPGRI's key aims is to stimulate degree and postgraduate courses in PGR at key universities. Studying abroad, in particular in the North, is difficult for many students in developing countries, because of language barriers, costs and the questionable relevance of the courses to their home situations. IPGRI is now working with and strengthening regional academic centres of excellence for the development of post graduate PGR courses. One of the first of these courses began at the

University PGR courses sponsored by IPGRI

Aleppo University, Syria

American University of Beirut, Lebanon

Hassan II University, Morocco

Universidad Nacional, Colombia

Universidad de San Carlos, Guatemala

University of the Philippines Los Baños

Universidad de San Carlos in Guatemala. Agronomy students have been able to take a PGR course at the university since in 1996. The following year IPGRI helped the University of the Philippines Los Baños set up a Master of Science course in PGR, donating laboratory equipment and computers. IPGRI has played a major role in setting up PGR courses at six universities (see Box).

IPGRI actively supports the efforts of these universities to attract students from other countries in the region as well as the home country. This strategy is already paying dividends. Many of the students have now gone on to take up prominent positions in their home countries. In Fiji, for example, the director of the country's genetic research into coconuts gained his Master of Science degree at Los Baños on a course supported by IPGRI.

IPGRI advises on how to develop the course curriculum and adapt it to local needs. IPGRI scientists regularly give lectures and demonstrations of techniques to students. And IPGRI also helps the university with the essential task of approaching donors to raise the funds for student scholarships.

One of the cornerstones of IPGRI's training strategy is to develop academic networks that cooperate in providing training. Criteria have been developed for evaluating potential centres of excellence and several are being set up. In Africa, for example, the East African Plant Genetic Training Consortium, which is led by the University of Nairobi, was set up after IPGRI organized an initial meeting of interested parties in December 1999. Six universities in Kenya are part of the consortium. One way in which the collaboration works is that students at one university are able to take relevant courses at another university, but they still receive their degrees from the university that they first enrolled in.

IPGRI's involvement with PhD and Master of Science students is a fruitful area of collaboration between IPGRI and the national PGR programmes. IPGRI scientists often supervise the theses. This has benefits that go far beyond simply helping students to hone their skills in plant genetics. The existence of high-level research has the effect of raising standards generally in the institution—as well as lending practical support to important research.

One of IPGRI's most important roles is to provide a source of expertise and knowledge that university teachers can draw on. IPGRI has developed a series of training modules, including slides, lecture notes and background material. These modules are designed to be flexible, so they can be adapted to both short courses and to degree courses.

Much of the training material is already available on the IPGRI Web site. But access to the Web is difficult in many developing countries so IPGRI is also publishing the material on CD-ROM. The Institute continues to translate its training material into the different languages. Much of the material is now available in Portuguese, Spanish, French, Russian and Arabic. Staff in IPGRI's regional offices have tested the material with students and teachers from the region to ensure that the course materials are at the appropriate level.

Training in *in vitro* conservation and cryopreservation, India.

IPGRI aims to ensure that the people who are trained are the right people—and that they receive the training that they need. IPGRI is now developing strict criteria for the selection of people to be trained, both for its own use and its regional partners in training and to strengthen the dialogue between course direction and the institution of the trainees so that the training course is geared to the needs of both the individual and the institution.

The practical support that IPGRI gives to national programmes in its efforts to help them become self-sufficient goes well beyond traditional training. Many institutions in developing countries, for example, find the computer software that is widely used in PGR information management and research prohibitively expensive. So IPGRI has recently started to evaluate 'open source' software, which is under a so-called public licence and can be used without paying licence fees. The conclusion was that open source software can, in many cases, replace expensive commercial software. IPGRI's regional office in sub-Saharan Africa has already started to use this type of software for its own work, and to develop a PGR information management system to be used by its partners.

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Project briefs

Strengthening national systems

Supporting the establishment and strengthening of national programmes in the Americas region

Scope and intent
This activity supports the organization and coordination of PGR activities at the national level by promoting and helping to establish national PGR committees, commissions and programmes and by strengthening the corresponding national institutions.

Key results and achievements
The Project has been active in promoting the development of national PGR programmes, in particular in Bolivia, Guyana, Mexico, Paraguay and the Caribbean islands. A national committee was formed in Mexico under the auspices of SOMEFI to promote the development of legislation establishing a formal national PGR programme. In Bolivia, the Project bid to design the Bolivian national PGR programme and contributed to meetings and publications aiming to increase national coordination of PGR activities. Efforts to establish coordination structures in Caribbean countries and territories, spearheaded by IPGRI in partnership with PROCICARIBE, resulted in the formation of committees in most countries of this subregion.

Activity Manager:
R. Lastra

Training and capacity building in the Americas region

Scope and intent
This activity provides strategic training to scientists involved in PGR conservation and use in the Americas, develops training support materials and provides information on training opportunities, with an explicit focus on developing national programme capacity.

Key results and achievements
A training module on *ex situ* conservation was released in 2000 in printed and electronic forms. Courses using it were organized in 2000 with countries in the region. In 2001, the module was translated into Portuguese and English. Spanish versions of the modules on ecogeographic surveys, introduction to collecting and planning collecting missions were released in 2001 and made available on the Web. Project staff provided guidance and technical support to eight students working towards degrees at different levels. In 2001, an MSc programme in PGR was inaugurated at the Colombian National University in Palmira, with IPGRI staff providing lectures and advising students. In 2001, the University of the West Indies developed a two-week component on PGR management as part of its MSc course on Tropical Biodiversity Conservation.

Activity Manager:
R. Lastra

Supporting national PGR activities and human resources development in APO

Scope and intent
The activity supports national programmes through visits, providing advice and information, assisting in preparing proposals and organizing national PGR workshops, emergency collecting and characterization and evaluation, and supporting human resources development activities in the region.

Key results and achievements
Visits were made to Bhutan, China, India, Mongolia, Nepal, South Korea, North Korea, island states of the South Pacific, Sri Lanka and Vietnam to advise on and assess PGR status. The proceedings of the national PGR workshops organized in Bhutan and China in 1999 were edited and published. Assistance was provided for national PGR workshops in Sri Lanka (November 2000) and DPR Korea (September 2001). Under the Nepal–Japan collaborative project on collecting, characterization and evaluation of PGR, a scientist from Nepal was trained in Japan in molecular techniques and buckwheat genetic diversity was assessed in 11 *Fagopyrum cymosum* populations using RAPDs; this study recommended *in situ* conservation monitoring of two populations showing highest genetic diversity. The InfoBase was developed further for assessment of national programmes' conservation status. A manual on the establishment and management of field genebanks was published and distributed to partners in the region. Regional training courses were conducted on: *In vitro* conservation and cryopreservation of PGR (focus on coconut), October 2000; Characterization, evaluation and conservation of tropical fruit species, May 2001, at the Indian Institute of Horticultural Research, Bangalore, India; and Use of molecular techniques for characterization of tropical fruit species, October 2001, at Wuhan, China. These courses were attended by 27 partners from 15 countries. Seven scholars that were supported through ADB funds completed the MS PGR course at the University of Philippines at Los Baños (UPLB). IPGRI staff lectured for some courses at UPLB, Philippines and Universiti Kebangsaan Malaysia.

Activity Manager:
R. Rao

Human resources development in CWANA

Scope and intent
The objective of this activity is to increase the number of skilled researchers and technicians involved in the conservation and sustainable use of PGR in CWANA.

Key results and achievements
The Activity involved training of more than 209 trainees (138 in 2000 and 71 in 2001) from 21 countries (14 from CWANA). Supervision of MSc and PhD thesis continued. 9 PGR courses (4 in 2000 and 5 in 2001) were held in Spain, Greece, Lebanon and Egypt, covering a variety of PGR aspects including GIS, molecular characterization, seed conservation and gene bank management and *in situ* conservation. One of these courses was organized jointly with the UNDP–GEF Near East Project in Syria for training trainers of Agrarian Schools. During the year an IPGRI-supported MSc student from the University of Aleppo defended successfully his thesis on wild almonds in Nebek, Syria. On the job training was also carried out to enable the Omani national

programme to develop a national management information system for PGR in the country (4 trainees) and plant descriptors in Morocco (one trainee) and GRIS PGR management system in Morocco and Tunisia (one trainee each).

Activity Manager:
A. Hadj-Hassan

Development of regional proposals and strengthening of institutional capacities in CWANA

Scope and intent
This activity aims at increasing the levels of funds available to national programmes in CWANA to undertake research and development activities for the conservation and sustainable use of PGR.

Key results and achievements
The OIC–COMSTECH/ IPGRI project proposal entitled '*In situ*/on-farm conservation of Agrobiodiversity in Central Asia' was approved by GEF–UNEP and Phase A of PDF initiated through five regional stakeholder workshops. An IPGRI/IFPRI proposal entitled 'Strengthening community institutions in support of conservation and use of GR in Uzbekistan and Turkmenistan' has been developed, submitted and approved for funding by the CAPRi CG's system wide project. A project proposal on the use of Cactus in the WANA region has been developed with the active involvement of IPGRI during the International Cactus Conference in Hammamet, Tunisia, 24–28 November 2000 and a proposal for ITC capacity building (E-Networking) of PGR National Programmes in CWANA was developed and submitted to InfoDev/World Bank.

Activity Manager:
G. Ayad

Sustainable crop genetic resources programmes in Eastern Europe

Scope and intent
This activity provides technical and organizational support to national programmes in eastern Europe through facilitation of research and conservation activities, workshops, training and capacity building, institutional strengthening and provision of technical assistance in emergency situations.

Key results and achievements
The emergency assistance project to the Suceava Genebank in Romania was completed at the end of 2000. The main objective was to improve the conservation facilities by upgrading one of the old chambers for long-term conservation storage. The project provided assistance for the further development of the national documentation system and printed the national catalogue of *ex situ* collections. Data on more than 24 000 accessions, previously held in different collections around the country, were entered directly into the genebank's information system. The technical cooperation project of FAO, approved for funding in May 2000, has built upon and further developed the work started by this project. Documentation of PGR collections in east European countries, focusing on the European part of the former Soviet Union, was supported through providing linkages with the EU-funded European Plant Genetic Resources Information Infra-Structure (EPGRIS) project. In particular, financial assistance was provided for non-EU countries to participate in the start-up subregional meetings. Technical advice and financial inputs were also provided for the organization of national workshops and the development of national *ex situ* PGR inventories in Armenia, Azerbaijan and Georgia. Collaboration with VIR gained a new momentum through the signing of a Memorandum of Understanding in 2001 between VIR and IPGRI. Joint activities have been initiated, including a workshop on sustainable programmes in the former Soviet Union countries, held at VIR in St Petersburg in October 2001, and translation into Russian of an increasing number of technical and public awareness materials.

Activity Manager:
B. Laliberté

Sustainable forest genetic resources programmes in Eastern Europe

Scope and intent
This activity aims at strengthening national programmes on forest genetic resources in eastern Europe. It facilitates international cooperation between east and west by providing support for participation of scientists and forest officers to international meetings, support to national and subregional workshops and collaborative research activities, capacity building and training, as well as development and coordination of specific technical projects aimed at strengthening national programmes.

Key results and achievements
IPGRI coordinated the project 'Genetic resources of broadleaved forest trees species in southeastern Europe'. Main activities during 2000 and 2001 included ecogeographic inventories leading to development of distribution maps and *in situ* gene conservation units. Seed stand databases were compiled. Scientists from all five participating countries (Bulgaria, Luxembourg, Moldova, Romania and Ukraine) were involved in joint experimental work on micropropagation carried out at the Centre de Recherche Publique in Luxembourg. Spatial genetic structures of autochthonous *Fraxinus* (ash) populations from Bulgaria and Romania were also studied at microsatellite loci. The main results were published in various technical publications. A national workshop on FGR was held in Yerevan, Armenia, in May 2000, with support from this activity. A comprehensive background study was prepared for the workshop. The first workshop of the International Training Programme on Conservation and Management of Forest Genetic Resources in Eastern Europe, jointly organized by the Federal Ministry of Agriculture and Forestry, Environment and Water Management (BMLFUW) of Austria and IPGRI, in technical collaboration with FAO, was held in Austria in 2000. The two-week workshop was attended by 22 young scientists and practitioners from 15 countries. A training manual on forest genetic resources was developed as a result of the workshop

Activity Manager:
J. Turok

National programme development in SSA

Scope and intent
This activity provides assistance to SSA countries in developing their capacity to conserve and utilize plant genetic resources through establishment and strengthening of national programmes.

Key results and achievements
National workshops on plant genetic resources were held in Gambia, Botswana, Cape Verde and Chad in 2000 and

in Sierra Leone and Equatorial Guinea in 2001. Outputs included the establishment of the plant genetic resources centre in Gambia and the adoption of a draft constitution for presentation to the Government of Chad for approval. Kenya and Uganda have developed strategic plans of action for implementation of PGR activities. An MOU was signed with the NMK with a view to promoting and fostering collaboration on PGR-related activities. Sudan was provided with material support to multiply 2000 accessions of cereal germplasm. IPGRI and INIA of Portugal carried out an assessment of the status of plant genetic resources in Guinea-Bissau that will form the basis for the implementation of training and other national programme development activities under the Lusophone Countries of Africa (LCA) Initiative. INIDA in Cape Verde and CIAT in Sao Tome and Principe were supplied with germplasm conservation equipment and accessories for the national genebanks under the auspices of the LCA Initiative. An assessment of impact made in national programmes that was carried out in collaboration with IFPRI, using Ghana as a case study, revealed that IPGRI inputs into helping countries to develop national capacities and implement PGR activities were substantial and well received. The national programmes of Benin, Cameroon, Guinea Conakry, Ghana, Guinea Bissau, Mauritania, Niger, Nigeria and Sao Tome & Principe were provided with chest deep freezers, ancillary seed technology equipment, generators, UPS, computers and printers.

Activity Manager:
D. Kiambi

Training and capacity building in SSA

Scope and intent
This activity aims at strengthening the human and institutional capacity of countries to sustainably conserve, manage and use their genetic resources in a more efficient and effective manner.

Key results and achievements
A report on plant genetic resources training capabilities and capacities in eastern Africa was prepared. Nearly 150 people were trained in various aspects of plant genetic resources. Two training modules (*ex situ* and *in situ* conservation) were translated into Portuguese and adapted by including relevant examples from Africa. Two descriptor lists (*Phaseolus vulgaris* and *P. lunatus*) were translated into Portuguese, printed and distributed to the Portuguese speaking countries in Africa.

Activity Manager:
H. Kamau

Developing methodologies, tools, curricula and training materials

Scope and intent
This activity focuses on the development of methods, tools, curricula and training materials for use in enhancing national capacity for research and strengthening national PGR training institutions. The desired outcome is increased knowledge and expertise to design, implement and manage genetic resources research activities and programmes.

Key results and achievements
Several training materials were developed in IPGRI's Americas office, with financial support from Spain and Portugal, and posted on the IPGRI Web site. The activity supported the development and publication of the proceedings of a training workshop in Austria on Forest Genetic Resources. In 2000, a baseline study was conducted to determine the level of teaching and training capacity and capabilities in eight universities, three national genebanks and three research institutes in East Africa. This study was published in 2001 and is being used as a guide to plan next steps for the Training Consortium of Eastern Africa public universities and institutions. As a result of the study, IPGRI helped the East African Training Consortium to develop a curriculum on seed/germplasm conservation techniques for use for degree training of technicians. A training needs assessment framework methodology was drafted and tested in CWANA in 2001 at the University of Amman, Jordan and the American University of Beirut, Lebanon. A feasibility study for MSc PGR curriculum using distance mode was carried out in 2001 in APO. In the Americas region, the activity made significant contributions to the development of a PGR curriculum at the Universidad Nacional de Palmira, Colombia. The first enrolment included 10 students in 2001. This MSc programme was recognized by the University as strategic and a model of cooperation between CIAT, IPGRI and the Universidad Nacional de Palmira, Colombia.

Activity Manager:
I. Zoungrana

Facilitating IPGRI training and capacity building activities

Scope and intent
This activity has focused on the promotion, dissemination and use of IPGRI training materials and tools for effective group training Institute-wide. It also supports individual training through IPGRI's fellowships and internships schemes.

Key results and achievements
In 2000–2001, 73 courses were organized by IPGRI. A total of 1796 people took part in group training and 73 people received individual training. Two IPGRI Vavilov–Frankel Fellowships were awarded in 2000 and a further two in 2001. Fellows came from El Salvador, Iran, Mauritius and Mexico and carried out their research in the USA and Denmark. In 2001, an evaluation of the former Italian-funded Research Fellowship and the Vavilov–Frankel Fellowship schemes found that the fellowship programme benefited the fellows by building their skills and knowledge, building contacts with other researchers, creating opportunities for publishing research results and presenting them in international or regional congresses or seminars. Most of the fellows went on to pursue and complete advanced degrees, and the fellowship research contributed directly or indirectly to the degree-related research. The fellowship programmes also contributed to the plant genetic resources programmes by increasing knowledge about species of national, regional or international importance. In 2001, new fellowship and internship schemes were initiated: (1) the Instituto Agronomico Oltremare (IAO) Fellowships initiated between IAO and IPGRI; (2) CIRPS Consortium of Italian Universities Internship scheme for graduates of the 'Cooperators in development' Master's degree programme at the University of Rome 'La Sapienza'; (3) the Commonwealth of Learning (COL) internship; (4) an internship scheme with the Quebec Ministry of Foreign Relations.

Activity Manager:
I. Zoungrana

Capacity building in evaluation and impact assessment for IPGRI and national programme partners

Scope and intent
The activity focuses on institutionalizing impact assessment and evaluation in IPGRI and its partners by assisting in the development of evaluation components of regional and project plans, building skills among IPGRI staff in evaluation methods and models, and improving internal planning and evaluation systems.

Key results and achievements
Following extensive consultation with IPGRI staff and external evaluation experts a strategy was developed to guide the work of impact assessment and evaluation in IPGRI for the next five-year period. The strategy combines a focus on evaluation studies needed to increase information about key IPGRI activities with emphasis on communicating the results of evaluation and impact assessment to external parties through public awareness activities. Presentations and written inputs were made to the SSA regional planning meeting and planning meetings of the Leafy Vegetables project, Fonio project and the Forestry Group. A self-assessment workshop was conducted for the GRENEWECA network in association with the capacity development assessment being carried out in Ghana. A seminar presented an overview of capacity development models and methodology for evaluating capacity development to IPGRI HQ staff and colleagues from other Rome-based international organizations. Assistance was provided to the development of a paper on the external review process to incorporate a stronger self-assessment dimension. The activity team, together with others in IPGRI, undertook a major collaboration with the FAO to develop a global system for monitoring the implementation of the Global Plan of Action. A strategy for FAO/IPGRI collaboration during the pilot-testing phase has been prepared and external funding will be sought to support the pilot phase.

Activity Manager:
J. Watts

Research on institutional frameworks to strengthen PGR programmes at the national, regional and international levels

Scope and intent
This activity focuses on research on institutional frameworks and decision-making and management tools to assist countries in the development and/or strengthening of effective national PGR programmes. The desired outcome is increased access to genetic resources policy analyses as well as to decision-making and management tools for national systems, policy-makers and the development community.

Key results and achievements
Issues Paper No. 8 and the accompanying fact sheets on key PGR issues for decision-makers were produced, translated into Spanish and French, and distributed to over 2000 PGR decision-makers and to participants at various workshops. A workshop on strengthening national PGR programmes was held in 2000 in Zschortau, Germany, with 22 participants from 18 CORAF member countries. The proceedings of the workshop were published in 2001. An evaluation study of the Plant Genetic Resources Centre (PGRC) in Bunso, Ghana was carried out in 2001 in collaboration with ISNAR, IPGRI Project C15 and GRENEWECA. The case study has provided evaluation skills to the local staff. It also helped fine-tune the participatory approach in evaluating national programme capacity. Two case studies on national policy implementation in Nepal and Ethiopia were carried out by national partners, in collaboration with other IPGRI projects. IPGRI training and impact assessment staff are collaborating with FAO to develop a global system for monitoring implementation of the Global Plan of Action. As part of this initiative, a set of indicators is being developed along with a reporting format to monitor IPGRI's work on national programme strengthening.

Activity Manager:
J. Engels

Strengthening coordinating mechanisms, structure and functions for carrying out capacity building and training

Scope and intent
This activity focuses on developing coherence across the institutional training programme by leading the development of a training strategy and action plan, managing databases of ex-trainees, training materials, events and opportunities, disseminating IPGRI training materials in electronic formats for wider use, and providing public awareness of IPGRI training activities.

Key results and achievements
A training officer was appointed in 2001 to lead IPGRI's training and capacity development programme. In September 2001, a report on the status of IPGRI's training programme and the way ahead was drafted and presented to IPGRI's Board of Trustees. This document will be fine-tuned into a new training and capacity-building strategy taking into account input from all IPGRI Groups, Programmes and Projects. IPGRI training materials were announced through the training Web site, in regional newsletters and special reports. A download format was added in 2001 to the Web site that requires all users downloading training materials to register their institution and their purpose. This format will allow the Project to closely monitor the use of the training modules and the audiences being reached. The training materials published on the IPGRI Web site have been heavily downloaded which indicates a significant take up. For instance, for the *Ex situ* Conservation module in Spanish, alone, there were 1721 downloads within a 3-month period. The TROP Database was Web-enabled in 2000. In order to reach a wider audience, information on training and fellowship opportunities from TROP is selected in the regions and shared with partners in newsletters, electronic bulletins and listservs, as well as on the IPGRI Web site. In 2001, a self-assessment workshop was carried out by the Project Team along with other DIT Group Projects and the results were used to develop a comprehensive report for an external review of the Project.

Activity Manager:
E. Goldberg

Working with networks

Supporting international collaboration and subregional networking in the Americas region

Scope and intent
This activity promotes international collaboration in the Americas through subregional PGR networks. Networks are key mechanisms to support and implement PGR activities at the national and subregional levels.

Key results and achievements
IPGRI was closely involved in the establishment of NORGEN in 2000, integrating Canada, Mexico and the USA. NORGEN will strengthen PGR activities in Mexico, enhancing the possibilities for germplasm and information exchange and for collaborative research; it is also expected to provide technical support to other networks. In 2001, IPGRI provided technical support to REMERFI in the preparation of a GEF project on biodiversity conservation in Central America and of a project on Sapotaceae conservation and use for the McKnight Foundation. In the Caribbean, the network appointed an information officer and CAPGERNet began to act on its own on key issues, for example in establishing a two-week component on PGR management as part of an MSc programme offered by UWI.

Activity Manager:
D. Williams

Coordination of INIBAP's activities in Latin America and the Caribbean and support to *MUSA*LAC

Scope and intent
This activity helps national banana research programmes in the region identify and address *Musa* research priorities at national and regional level and facilitates the establishment of collaborative linkages and intra-regional technology transfer; coordinates INIBAP's global activities within the region; supports the regional banana network, *MUSA*LAC, and maintains a mechanism for regional co-operation, information exchange and communication.

Key results and achievements
In 2000, the regional network (LACNET) was re-launched as *MUSA*LAC under the framework of FORAGRO. INIBAP sponsored several courses in Latin America and the Caribbean by Dr Sylvio Belalcazar on plantain culture and exploitation. A total of 619 people participated in these courses during 2000 and 2001. Scientific exchange visits between Latin America and the Canary Islands continued and a study tour on 'Improving plantain productivity: the transfer of technology from Caribbean and Latin America to Africa' took place in April 2001 in Dominican Republic and Costa Rica, involving 10 people from West Africa. A collaborative project with Peru focusing on organic production continued. A project in Cuba was initiated to study the variability of the Foc pathogen and its effect on FHIA hybrids. A project entitled 'Capacitación e investigación para manejo integrado de la Sigatoka negra del plátano en América Latina y el Caribe', financed by FONTAGRO, was launched. An International Workshop on Black Sigatoka Integrated Management Research was held at CATIE, Costa Rica in July 2001 and 35 people from 11 countries received training. A second course on methods to detect black Sigatoka sensitivity was attended by 15 people from 9 countries at CATIE in September 2001. The OAS–CICAD Project on the introduction of improved banana varieties to Alto Beni, Bolivia was approved. As a follow-up, a task force visited Alto Beni to prepare a larger proposal on the production of organic bananas for export, which was submitted to OAS–CICAD in September 2001. A second mission evaluated packing and transportation needs in October.

Activity Manager:
F. Rosales

Regional collaboration in APO

Scope and intent
This activity aims to strengthen links with regional and non-governmental organizations interested in PGR conservation and use and in equitable sharing of the benefits derived from exploitation of PGR. Institutional linkages, complementarity and synergy will be promoted in collaboration with IARCs, and other organizations working on PGR in the APO region.

Key results and achievements
Links with APAARI were further strengthened with IPGRI's participation in its regional meetings in 2001. The proceedings of 4th South Asia Network on PGR (SANPGR) meeting held in 1999 were published and distributed. The 5th SANPGR meeting was organized at NBPGR, New Delhi in October 2000 and an action plan was developed for implementing the recommendations. The proceedings of the East Asia Network for PGR (EA–PGR) meeting held in 1999 were published and distributed. An EA–PGR meeting was held in August 2001 in Ulaanbaatar, Mongolia and an action plan was developed. A subregional PGR directory, an analysis of genetic diversity in the Vigna angularis complex and a study on testing seed viability of eight crop species to develop models for predicting loss of viability were concluded under the auspices of EA–PGR. The first Pacific PGR network (now called Pacific Agricultural PGR Network — PAPGREN) was organized in September 2001. A work plan was developed and a PGR Adviser has been recruited. The proceedings of the Asian Network on Sweetpotato Genetic Resources (ANSWER) meeting held in November 1999 at Bogor, Indonesia were edited jointly with the International Centre for Potato (CIP) and published. The ANSWER Web page was established (http://www.eseap.cipotato.org/answer). The third ANSWER meeting was held in Bali, Indonesia in October 2001, focusing on *in situ* conservation of sweetpotato and a workplan for the next 2–3 years developed.

Activity Manager:
P. Sajise

Coordination of INIBAP's activities in Asia and the Pacific and support to BAPNET

Scope and intent
This activity helps national banana research programmes in the region identify and address *Musa* research priorities at national and regional level and facilitates the establishment of collaborative linkages and intra-regional technology transfer; coordinates INIBAP's global activities within the region; supports the regional banana network, BAPNET,

and maintains a mechanism for regional cooperation, information exchange and communication.

Key results and achievements
Ongoing research activities include work on germplasm characterization, IPM for virus control in the Philippines, study of nematodes in Vietnam and leaf spot diseases in China, India, Malaysia and the Philippines. Training courses were held on virus management and virus indexing in Bangladesh, IMTP in Malaysia and MGIS in India. The MGIS course was followed by a workshop on Names and Synonyms of Indian Banana Varieties. A full list of Indian banana names and synonyms will be published as a result of the workshop. A symposium was held in Davao, Philippines, to assess the information needs for the development of the banana industry. A workshop was held in Vietnam to assess R&D needs to enhance the *Musa* industry in Vietnam. A professionally facilitated meeting was organised for NARS representatives from the region to revitalise the regional network. As a result ASPNET was relaunched as BAPNET and a new network constitution and logframe were developed. Improved hybrids are being disseminated and evaluated in the Pacific region through an agreement with SPC and LoAs have been signed with Bangladesh, China, Indonesia, India, Malaysia, Philippines, Sri Lanka and Vietnam to establish national germplasm multiplication centres for *Musa* germplasm. A collaborative project with a private company on *Musa* disease control has been initiated in the Philippines. The research on *Musa* nematodes in Vietnam is now in its fourth year and is continuing to produce useful results and to build strong capacity for nematological research. Projects were started for two PhD students and an MSc student.

Activity Manager:
G. Molina

Provision of support to international collaboration in CWANA

Scope and intent
This activity aims to enhance international cooperation in the CWANA region so as to strengthen national programmes on PGR.

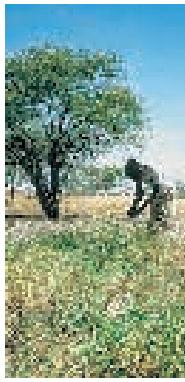
Key results and achievements
The CATC Network–PGR Forest Genetic Resources Regional Working Group met in Uzbekistan. A regional database on forest genetic resources was produced by the Uzbek Research Institute of Forestry. The Working Group on Fruit, Subtropical Plants and Grape Genetic Resources Regional held its first meeting in Uzbekistan. *Pyrus* genetic resources were surveyed and collected in Central Asia. Databases on fruits, grape and cotton in Central Asia were developed. Phase A of a Project Development Fund (PDF–A) on '*In situ*/On-farm Conservation of Agricultural Diversity in Central Asia' was developed.

Activity Manager:
A. Bari

Coordination of the European Cooperative Programme for Crop Genetic Resources Networks (ECP/GR)

Scope and intent
ECP/GR is a collaborative programme among European countries aimed at ensuring long-term conservation and facilitating the increased use of plant genetic resources in Europe. Special focus is given to East–West interaction and to the implementation of joint activities. The Programme, which is entirely financed by the participating countries and is coordinated by IPGRI, is overseen by a Steering Committee composed of National Coordinators.

Key results and achievements
Thirty-five countries are currently members of ECP/GR. During 2000 and 2001 Albania and Croatia formalized their membership. Regular meetings of the Potato, Barley, Grain legumes, and Wheat Working Groups were organized, as well as a number of additional ad hoc and network coordination meetings. The work of the *In situ* and On-farm Conservation Network was initiated during its first meeting in May 2000. This resulted in the preparation of a project proposal for a network on 'European wild plant diversity assessment and conservation', which has been approved for EU funding. The Inter-regional cooperation task force held its second meeting and prepared three project pre-proposals for the organization of inter-regional workshops on *in situ*, policy and documentation issues. Participation of non-EU partners in the meetings of the EU-funded conservation projects on *Avena*, carrot, barley, eggplant and *Vitis* was supported. Reports of the different meetings were compiled and printed by IPGRI. The *Allium* descriptors were produced with the support of the ECP/GR *Allium* Working Group. IPGRI's tasks in the EU-funded project for the establishment of a European Plant Genetic Resources Information Infra-Structure (EPGRIS) were carried out within this activity. These included identification of 37 national focal persons; preparation of a demonstration Web site for the Central Catalogue (EURISCO) of passport data for crop accessions conserved in Europe; support for the participation of non-EU funded focal persons in subregional meetings; and contribution to the development of the EURISCO descriptors, as part of the revision of the IPGRI/FAO Multicrop descriptors. The ECP/GR Mid-term Steering Committee meeting was held in October 2001, during which the first part of Phase VI was evaluated and a mechanism to prepare a strategy for the future of ECP/GR was defined.



Activity Manager:
L. Maggioni

Coordination of the European Forest Genetic Resources Programme (EUFORGEN)

Scope and intent
EUFORGEN is a collaborative programme among European countries aimed at ensuring the effective conservation and the sustainable use of forest genetic resources in Europe. EUFORGEN is overseen by a Steering Committee of National Coordinators nominated by the participating countries.

Key results and achievements
The second five-year phase of EUFORGEN started on 1 January 2000. Albania and Italy formally joined the Programme in 2001, bringing the total number of participating countries to 32. Eight Network meetings were organized during 2000 and 2001. The main objective of the first meetings of the Conifers and the Mediterranean Oaks Networks was to discuss priorities and establish workplans of these two new Networks. These were based on the outputs of the previous activities on *Quercus suber* (cork oak) and *Picea abies* (Norway spruce). The literature overviews, initiated by the Networks in Phase I, were enhanced and merged into a single EUFORGEN

bibliographic database, available on-line and providing access to literature published mainly in journals with limited distribution. The principal task of the Networks during Phase II is to produce a set of technical guidelines for genetic conservation and management of the different mandate species. As the development of the technical guidelines has been advanced in all the five Networks during past two years, it has become clear that one of the key factors for their adoption at national level is their availability in local languages. Some material has been translated. A technical bulletin on *in situ* conservation strategies for black poplar (*Populus nigra*) was printed in 2001. All the Networks developed tools for raising public awareness, including image collections, brochures and posters. The EUFORGEN Networks were associated with various research projects. The results and their implementation were discussed during Network meetings. Overviews of ongoing relevant research projects were also produced and Network members developed various new proposals. The concept of a Europe-wide system of *in situ* conservation units for sharing genetic conservation responsibilities was discussed and developed during the Network meetings held in this period.

Activity Manager:
J. Turok

Networks in SSA

Scope and intent
The activity seeks to advance and catalyse plant genetic resources conservation and use through subregional, regional and international collaboration and networking. The emphasis is on support to the three subregional plant genetic resources networks, GRENEWECA, EAPGREN and SPGRC.

Key results and achievements
GRENEWECA and IPGRI organized two regional conferences: in May 2000, the DSE workshop in Zchortau, Germany entitled, 'Towards sustainable national plant genetic resources programmes—policy, planning and coordination issues' for the Western and Central Africa national programmes, and the electronic conference in January/February 2001 with CORAF on the potential impact of the OAU model legislation on plant genetic resources work in West and Central Africa. EAPGREN funding for start-up of network activities was approved by SIDA in June 2000. Its first Regional Steering Committee meeting in Entebbe, Uganda in October 2000 developed work plans for the year 2001 and a programme of work for four years. Among the regional priority activities identified was the need for development of an information and documentation system that would enable harmonization and ease of exchange of plant genetic resources data and general information. Two discussion papers for SPGRC on strategies for *in situ* conservation and underutilized species formed the basis for strategies that SPGRC is developing for the region in these two thematic areas. IPGRI attended meetings of four Regional Crop Working Groups of SPGRC: *In Situ* and Underutilized Plants; Vegetables; Fruit and Nuts; and the first meeting of the Oil and Industrial Crops Working Group. Through the LCA Initiative, key documents identified by the LCA were translated into Portuguese distributed to LCA. National programme establishment activities were implemented steadily in Cape Verde, Guinea Bissau, Sao Tome and Principe. Basic conservation equipment was purchased, delivered and installed.

Activity Manager:
R. Vodouhe

Coordination of INIBAP's activities in East and Southern Africa and support to BARNESA

Scope and intent
This activity helps national banana research programmes in the region identify and address *Musa* research priorities at national and regional level and facilitates the establishment of collaborative linkages and intra-regional technology transfer; coordinates INIBAP's global activities within the region; supports the regional banana network, BARNESA, and maintains a mechanism for regional co-operation, information exchange and communication.

Key results and achievements
The BARNESA select committee met in August 2001 to discuss a draft strategy, which was subsequently submitted to ASARECA Committee of Directors for approval. Funding for the implementation of the BARNESA Strategy awaits approval by the EU. The project on the 'Conservation through utilization of banana and plantain in the Great Lakes region of Eastern Africa', funded by IDRC, entered its third year in 2001. A germplasm specialist was recruited in 2000. Information on cultivar diversity in the project sites has been collected and genetic erosion factors have been identified. NARS staff have been trained in germplasm characterization, pest and disease diagnosis and integrated pest management. Farmer exchange visits took place between project sites in Uganda and Tanzania. A project to collect and analyse baseline information on banana production systems using GIS commenced in 2000. Data collection and validation is now at an advanced stage. Similarly in 2000 a new project on farmer-participatory testing of banana IPM options in Uganda, Tanzania and Kenya began, funded by DFID, UK. Farm selection was finalized and stakeholders' meetings have been held in each of the participating countries to agree on the options to be tested on farm. Field trials are being planted. In 2000 the Government of Uganda approved the allocation of its CGIAR donation to INIBAP for the implementation of a biotechnology project. Following an initial planning meeting involving all project partners (NARO, Makerere University, CIRAD, KUL, IITA and INIBAP) research activities are underway in Uganda and Belgium. A planning meeting for the second year of the project was held in September 2001.

Activity Manager:
E. Karamura

Coordination of INIBAP's activities in West and central Africa and support to *MUSA*CO

Scope and intent
This activity helps national banana research programmes in the region to identify and address *Musa* research priorities at national and regional level and facilitates the establishment of collaborative linkages and intra-regional technology transfer; coordinates INIBAP's global activities within the region; supports the regional banana network, *Musa*co, and maintains a mechanism for regional cooperation, information exchange and communication.

Key results and achievements
Germplasm of improved varieties has been sent to seven countries for evaluation. The preparatory work for the project on peri-urban production of banana

and plantain in Ghana and Benin is complete and nursery and hardening facilities are established. Nine institutes/countries are participating in this project. Farmers, agricultural scientists and extension officers from five countries participated in a study tour to the Dominican Republic and Costa Rica in 2001 organized in collaboration with CTA. The study tour focused on new technologies for plantain production; participants agreed that the high-density plantain production technology demonstrated had the potential to revolutionize production of the crop in West and central Africa. The farmers who took part in the study tour have already started using this technology in their own countries. A training course on post-laboratory handling of tissue culture plantlets and on rapid multiplication of planting materials took place in December 2001, involving participants from six countries. Plantlets of the varieties to be evaluated in an on-farm evaluation project were prepared in South Africa to send to the Democratic Republic of Congo and Guinea (Conakry).

Activity Manager:
E. Akyeampong

Coordination and capacity building in coconut genetic resources

Scope and intent
This activity coordinates global research collaboration in coconut research and promotes the development and sustainable operation of national research programmes and regional networks in the Asia Pacific, Africa and the Americas regions, and their collaboration with each other and partner organizations and donors. It also strengthens national research capability through training, workshops, meetings, technical assistance and the sharing of expertise and technology.

Key results and achievements
Thirty-eight coconut-producing countries are now COGENT members. Five regional subnetworks are fully established and operational: South Asia (four member countries), Southeast and East Asia (7), South Pacific (8), Africa and the Indian Ocean (9) and Latin America and the Caribbean (10). Six training courses in coconut breeding, germplasm management, embryo culture, cryopreservation held in 2000/2001 were attended by 87 participants from 25 countries. Eight network meetings and workshops attracted 328 researchers from 35 countries. The Network supported 83 research projects involving 20 countries. Seven technical assistance missions involving 11 experts were conducted in 2000/2001. The Network generated support for MSc scholarships to enable 10 coconut researchers to study at the University of the Philippines at Los Baños. Regional project proposals for ADB, IFAD and ACIAR and bilateral projects for Kenya, Vietnam, Philippines and Malaysia were formulated and submitted to donors. Meetings of the COGENT Steering Committee were held in India in July 2000 and in Tanzania in June 2001.

Activity Manager:
P. Batugal

Secretariat to PRO*MUSA*

Scope and intent
PRO*MUSA* provides a link between *Musa* researchers worldwide, working within or outside the CGIAR on crops for export or for domestic consumption. By building on existing research initiatives and achievements, PRO*MUSA* provides a mechanism to maximize outputs and impact of the *Musa* improvement effort and strengthen NARS.

Key results and achievements
The third global PRO*MUSA* meeting was held in Bangkok in November 2000, during which INIBAP and Emile Frison were re-elected as the secretariat and coordinator of PROMUSA respectively. A nematology working group meeting was held in South Africa in May 2001. A meeting of the convenors of PRO*MUSA* working groups at INIBAP in 2001 discussed mechanisms for improving communication within and between the groups. Efforts are being made to distribute tasks between members of the different working groups. Email listservers have been set up to serve individual groups and the programme as a whole and a PRO*MUSA* section is published in INFO*MUSA* twice yearly. A project has begun in the framework of the Advanced Research Platform of Agropolis to map *Musa acuminata* translocation break points through molecular cytogenetics. As a result of collaborations through PRO*MUSA*, INIBAP facilitated the creation of the Global *Musa* Genomics Consortium, involving 26 partners from 13 countries. The Consortium was officially launched and a strategy developed at a meeting in Washington DC in July 2001, attracting considerable press coverage. A PRO*MUSA* collaborative research proposal, EUCCOM, has been submitted to the European Commission in the framework of the 5th PCRDT and a proposal has been approved for a project to take place in the framework of the Advanced Research Platform of Agropolis on the structural and functional genomics of banana streak virus sequence integration into the *Musa* genome.

Activity Manager:
J.-V. Escalant

Improving conservation strategies and technologies

Developing and promoting PGR management strategies and technologies in the Americas region through collaborative research

Scope and intent
This activity aims at initiating, developing, conducting and strengthening collaborative research activities with national and regional programmes to promote and improve methods for collecting, conserving, characterizing and using plant genetic resources.

Key results and achievements
Regional research focused on tropical fruits, germplasm health and the use of GIS. A project on the characterization of viral pathogens affecting *Passiflora edulis* was extended to other species, the research concentrating on the control of two viruses: a strain of *Soybean mosaic virus* adapted to *Passiflora* spp., and *Passionfruit yellow mosaic*. The morphological, molecular, cytogenetic and phytosanitary characterization of the Colombian *Passiflora* germplasm collection was completed in 2001 as well as the morphological and molecular characterization of pineapple. Data collection for USDA-funded inventories of wild crop relatives in Bolivia and Paraguay was completed in 2001. Two Paraguayan scientists received training in

the use of GIS tools for the analysis of species diversity and began data analysis. GIS models of the distribution of genetic diversity and genetic erosion risk were developed using wild and cultivated *Arachis* as a test case. With USDA support, peanut landraces from Guatemala were multiplied and characterized by national programme partners.

Activity Manager:
F. Morales

Studies on the factors affecting the extent and distribution of genetic diversity

Scope and intent
This activity is conducting case studies to investigate how environmental and cultural factors (including gender) and species biology interact to affect genetic diversity, in order to develop conservation strategies.

Key results and achievements
Research case studies have been effective not only in obtaining and analyzing data for various genepools of interest to national programmes and other IPGRI projects, but also in extending the skills and experience of collaborating national programme staff and in raising awareness of different ideas and approaches. Projects supported by BADC in Costa Rica (on the demography, phenology, ecogeography and genetic diversity of *Phaseolus lunatus*) and Mexico (on genetic diversity in the host–pathogen pair *Stylosanthes/Colletotrichum*) came to an end and partners concentrated on producing final publications. A follow-up proposal was submitted for the *P. lunatus* study focusing on the implementation of conservation strategies based on analysis and interpretation of the genetic and demographic data collected, while also extending its scope to other species in the genepool and another country (Peru). Support was provided to the preparation of a publication on the ecogeography, diversity and ethnobotany of Sapotaceae in Central America, due out in 2002. The role of farmers in shaping diversity was investigated in the IFAD project.

Activity Manager:
L. Guarino

Development and dissemination of methodologies and technologies for effective conservation and use of PGR with special emphasis on arid and semi-arid ecosystems

Scope and intent
This activity addresses the integration of methods, approaches and technologies for achieving effective conservation and use of PGR focusing on priority species for arid and semi-arid ecosystems. It includes several sub activities covering a variety of species and Stakeholder groups from across the region.

Key results and achievements
Ecogeographic surveys, germplasm collecting and agromorphological characterization were carried out on *Pistacia vera* in Central Asia (Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan) and West Asia (Syria) in 2000 and 2001. An expert mission assessed the status and diversity of the world's largest pomegranate collection in Turkmenistan and produced an initial germplasm catalogue in 2000. Ecogeographic and socioeconomic surveys and characterization of pomegranate were carried out in Syria in 2000 and 2001. Domestication studies on wild medicinal and vegetable species in Lebanon (chicory, salvia, oregano and gundelia) were completed in 2001. The ecogeographic distribution of melon in Uzbekistan was surveyed and a melon catalogue (110 accessions) was produced (in Russian, English and Uzbek) in 2001. The GEF–UNDP Project on Date Palm was launched and a stakeholder workshop on a participatory approach to surveying was held in Morocco in 2001. A new research on olive genetic diversity in Morocco and Syria was initiated in 2001 through participatory ecogeographic surveys, agrobotanical characterization and methodology development for quick variety identification using a combination of farmers' perceptions and innovative technologies (fractals). The IPGRI–CWANA genetic resources information system package (GRIS) was developed in 2000 and 2001 and distributed to national programmes in the region including Egypt, Morocco, Oman and Tunisia. The construction of the Libyan gene bank was successfully completed and its staff trained in Egypt in 2001. A national stakeholders priority-setting workshop for PGR was successfully held in Oman in 2001.

Activity Manager:
S. Padulosi

Cooperation with botanic gardens

Scope and intent
This activity was initiated in 2001 and aims at contributing to more cost-efficient and effective *ex situ* conservation efforts through better coordinated and synergetic activities between genebanks and botanic gardens at the institutional, national and international levels.

Key results and achievements
A plan for the establishment of a Web page for botanic gardens on IPGRI's Web site was developed with the aim of providing relevant IPGRI publications and other information sources in an easy accessible form to the botanic garden community. Consultations with BGCI on a possible collaboration are in progress and it is planned to create the page during 2002.

Activity Manager:
J. Engels

Crop wild relatives

Scope and intent
The project is concerned with strengthening the capacity to conserve and use crop landraces and their wild relatives and developing the knowledge required to make appropriate conservation decisions. The expected impacts of the project are: (1) a comprehensive and interdisciplinary base of *in situ* conservation theory, methods, and applications for crop cultivars and their wild relatives for national PGR programmes; (2) a better understanding of when, how and where farmers select, maintain and use local cultivars; (3) actual examples, methodologies and guidelines that can guide national programmes in establishing *in situ* conservation projects for crop cultivars and their wild relatives; (4) increased capacity of participating communities to use existing agricultural biodiversity as part of local development strategies through locally based crop-improvement programmes.

Key results and achievements
National workshops were held in partner countries and individual country components for the project were identified for the global UNEP–GEF PDF B project *In Situ* Conservation of crop wild relatives through enhanced information

management and field application.' In China 3000 specimens of wild crop relatives were found in herbariums and genebanks in Sichuan. The names, locations, habitats of these specimens were entered into GIS. Results showed that 55% of wild relatives were found in existing protected areas. Two other areas with high concentrations of crop wild relatives but outside of protected areas were recommended as priority areas for future research.

Activity Manager:
T. Hodgkin

Development and implementation of complementary conservation strategies

Scope and intent
To develop a complementary conservation strategy for crop genepools combining *ex situ* and *in situ* methods, and their utilization. The main aim of the activity has been to develop guidelines for a decision-making tool for the complementary conservation strategies of target genepools, using cassava genepool in pilot studies.

Key results and achievements
Guidelines for developing a complementary conservation strategy were prepared based on information gathered on decision-making tools. The guidelines were tested on cassava in Peru as a case study at the end of the year 2000. A workshop was held, during which the objectives for cassava conservation were defined, the extent of genetic diversity to be conserved prioritized and the most useful conservation options identified and prioritized. In 2001, the activity entered a new phase with the development of an approach aimed at integrating the various conservation methods while building on the results achieved in the past years. A discussion paper on a new strategy for complementary conservation was prepared and a workshop to discuss the future intervention will be held.

Activity Manager:
E. Dulloo

Effective methods and practices for collecting genetic diversity

Scope and intent
Despite much progress, germplasm collecting remains a key activity for national programmes. IPGRI has strongly supported PGR collecting activities in the past, but more recently the emphasis of this activity has shifted to strengthening and expanding methodologies and promoting best practices.

Key results and achievements
A consultancy was commissioned to review the use of computer-based taxonomic identification aids for PGR workers. On the key collecting issue of sampling strategies, attempts were made to clarify a disagreement in the literature over minimum sample size. A review of the divergent views was conducted and a paper was prepared for publication in a scientific journal. The results of past work testing the efficacy of targeted collecting were analysed and readied for publication. A paper and conference presentation on future trends in collecting were prepared. Internal guidelines for the conduct of collecting activities supported by IPGRI were developed. An activity with SGRP computerized existing IPGRI mission reports, covering the 80 000 accessions sent to CGIAR Centres (30% of the total) and investigated data quality.

Activity Manager:
D. K. Kiambi

Ex situ storage technologies

Scope and intent
This activity focuses on the development of technologies for the conservation of orthodox seeds, pollen and *in vitro* cultures for recalcitrant and vegetatively propagated species.

Key results and achievements
Orthodox seed research has focused on the development of low-input storage technologies (sun drying, freeze- or vacuum drying, ultra-dry seed storage). Projects have been implemented with partners in Africa, China, Europe, India and the USA. A synthesis meeting to discuss the main results of the global seed storage experiment, initiated in 1995 in collaboration with NSSL, ICRISAT and CAAS using lettuce seeds as a model, was held in China in November 2001. Following the synthesis meeting an international training course on ultra-dry seed storage was implemented jointly with FAO, during which the results of the global seed storage experiment and the freeze-drying project, performed with BVRC (China) and University Paris 6, were presented. Recalcitrant seed research included the continued screening of various species for their tolerance to desiccation and freezing in South Africa, the study of various physiological mechanisms linked to desiccation and freezing tolerance and the development of cryopreservation protocols for mango apices and somatic embryos in China. A project performed with CATIE (Costa Rica) and IRD (France) successfully established a cryopreserved collection of *Coffea arabica* seeds. A cryopreservation workshop, jointly funded by FAO and SGRP, was held in 2001 to strengthen the collaboration between CGIAR centres involved in cryopreservation research. A Technical Bulletin on cryopreservation techniques was drafted. A number of technical and scientific publications were produced or were being finalized, including Technical Bulletins on seed drying techniques and *in vitro* collecting.

Activity Manager:
F. Engelmann until February 2001; then J. Engels

Genetic resources management activities under SGRP

Scope and intent
This activity aims to promote and assist initiatives that advance knowledge, technology, capacity and practice for managing genetic resources *ex situ* and *in situ* in livelihood/production systems through CGIAR System-wide collaboration and partnerships with national and other organizations.

Key results and achievements
The management of genetic resources in ecosystems continued to be a pursuit of SGRP through involvement with the CGIAR's agenda on Integrated Natural Resources Management (INRM). An SGRP–CIFOR Workshop on Genetic Resources Management in Ecosystems was held at CIFOR in Bogor, Indonesia, in June 2000. This workshop brought together Centre scientists from the plant, animal, forestry and aquatic sectors; the genetic, NRM and social science disciplines, and outside experts. It was successful in debating the need for an integration of the 'twin pillars' of IGM (Integrated Gene Management) and INRM and developed a discussion paper and conceptual framework to illustrate the relationship between genetic resources management and INRM approaches. This paper was presented to the CGIAR

meeting on INRM at CIAT, Cali, Colombia in August 2001. SGRP was co-organiser of a session on the role of agricultural biodiversity in system productivity and resilience at this meeting. These initiatives have contributed to the attention now being given to genetic resources management in INRM approaches within the CGIAR. A CIP–SGRP–Swiss Development Cooperation Workshop on on-farm conservation research, held in August 2001 at CIP in Lima, Peru, shared lessons learnt on the methods, the sustainability and the policy and institutional requirements to support on-farm conservation. SGRP and FAO are co-financing the publication of the proceedings of this Workshop.

Activity Manager:
J. Toll

Germplasm documentation methodologies and applications

Scope and intent
This activity includes the development and enhancement of methods and applications to support activities in PGR documentation.

Key results and achievements
During 2000/2001 descriptor lists for *Citrus*, *Lathyrus,* jackfruit, Bambara groundnut, *Oxalis* and *Phaesolus lunatus* were published, some in several languages, in collaboration with IPGRI Regional Offices and numerous external partners. A revised version of the IPGRI/FAO Multi-crop Passport Descriptors was released in late 2001. Work on guidelines for the development of descriptor lists is under way. A draft version of descriptors for biochemical and molecular markers draft was produced and circulated amongst international experts. Systematic selection and initial testing the utility of free, open source software for germplasm documentation was carried out in collaboration with the IPGRI SSA Office. Initial results showed that the statistical package R is useful to PGR scientists. The GIS software GRASS is generally useful, but for specific applications related to biodiversity analysis there are better tools available either free or at low cost (DIVA, FloraMap). The molecular genomics database software ACeDB is a very powerful but complex tool for large amounts of molecular data. Its current application in PGR documentation seems rather limited.

Activity Manager:
T. Metz

Germplasm health

Scope and intent
This activity focuses on improving the health status of germplasm collections through the implementation of research projects and by disseminating information on relevant germplasm health issues.

Key results and achievements
Much of the work performed under this activity has focused on the production of technical publications. Technical guidelines for the safe movement of pomefruit and legume germplasm were finalized in 2000 and 2001 and a technical guideline for the safe movement of acacia germplasm was under development in 2001. A Technical Bulletin on forest tree seed health testing was under review and editing in 2001. A draft of germplasm health guidelines for the conservation of plant genetic resources was prepared and sent for review. Plant viruses affecting *Passiflora* spp. and African oil palm in the Americas and West Africa were characterized. Research on viral pathogens affecting *Carica* spp. germplasm in the Americas was undertaken to implement reliable pathogen detection methods. Seed transmission of the rice stripe necrosis virus was confirmed and linked to international dissemination of this new rice disease in the Americas.

Activity Manager:
F. Morales

Germplasm management

Scope and intent
This activity develops strategies and methods to organize and structure *ex situ* collections and develops management practises for the conservation, regeneration, characterization and distribution of accessions. The objective is to ensure secure, scientifically sound, practical, rational and economic maintenance of *ex situ* germplasm collections. Publication activities include the production of guidelines and technical bulletins.

Key results and achievements
Research work focused mainly on management of field collections, germplasm management at the community level and the development of a regeneration expert system. A project performed in collaboration with UPM (Malaysia) has shown that molecular markers provide an accurate picture of population diversity in a field collection of sweet potatoes. During a survey in the Suba district in Kenya, information was gathered on traditional seed systems, on-farm seed management, storage methods and gender roles with the aim of documenting and improving the traditional seed management at the community level. A regeneration expert system is under development with the assistance of a scientist at CAAS. The system will allow genebank curators to predict the time for regeneration based on existing vigour models of the crop and will help in planning future regeneration. A study aimed at developing improved conservation methodologies for medium- and long-term storage of coffee germplasm was initiated. Work started on two technical bulletins, 'Accession management: combining or splitting accessions as a tool to improve germplasm management efficiency', and 'A guide for effective germplasm collection management' to help genebank curators to better manage their collections.

Activity Manager:
E. Dulloo

Global Conservation Trust campaign

Scope and intent
This activity aims to promote, coordinate and undertake efforts to establish the Global Conservation Trust and develop its operations in building and sustaining an efficient global system of *ex situ* crop conservation. The campaign aims to create an endowment of US$260 million that will provide a permanent source of funding to sustain the management of the collections of plant genetic resources held in trust by the CGIAR Centres. It also aims to support other genetic resources collections to meet the standards of management that would enable them to become eligible for long-term financing from the Trust.

Key results and achievements
The campaign for the Global Conservation Trust got underway in mid-2001 following endorsement at the CGIAR Mid-Term Meeting. The SGRP-commissioned study by professional fundraisers Community

Counseling Services (CCS) examined the feasibility of a Trust as envisaged above. CCS indicated that it might be possible to raise US$260 million over four years to both endow the in-trust collections and provide technical support to other collections, given the support of FAO, the CGIAR System and the World Bank. With CGIAR endorsement and funding from the System, donors, SGRP and all Centres, CCS were engaged to commence the fundraising campaign. During 2001, the partnership to lead the campaign was forged between the Future Harvest Centres and FAO with important support from The World Bank and the Global Forum for Agricultural Research (GFAR). The UN Foundation has expressed strong support for the campaign, several governments have indicated serious interest in supporting the Trust and a number of positive discussions have been held with private-sector corporations. A study on requirements and options for the governance of the campaign was initiated at the end of the year.

Activity Manager:
R. Raymond

Knowledge base to support *in situ* conservation on-farm

Scope and intent
This activity aims to answer four main questions through research in six countries around the world: (1) what is the extent and distribution of genetic diversity maintained by farmers over space and over time, (2) what are the processes used to maintain the genetic diversity on-farm, (3) who maintains genetic diversity within farming communities, and (4) what factors influence farmer decisions on maintaining traditional varieties.

Key results and achievements
Farmers may characterize the units of crop diversity they manage not by a name but by a set of traits, referred to as 'Farmer's Units of Diversity Management' or FUD, which may or may not equal a named variety. The survival of certain cultivars can be linked to specific accompanying management practices. By altering environmental selection pressures that crops face, farmers influence the maintenance of genetic diversity in their agroecosystems, e.g. re-routing water to be warmed by the sun before irrigating high elevation rice plants in Nepal. Seeds from the formal seed sector cover a very small percent of cultivated area in the partner countries. Thus less than 3% of rice in Nepal, 5% of sorghum in Burkina Faso, 30% of maize in Mexico, and 13% of durum wheat and 3% of grain legumes in Morocco come from the formal seed sector. Research in Morocco, Nepal, Vietnam, Mexico, Burkina Faso, and Peru has shown that women farmers are not only very knowledgeable about the quality aspects of crop varieties but also about agromorphological and ecological adaptive traits of these varieties; they are informed and involved in the marketing of agricultural products. A Global Workshop was held in Burkina Faso on genetic diversity analysis and on-farm conservation. Specific hypotheses were developed and tested that could determine conservation and development actions. From these findings, a portfolio of development options, including seed cleaning, support to local seed cooperatives, participatory plant breeding, public awareness for cooking quality, and information exchange with policy-makers, has been established to enhance the benefits of local crop diversity to farming communities.

Activity Manager:
D. Jarvis

Methods for locating genetic diversity

Scope and intent
In order to plan and prioritize conservation activities, a PGR programme must first identify and locate geographic areas of interest as part of an eco-geographic study. This activity is developing and testing new and improved methods for describing the distribution of genetic diversity in space, in particular GIS, and transferring these to national programmes through publications and training materials.

Key results and achievements
Various GIS software tools were developed and tested in collaboration with CIAT and CIP, and made available to selected national programmes, e.g. by training IPGRI regional offices and PGR subregional networks in their use. In particular, DIVA–GIS Ver. 1.4 was officially released at the beginning of 2001 and Ver. 2.0 is planned for early 2002. Analyses of a variety of datasets were carried out in a series of case studies, when possible involving training of national programme staff, to test different GIS approaches and methodologies and the new software tools. An example is the analysis of data on wild peanuts in South America in support of crop wild relatives conservation activities by national programmes in collaboration with USDA, ICRISAT and IPGRI. Awareness building within the PGR community was also addressed through conference presentations, scientific papers and posters, in particular a number of contributions to SAT21. Implementation of the GTZ-funded project 'Patterns of genetic diversity and genetic erosion of traditional crops in Peru: Rapid assessment and risk prediction using GIS tools' in the Amazonian department of Ucayali included data gathering, training national programme staff in GIS and cassava microsatellite analysis, and initial germplasm collecting. A draft of a technical bulletin describing a methodology for ecogeographic studies of crops was prepared.

Activity Manager:
L. Guarino

Methods for measuring genetic diversity

Scope and intent
PGR programmes need access to a range of techniques for the measurement of genetic diversity to be able to gather the basic information necessary for the efficient conservation of target genepools. Through this activity a range of different complementary techniques (morpho-agronomic, biochemical, molecular, ethnobotanical) is being developed, refined, tested through case studies in various crop genepools and transferred to national programmes through publications and training materials.

Key results and achievements
A molecular geneticist was appointed in 2000 to lead this activity. She developed a strategy for future work that stresses collaboration with national programmes and other CGIAR centres. Marouen Jammazi of INAT (Tunisia) was appointed IPGRI–IAO fellow and started work on the project 'Patterns of molecular diversity: integrating GIS and molecular marker studies'. Partners from Mexico and India are ready to begin work on the CIRAD–IPGRI project

'Microsatellite markers and genetic resource management within networks'. Support was provided to two collaborative activities with Cornell University: 'Harnessing investment in genomics of model species for vegetable improvement' (expected to provide public access to a number of molecular tools and resources of *Capsicum* now in the private domain), and 'Genomic approach to the improvement of fruit quality on melon and other cucurbit crops' (expected to develop a fruit microarray that will be useful in the large-scale assessment of genetic variability and nutritional traits in this melon and other cucurbits). Work continued with partners in Latin America on developing a Spanish-language manual for the analysis of morphological characterization data.

Activity Manager:
M.C. de Vicente

Methods for monitoring and predicting genetic erosion

Scope and intent
Effective monitoring of changes in the extent and distribution of genetic diversity, and prediction of such changes, are necessary for the prioritization and timely implementation of conservation measures. The activity develops, tests and disseminates methodologies for the assessment of past genetic erosion and for the identification of predictors of future genetic erosion.

Key results and achievements
The IFAD project 'Programme for the development of strategies for *in situ* conservation and utilization of plant genetic resources in desert-prone areas of Africa' continued its field and laboratory work and entered a phase of data analysis. Surprisingly, a study in Mali that compared currently grown sorghum landraces with material collected by Orstom, ICRISAT and IBPGR 20 years ago provided only marginal support for the theory that decreasing annual rainfall over the last 40 years is leading to genetic erosion. It indicated that the major cause of high genetic erosion in the south of Mali is in fact the increased area under maize and cash crops such as cotton. Rapid genetic erosion monitoring methodologies were also developed and tested on pearl millet in India and data analysis is in progress. This study also includes comparison of pearl millet landraces collected in 2001 and some 20 years ago by ICRISAT in Rajasthan. Similar studies on coconut genetic erosion were undertaken with COGENT member countries, and information on erosion indicators is now available from India, Sri Lanka, Philippines and Kiribati. GIS methodologies for the spatial analysis of genetic erosion were developed with support from FAO and incorporated in the DIVA–GIS software. GIS analysis of the possible effect of climate change on species distributions was applied to datasets on wild peanuts and rice, and the W. African fruit tree *Irvingia* using the FloraMap software.

Activity Manager:
P. Mathur

Increasing the use of PGR

Characterization, evaluation and use of coconut diversity

Scope and intent
This activity catalyzes and supports work to characterize coconut germplasm collections in national and regional genebanks, to enhance and share these materials with other programmes, to undertake in-country, inter-country and inter-regional evaluation of promising varieties and hybrids and to disseminate promising selections for replanting and breeding activities in national programmes.

Key results and achievements
Passport and characterization data of 593 accessions in 17 national coconut genebanks were submitted to COGENT for documentation in the International Coconut Genetic Resources Database in 2000/2001, increasing the number of entries to 1352. Assessment of the performance of high-yielding varieties and hybrids and farmers' varietal preferences was ongoing in 18 countries, with initial reports received from 10 countries. The Philippines sent pollen of five varieties to Vietnam for the latter's breeding programme. Multilocation trials to evaluate six common hybrids and locally produced hybrids were initiated in three African countries (Benin, Côte d'Ivoire, Tanzania) and three LAC countries (Brazil, Jamaica, Mexico). A paper entitled 'Construction of a Linkage Map of the Rennell Island Tall Coconut type (*Cocos nucifera* L.) and QTL Analysis for Yield Characters' was published in Genome.

Activity Manager:
P. Batugal

Diversity in production

Scope and intent
Inter- and intra-specific crop diversity is a desirable and necessary element of sustainable production in many farming situations. However, the contribution of diversity to the farming system is inadequately documented, as are factors motivating the maintenance (or reduction or enhancement) of diversity. The activity seeks to identify when and where enhancing diversity may be desirable, what germplasm fulfils these needs and how it may best be deployed.

Key results and achievements
Collaborative work with FAO led to the publication of Cooper, D, Spillane, C., and Hodgkin, T. (Eds.), Broadening the genetic base of crop production CABI, IPGRI, FAO, 2001). The possibility of developing a case study involving soybean was explored at an international workshop in India where a work plan was developed for which funding is now sought. Diversity of yams in W. Africa appears in part to be maintained through the continued introduction of new feral or wild materials that are then 'domesticated' by farmers. Studies in collaboration with two villages in Benin, the Université nationale du Benin (UNB), the Institut nationale de recherche agricole du Benin (INRAB) and IITA have led to two Ph D theses and involve participatory diagnosis of seed tuber systems with morphological and molecular characterization of materials.

At the end of 2001, IPGRI co-organized (with UNU, FAO and CBD) a symposium in Montreal on the management of agricultural biodiversity as an input to the CBD SBSTTA. This explored issues in management and use of diversity in all aspects of sustainable production – see http://www.unu.edu/env/plec/cbd/Montreal/content.html.

Activity Manager:
M. Grum

Improving the use of *ex situ* conserved germplasm

Scope and intent
The activity is concerned with improving the use of genetic resources maintained in *ex situ* collections. It includes work on characterization and evaluation of germplasm and on the development and application of methods to locate accessions with specific desirable traits in large collections. Work on the development and use of core collections in order to enhance germplasm use has been supported and, more recently, there has been increasing emphasis on the potential of molecular methods for improving use of accessions in gene banks.

Key results and achievements
Technical Bulletin No. 3 on core collections and Technical Bulletin No. 4 on the design and analysis of evaluation trials of genetic resources collections were prepared, published and distributed. In collaboration with Projects C08 and C09, and with the support of CIRAD, France and LARS, UK, a set of coconut microsatellites was developed and tested. This set will provide a kit that can be used by gene banks, researchers and others throughout the world to determine molecular patterns of diversity in coconut materials, supporting accurate identification and characterization of material and helping breeders choose appropriate breeding lines. With support from the EU, the use of molecular markers to support conservation and use of germplasm was tested by complete molecular characterization with AFLPs and microsatellites of the CGN lettuce collection of over 2000 accessions. The results showed that the approach was technically feasible but that new approaches to the analysis of data were needed to cope with such large amounts of data. EU funding has been obtained for a follow up project called GENEMINE, which will focus on analysis of molecular data.

Activity Manager:
T. Hodgkin

Patterns and problems in using *ex situ* conserved plant genetic resources

Scope and intent
A prerequisite for improved use of plant genetic resources is a clear understanding of the different ways in which they are currently used and of the problems encountered by potential users. The activity seeks to determine the extent of germplasm use in all its aspects, including use in evaluation, in research to improve production, in plant breeding and other areas. At present, the activity focuses on use of germplasm conserved *ex situ* and is expected to provide information of direct relevance on multilateral use patterns, accessibility and the benefits of plant genetic resources use

Key results and achievements
A survey in China of use of *ex situ* conserved germplasm over the past 15 years of 10 crops (rice, wheat, maize, soybean, cotton, Citrus, cucumber, tea, mulberry, cabbage) was concluded in collaboration with the Institute of Crop Germplasm Resources of CAAS. The results of this study were published in Plant Genetic Resources Newsletter (123: 1–8). Studies of use of genetic resources in USA *(Amaranthus*, *Helianthus,* Cucurbits), of the use of US germplasm distributed overseas (wheat, rice, soybean, maize, barley, cotton, sorghum, potato, beans and squash) and of the use of germplasm maintained at CATIE were also completed during this period. An analysis of the use of cassava and beans maintained at CIAT is close to completion. The results show that material from the gene banks studied is widely distributed and extensively used. The major limitations to use seemed to be associated with user capacity (numbers of breeding programmes and approaches used), the amount of information available on accessions especially evaluation data, and the availability of accessions as a result of regulatory or other constraints. About 22% of the papers published in four internationally recognized crop plant genetics journals reported use of plant genetic resources from *ex situ* collections (Crop Science 41:6–10).

Activity Manager:
R. Rao

Strategies in the conservation and use of neglected and underutilized species (NUS)

Scope and intent
The activity addresses key strategic concerns and major global issues relevant to the improved conservation and use of neglected and underutilized species. It seeks to create synergies and facilitate sharing of experiences between regionally or locally based actions. It includes support for NUS documentation, Web page preparation, project development and coordination, and representation of IPGRI in relevant meetings.

Key results and achievements
A proposal for a global project on 'Enhancing the contribution of neglected and underutilized crops to food security and incomes of the rural poor' was developed. The project will involve seven countries (Bolivia, Ecuador, Egypt, India, Nepal, Peru Yemen) and a range of traditionally important crops including minor millets, quinoa and locally important medicinal and aromatic plant species. Through support from IFAD, stakeholder meetings were held in each country to plan project activities and develop work programmes and timetables. A number of public awareness activities were carried out including radio, TV and magazine interviews, and presentations at international meetings. With support from Germany, and under the aegis of GFAR, IPGRI has agreed to host a Global Facilitation Unit on Neglected and Underutilized Species at its Rome HQ. This unit will act as an information clearing house and allow the different organizations involved in some way with neglected and underutilized species to coordinate their activities better. During the biennium, IPGRI continued to support work on the distribution and management of genetic diversity of fig in Syria as a model for exploring diversity management issues in a perennial neglected species.

Activity Manager:
S. Padulosi

Managing and communicating information

Dissemination of information and public awareness in the Americas region

Scope and intent
This activity increases access of target audiences in the region to relevant information and enhances and facilitates their own information activities. It aims to raise awareness of key PGR issues, especially among national policy makers and representatives to international fora.

Key results and achievements
The IPGRI-Americas Web pages were produced and launched in 2001, with versions in English and Spanish. A bibliography on Neotropical fruits was released in 2000 and one on underutilized root and tuber crops was released in 2001; both are available through the IPGRI Web pages. An inventory of native fruits of the Americas was also made available on the IPGRI Web site in 2001. Three stories were written for the 1999 Annual Report, two of which were also used for *pgr*. Two issues of the regional newsletter and three fact sheets were produced in English and Spanish and distributed. The text for the Americas Regional Report 1999–2000 was written.

Activity Manager:
M. Baena

Supporting documentation activities of national programmes and networks in the Americas region

Scope and intent
This activity aims at strengthening the capacity of national programmes and institutions in germplasm documentation. It supports the development of documentation tools and methodologies to manage genebank data, provides training and promotes the use of common standards to facilitate data exchange.

Key results and achievements
In 2000, PROINPA, Bolivia and INIAP, Ecuador migrated their data of their roots and tuber crop collections into pcGRIN. In 2000 and 2001, documentation training courses were held in Bolivia, Guyana, Mexico, Peru and the Caribbean. An English version of the pcGRIN exercise book was developed. 23 genebank managers from several West African countries participated in a pcGRIN training course conducted in French in Benin in 2001. This was the first pcGRIN course held outside the Americas region. A proposal for a third phase of the CIP-led root and tuber project was completed. Development of a Spanish-language manual for the analysis of morphoagronomic characterization data was begun in 2001. The descriptor list for *Oxalis tuberosa* was published in 2001, in collaboration with CIP. Computers donated by USDA were sent to 12 countries to support genebank documentation activities.

Activity Manager:
T. Franco

PGR documentation and information management and public awareness in APO

Scope and intent
This activity aims to provide training in PGR documentation to build the capacity of national programmes. It also supports development of tools for PGR documentation that using current information technology and promotes information exchange and formation of information networks on crop, national and regional bases.

Key results and achievements
A revised TaroGen Excel macro (TaroGen 2000) for taro descriptors was developed along with a users' manual to facilitate data documentation and exchange. The macro developed is also being used in developing electronic descriptors for mango, citrus and jackfruit. The activity assisted Nepal in the development of Community Biodiversity Registers. A documentation training course was held in the Philippines in September 2000 for participants from nine countries working on tropical fruit species project. Eleven staff members of the National Agricultural Research Institute, Papua New Guinea were trained in information management in December 2000. An Information and Communication Technology Workshop was held in May 2001 and an action plan for the next three years was developed. Documentation tools developed included *In situ* 2001 recording software and manual, data analysis software for use by *in situ* project members and electronic catalogues. Electronic catalogues of 10 crops were placed on CD-ROMs and are available to users in China. A new DIP viewer was developed at request of NBPGR, India to facilitate electronic cataloguing. IPGRI's partners in Thailand published the documentation guidebook in Thai. The education kit was further revised and the activity assisted in the distribution of PA posters for primary school children in APO. A plan for a school Web site was developed through a tree site linked to the activity on E-conservation. A proposal for a 'Cyber plant conservation project' developed with MIMOS (an ISP) and MARDI received funding from the government of Malaysia and work has begun. Six issues of the APO Newsletter published and widely distributed.

Activity Manager:
P. Quek

Production and dissemination of appropriate PA material to targeted audiences in CWANA

Scope and intent
The objective of the activity is to raise the awareness on the importance of PGR at the regional and national level in the CWANA region.

Key results and achievements
Many activities have been directed to different target groups and successfully carried out in close collaboration with national programmes and regional projects such as the UNDP-GEF Near East Agrobiodiversity Project. An evident sign of the impact of this work is the recognition by senior policy makers (e.g. the Syrian Minister of Education) of the strategic role played by IPGRI in this field. The project actively contributed towards the development of national PA strategies for PGR in several countries (including Syria, Jordan, Lebanon). New stakeholders joined in the PA campaigns led by IPGRI;

these include *inter alia* the Syrian National Inventors' Committee and a number of national NGOs. Five issues of IPGRI CWANA Newsletters produced in English, Russian and Arabic.

Activity Manager:
R. Khalil

Public awareness on *Musa*

Scope and intent
This activity aims to promote INIBAP's activities and achievements and to improve the awareness among donors, policy-makers and the general public of the importance of *Musa* for sustainable development and food security.

Key results and achievements
Several public awareness products were developed on the occasion of INIBAP's 15th anniversary in 2000, including fact sheets, stickers, display panels and an English version of the brochure 'Les bananes' and related multimedia CD-ROM. 'The conservation and distribution of *Musa* germplasm' from the INIBAP genebank was selected for presentation at EXPO 2000 (Hanover, Germany). The Eden Project opened to the public in the UK with exhibitions of bananas from the INIBAP genebank. The launching of the Global *Musa* Genomics Consortium in July 2001 attracted an exceptional press response managed by Future Harvest, Burness Communications and INIBAP. Well over 100 published articles and broadcasts in at least nine languages have been documented so far. Filming by Baobab Productions took place in Asia, Africa, Europe and America, resulting in more than 18 hours of film footage of banana farmers, INIBAP projects and partners. An 18-minute film on the importance of bananas, the problems faced by smallholder banana farmers and INIBAP's work has been produced and was launched during the AGM of the CGIAR in 2001. The format of the slide database in MS Access has been revamped, new slides and data have been added and a new interface for searching the database has been developed for use on the Intranet.

Activity Manager:
C. Lusty

Bibliographic and researchers' information processing, retrieval and delivery; question and answer service on *Musa*

Scope and intent
This activity aims at providing an efficient information service to the global *Musa* community through responding to queries and regular maintenance of the INIBAP bibliographic database (*MUSA*LIT) and the Banana Research Information System (BRIS). It also ensures a continuous flow of information between INIBAP HQ and regional information and documentation networks.

Key results and achievements
In 2001, requests for information increased by almost 40%, with a total of 742 requests being dealt with during the year. Two editions and one index of the journal *Musarama* was published in 2000. The production of updated issues in 2001 was largely limited to electronic versions. New data for *MUSA*LIT were received from CIRAD-FLHOR and the RISBAP regional network; the database now holds 6200 bibliographic abstracts. Updates of the Spanish/English version of *MUSA*LIT continued to be sent to IICA (Costa Rica) in the framework of the project Agri2000. Both *MUSA*LIT and BRIS (with more than 800 records on researchers) data have been reformatted for inclusion in the annually produced *Musa*Doc CD-ROM. To improve the exchange of information with and within the regions *MUSA*LIT was migrated to the user-friendly software CDS/ISIS for Windows. BRIS was transferred to Access software to consolidate the link with the INIBAP mailing list. An electronic library is being built, linking full text documents to the corresponding reference in the *MUSA*LIT database.

Activity Manager:
G. Ponsioen

Information and documentation in SSA

Scope and intent
This activity focuses on enabling partners to make informed decisions in managing plant genetic resources by putting at their disposal better documentation tools for data management and analysis, as well as information to promote public awareness.

Key results and achievements
In 2001, GIS fellowships awarded to Sudan and Burkina Faso national programmes were completed. The fellows received training in using GIS technology in plant genetic resources work, as well as getting hands-on experience in data organization and structuring. The global *in situ* conservation project was supported to produce a coherent data structure. The activity team supported, facilitated and coordinated the pcGRIN documentation workshop for West and central African countries held in Benin; 11 countries attended the training and are now using pcGRIN as a documentation tool. The USDA was instrumental in the success of this course, primarily by providing 10 computers and providing funds for one resource person. Documentation support, on a continuing basis, was given to the National Genebank of Kenya. Support was also given to the IFAD *in situ* project in using GIS and statistical data analysis. A number of open source systems were evaluated, including MySQL, PHP and Apache. A prototype documentation system is now in place using this combination. The R statistical environment was also evaluated and found to be very robust as a possible system for the analysis of genebank data. Already, this system has been introduced to the Genebank of Zimbabwe. Newsletters numbers 14 and 15 were produced.

Activity Manager:
I. Mukema

Documentation and information on coconut research

Scope and intent
This activity provides documentation and information support to COGENT and promotes awareness of new developments in coconut research and development. Tasks include: publishing COGENT reports; producing the COGENT newsletter; developing an international coconut genetic resources database (CGRD) and a coconut data management (CDM) software; and promoting public awareness of coconut research.

Key results and achievements
By the end of 2001 the CGRD held information on more than 1300 coconut accessions in 25 sites from 22 countries, up from 936 accessions in 1997. This information, which is shared with coconut breeders worldwide, allows breeders to strategically select and request germplasm needed

for their breeding programmes. The development of catalogues of conserved germplasm, farmers' varieties, high-value products and food recipes was initiated and these activities are in progress. The development of manuals on coconut germplasm health management and translation/updating of the STANTECH manual in English, French, Spanish and Portuguese were initiated. Two issues of the COGENT Newsletter were published and the COGENT Web page was launched. Several articles on coconut were published in member countries in 2000/2001.

Activity Manager:
P. Quek

Publications on *Musa*

Scope and intent
This activity aims to provide ready access to up-to-date scientific and technical *Musa* information, especially on pests and diseases and genetic resources, in the form of books and CD-ROMs. Technical support is also provided when necessary for the production of regional publications. The regular updating of the mailing list database is also an important element of this activity.

Key results and achievements
Publications produced during 2000 and 2001 include 'Organic bananas 2000: Towards an organic banana initiative in the Caribbean', 'Evaluating bananas: a global partnership', '*Musa*logue II', and several publications in English, French and Spanish, viz four editions of INFO*MUSA*, two disease fact sheets, two pest fact sheets and 'Cryopreservation of *Musa* germplasm' (INIBAP Technical guidelines No. 5). 'Organic bananas 2000' was reprinted in 2001 as a response to strong continuing demand for the book. Publications produced from 1998 to 2001 and the complete trilingual technical guidelines and fact sheets collections were included in *Musa*Doc CD-ROMs for 1999, 2000 and 2001. Updating of the mailing list is ongoing and its interface has been improved.

Activity Manager:
C. Picq

Building capacity in information and communication technology

Scope and intent
This activity focuses on creating awareness, knowledge and expertise in information technology needed for the sustainable management of genetic resources at the local, national, regional and international levels. The two main areas of work are the evaluation and promotion of affordable and appropriate software for germplasm documentation, and facilitating access to networked information systems.

Key results and achievements
The cost of state-of-the-art software may be prohibitive for countries with low per-capita income, and as a result software piracy is widespread. To evaluate affordable alternatives, a feasibility study was carried out to assess the suitability of the Linux operating system and free open source software applications as an alternative computing platform for PGR information management systems in developing countries. The major conclusion reached was that open source software is a valid option especially for resource-poor national programmes. However, this option has resource implications for IPGRI staff and staff training to provide basic support to national programmes using open source software. IPGRI's regional office for sub-Saharan Africa has already started using selected open source software in national capacity building and database development. According to the Global Plan of Action for the Conservation and Sustainable Utilization of Plant Genetic Resources for Food and Agriculture, access to networked information systems within institutions, within countries and on a global level is an ultimate goal to facilitate the construction of comprehensive information systems for plant genetic resources for food and agriculture. An internship sponsored by the government of Quebec was used to investigate the role of open source software in bridging the digital divide between rich and poor countries. The results of this internship will be reflected in IPGRI's strategic action plan on plant genetic resources documentation.

Activity Manager:
T. Metz

Conception, development and maintenance of the INIBAP Web sites

Scope and intent
This activity maintains a Web site on INIBAP activities and products. The activity includes translating the site into three languages (English, French and Spanish) and the regular updating of information on INIBAP and PRO*MUSA* Web sites.

Key results and achievements
The new INIBAP Web site was launched in December 1999 in English and in April 2000 in French and Spanish. It provides comprehensive information on all INIBAP activities and outputs, and includes the full text of a wide selection of publications, access to the databases *MUSA*LIT and BRIS and a list of accessions available from the INIBAP genebank. It also provides information on meetings, events related to banana and plantain and links to other sites of interest for the *Musa* community. The PRO*MUSA* Web site and INIBAP page on the IPGRI Web site were also redesigned following the IPGRI style guidelines. The PRO*MUSA* Web site is still under construction. Over 50 000 visits were made to the INIBAP site between April 2000 and September 2001, the databases proving the most popular pages.

Activity Manager:
H. Doco

Conducting awareness raising activities aimed at policy-makers, donors, media, NGOs and children about plant genetic resources issues

Scope and intent
This activity focuses on regular production of publications such as *Geneflow*, the IPGRI Annual Report, *pgr* and the IPGRI calendar, as well as fact sheets, posters and news releases. It also responds to unforeseen and one-off PA opportunities.

Key results and achievements
The activity provided input to various PA activities developed by the APO office (educational kit, brochure) and worked closely with the INIBAP and the Europe and Americas offices for the development of fact sheets. The activity helped INIBAP to produce news releases and letters to the editor and supported plans to mark INIBAP's 15th anniversary. It also assisted in the production of the English version of the banana brochure. The IPGRI video,

'Diversity for Development,' was translated into French, Spanish, Arabic and Italian and *Geneflow 1999* was produced in French and Spanish. For the first time, the IPGRI Annual Report was prepared as a public awareness tool in 2000. News releases, posters and fact sheets were prepared and disseminated in connection with SAT21. Classroom posters, teachers' notes, and Bioquest, a Web site for children, were prepared. Moving Picture Bulletin, which focuses on Last Plant Standing, was produced, as was the Teachers' Pack 'Outreach,' thus bringing to an end the educational video project. Articles were written and appeared in a number of media outlets. Displays were produced for COP, IUFRO, MTM and ICW.

In 2001 the Bioquest Web site started to be adapted to serve as an outreach arm and testing ground for the Maccarese museum project. Four *pgr* newsletters, the 2002 calendar, postcards, Seasons' Greeting cards, Annual Report, *Geneflow* and *Geneflow Junior* were produced, several being placed on IPGRI's Web site. News releases, displays, posters, postcards, fact sheets and brochures were prepared and disseminated for the two inaugural events for Maccarese, which were well covered in the national and international press.

Activity Manager:
R. Raymond

Developing an institutional electronic knowledge base

Scope and intent
This activity provides a focus for the management and delivery of institutional information resources in electronic forms. It incorporates the development and management of the Institute's Web site and electronic knowledge products as well as management and upkeep of institutional databases.

Key results and achievements
A new version of IPGRI's Web site was developed and released in July 2000 and further developed through 2001. The new site is organized around PGR themes and makes use of databases to automate the publishing of a range of information resources, including a searchable staff directory, an information desk providing links to on-line scientific journals, reference tools and international databases and a wide range of public awareness materials in several languages. Many of IPGRI's publications can be downloaded from the site, free of charge. A study was conducted in 2000 and 2001 on the feasibility of producing a knowledge compendium in the area of plant genetic resources. The study, carried out in collaboration with CABI, indicated that there is widespread support for such a product and this is being pursued.

Activity Manager:
P. Neate

Managing internal information resources for effective knowledge management and sharing

Scope and intent
This activity aims at improving management of key internal information resources to support decision making within IPGRI and at identifying and facilitating mechanisms for knowledge sharing on collaborative research activities among staff and with partners.

Key results and achievements
Work began on developing a revised and updated intranet, together with an integrated document management system (IDMS)—key activities to help IPGRI manage and share knowledge more effectively, both internally as well as externally with partners. The objective is twofold—to provide staff more efficient access to administrative, financial and scientific documentation comprising IPGRI's Institutional memory in order to perform their work more effectively, and to create an electronic platform for collaboration on joint work. Surveys of staff needs were carried out, a consultancy study on institutional databases and legacy documents was commissioned, and an evaluation of document management systems was conducted. One of the applications tested, MS Sharepoint Portal, was recommended for adoption, primarily to manage high priority institutional documents. A task force on metadata standards was organized to develop standardized exchange formats and guidelines for publishing documents, databases or other information on the intranet, document management system or Web site. The search for and evaluation of applications to support communities of practice and knowledge sharing with external partners on shared research is ongoing.

Activity Manager:
E. Goldberg

Developing information products and institutional publications

Scope and intent
This activity focuses on the production of the *Plant Genetic Resources Newsletter* and IPGRI regional and thematic reports. It also provides services to other IPGRI projects in producing project publications, including conceptualization, design, editing and proofreading, layout and supervision of production.

Key results and achievements
Regional reports for sub-Saharan Africa, the Asia, Pacific and Oceania and Americas regions were published in English in 2001; the SSA report was also published in French and the Americas report in Spanish. The remaining two reports are in process. A total of some 180 papers were submitted for publication in *Plant Genetic Resources Newsletter* in 2000/2001 and eight issues of the journal were published. In 2001 IPGRI staff, with the assistance of interns, developed a new Web portal for the *Newsletter* (http://www.ipgri.cgiar.org/pgrnewsletter/last.asp). This provides access to full text, graphics and tables of all articles published in the *Newsletter* since issue 121. In 2000/2001, activity members were involved in producing some 200 documents, including some 80 substantial publications. Major co-publications in 2000/2001 included the French and Spanish editions of 'Seeding Solutions: Volume 1. Policy options for genetic resources (People, Plants, and Patents revisited)' in collaboration with IDRC, Canada, 'Seeding Solutions: Volume 2. Options for national laws governing control over genetic resources and biological innovations', also with IDRC, and 'Managing Plant Genetic Diversity', with CABI Publishing. A proposal to permit sales of IPGRI publications was developed and approved by the Board of Trustees. This will help promote awareness of IPGRI publications in new 'markets' such as among academic

libraries in the developed world. A survey of 11 000+ addressees on the IPGRI contacts database was initiated in August 2001 to ensure quality and usefulness of information held.

Activity Manager:
P. Neate

Improving knowledge and information about effective genetic resources management strategies

Scope and intent
This activity aims to increase knowledge of plant genetic resources research by carrying out or promoting the conduct of focused studies to evaluate impacts or effectiveness of IPGRI's work.

Key results and achievements
Six studies were conducted under this activity: a case study of capacity development in Ghana; a study of capacity development in West and central Africa; an assessment of the Zschortau workshop on policy and planning (including the PAPA analysis); an assessment of the impact of IPGRI's work on the International Undertaking negotiations; an assessment of the impact of two fellowship programmes (the Vavilov–Frankel and the Italian funded fellowships); and an assessment of information and communications technology in Africa. Inputs were provided to a meta evaluation of CGIAR system and a study of training in the CGIAR, which were planned by the TAC secretariat. These studies are being made available on IPGRI's Web site.

Activity Manager:
J. Watts

Information activities under SGRP

Scope and intent
This activity aims to develop and support information systems and networking for genetic resources conservation and use through the System-wide Information Network for Genetic Resources (SINGER) and partnerships.

Key results and achievements
The CGIAR System-wide Information Network for Genetic Resources (SINGER) was strengthened and began to forge links to other genetic resources information systems. Currently, SINGER provides Internet access to information on the collections of genetic resources held by the CGIAR Centres through a single entry point. New mapping, statistical, graphical features, have increased the use of SINGER and the range of users has broadened. SINGER's use has continued to increase and is now recording on average more than 10 000 query sessions a month, and increasingly from the plant breeding community, including the private sector. A programme of hands-on training in data management and dissemination for Centres has strengthened their information capacities in order to enable them to provide public access to their databases independently as well as through SINGER. During 2001, Centres progressed in improving the quality and range of data in their databases and their dissemination with assistance assured through the SINGER Help Desk facility in Rome. Work began on the development of a portal in SINGER that will allow access to species-level information relating, in the first place, to the crops of the CGIAR in-trust collections. SINGER has been contracted to implement the European plant genetic resources information system (EPGRIS), and in 2001 was requested to advise on the development of Internet-based information systems of other groups and organizations, such as AVRDC. SGRP initiated the development of crop and region-based information networking, led by individual CG centres, furthering SINGER's objective of being a major player in global genetic resources information exchange. For example, in 2001, pilot projects on wheat, barley and sweet potato were implemented by CIMMYT, ICARDA and CIP, respectively.

Activity Manager:
S. Gaiji

Providing information services to IPGRI staff and the plant genetic resources community

Scope and intent
This activity focuses on providing and promoting awareness of a full range of information services to IPGRI staff and partners to ensure maximum productivity in their activities to conserve and promote the use of plant genetic resources.

Key results and achievements
The activity team was active in several CGIAR wide information initiatives: (1) CG Inventory of Electronic Resources. IPGRI was the lead agency and coordinator. This developed a database of metadata about centre-produced scientific information resources and was intended to help people find related information resources. Fourteen centres input over 135 resources across a range of information types. This initiative was superseded by the FAO–CGIAR Info Finder in 2001. (2) Info Finder: This collaboration focuses on providing improved access to data and information holdings in CGIAR centres via the Internet. (3) Library Consortium. The CGIAR Information and Library Specialists formed a consortium to achieve system-wide efficiency gains through joint subscriptions of electronic information resources; our first success was a system-wide on-line subscription to the journal *Science.* (4) Collaboration with CABI, where IPGRI sponsors the subscription for 400 libraries in developing countries to *PGR Abstracts*. IPGRI also participated in developing the Crop Protection Compendium, an encyclopaedic, multimedia information product developed by CABI.

Activity Manager:
M. Garruccio

Strengthening collaboration and cooperation in PA

Scope and intent
This activity involves promoting collaboration in public awareness both inside and outside of the CGIAR system, the goal being to create a global climate of understanding and support for the conservation and use of genetic resources.

Key results and achievements
In 2000 the public awareness practitioners in the CGIAR centres, spurred on by Future Harvest and the Public Awareness Association started to act in a more coordinated fashion with regard to public awareness in the system. In 2001, the activity manager organized and chaired two meetings of the Public Awareness Association, participated in two meetings of the PARC, planned the public awareness and resource mobilization workshop that was held early in 2002, co-moderated the CGIAR community of practice on public awareness and resource mobilization, coordinated the centres' participation in the EPCOT

festival (and supported participation by IPGRI), supported the work of Future Harvest, assisted in the establishment and operation of Future Harvest UK, and coordinated the public awareness activities connected with the Johannesburg Earth Summit.

Activity Manager:
R. Raymond

Undertaking PA capacity building programmes in IPGRI and national programme partners

Scope and intent
This activity focuses on working with IPGRI's Regional Offices and national programme partners to build capacity to carry out public awareness activities through developing a training programme and supporting materials.

Key results and achievements
Public awareness (PA) training materials were prepared for GRENEWECA and COGENT members. The training and materials were modified in light of feedback from users and provided to PA staff in INIBAP and CWANA. National programme partners in the GEF-funded Dryland Agrobiodiversity Project (Syria, Lebanon, Jordan and the Palestinian Authority) were trained and PA strategies were developed for each country component of that project. The training included modules on the identification and development of news and feature stories, strategies and mechanisms for reaching and influencing various audiences, dealing with the media etc. A session on PA was held during a workshop on African leafy vegetables and the activity manager provided assistance in developing the PA strategy for that project in collaboration with Talent Consortium, an Africa-based PA firm and partner in the project. The production of regional and headquarters fact sheets in collaboration with the Americas, CWANA and SSA offices was used as an opportunity to strengthen staff capacity in story development and presentation.

Activity Managers:
R. Raymond and J. Cherfas

Addressing socioeconomic and policy issues

Documentation of indigenous knowledge

Scope and intent
This activity develops methodologies for documenting indigenous and farmers' knowledge on plant genetic resources in ways that protect the rights of farmers and their community.

Key results and achievements
IPGRI is collaborating with Yunnan Academy of Agricultural Sciences (YAAS), Yunnan Farmer's Speciality Technique Association (YFSTA), Yunnan Agriculture Technique Extension System, and Yunnan People's Radio Station in a project on 'Traditional knowledge on agrobiodiversity, ICT, and rural livelihoods: using information and communication technology to promote sustainable management of agroecosystems through better documentation and use of indigenous/traditional knowledge on plant genetic resources in poor areas of Yunnan, China'. A project on 'Documentation of indigenous knowledge, awareness creation and conservation of cultural and biological diversity: the case of the gourd (calabash) in Kitui District in Kenya' was carried out through the Kyanika Adult Women Group. A manual on using the 'IK Journal' concept was developed by YAAS. The activity team assisted the Sarawak Biodiversity Centre (SBC), Sarawak to develop knowledge centres for a Bidahyu community to document their IK.

Activity Manager:
P. Quek

Economics of PGR

Scope and intent
This activity applies agricultural and environmental economic research to develop methods and tools to support decision making by farmers, PGR conservation managers and policy makers for both *in situ* and *ex situ* conservation.

Key results and achievements
The first paper on international use of the US NPGS system was published as an IPGRI–IFPRI Discussion Paper. The paper was also publishing in the journal World Development. The activity team developed a detailed workplan for economics research in Hungary, and the first site visit for an informal survey was conducted late 2001. Research questions and survey instruments are being refined. Development of research questions, model and methods for Nepal economics research progressed. A preliminary visit was made to Morocco, and an economics workplan discussed.

Activity Manager:
M. Smale

Ethnobotany: ethnobotanical methods to identify and conserve agrobiodiversity

Scope and intent
This activity investigates the relationships between social institutions and human processes and the distribution and maintenance of genetic diversity within species. Ethnobotanical and participatory research

methods are developed to assess intra-specific diversity.

Key results and achievements
Ethnobotanical methods have become a regular feature of all work on neglected and underutilized crops where traditional knowledge, local uses, and cultural values are key to their maintenance. Similarly, the work on indigenous knowledge documentation has begun to show real impact as demands for documentation of PGR are coming directly from local communities, and IPGRI's expertise is now sought through many networks and regional offices. Participatory approaches are also mainstreamed into the work of partners and in commodity- and regional projects. National programmes list participatory research methods as a priority for training and capacity building.

Activity Manager:
P. Eyzaguirre

Gender issues in PGR conservation and use

Scope and intent
This activity supports case studies that focus on gender-differentiated management of plant genetic resources. Cases in Americas, Africa and Asia investigate how women farmers manage the interactions between multiple uses, micro-environment, and labour allocation in ways that have distinct (and, we hypothesize, positive) effects on the maintenance of genetic diversity in crop and agroforestry species.

Key results and achievements
The activity continued to disseminate experiences and lessons on mainstreaming gender on PGR conservation and deployment within IPGRI and to its partners. Several projects have used the methods. Partners have also included them. Cases were used to support public awareness activities through *Geneflow 2001* for example. Wageningen Agricultural University is working on a gender and PGR sourcebook with IPGRI.

Activity Manager:
P. Eyzaguirre

Global policies on PGR and biodiversity conservation

Scope and intent
Policy-makers operating at both the international and national levels need an awareness of the inter-relationships among countries in their use and conservation of biodiversity and the necessity for coordination. This activity monitors policies relating to biodiversity conservation and use and provides input into relevant international fora through background papers, presentations and seminars.

Key results and achievements
Concept notes were prepared on 'Rights and responsibilities for genetic resources: defining the role and parameters of the public domain' and 'Access to PGR'. A survey on access legislation promulgated in response to Article 15 of the Convention on Biological Diversity was conducted. A paper on IP in the CGIAR and IU for PIP conference hosted by the University of Sheffield and European PVP Office was delivered in Angers in January 2001.

Activity Manager:
S. Bragdon

Home gardens and *in situ* conservation and the use of PGR in agro-ecosystem management

Scope and intent
This activity carries out research on the management of genetic resources in agro-ecosystems, focusing on the maintenance of diversity-rich home garden microenvironments. Home gardens are globally important examples of microenvironments that represent pockets of diversity within a less diverse agricultural landscape.

Key results and achievements
A three-year GTZ-sponsored home gardens project was completed in 2001. The project results were shared at the final global workshop, held in July in Witzenhausen, Germany and the proceedings were prepared for publication by the end of 2001. National meetings were set up to link the project to development programmes and policy makers. A home gardens species database was created by IPK. Molecular characterization studies were carried out in Costa Rica. A book on home gardens and agrobiodiversity had been prepared and will be published by Smithsonian Institute Press. Case studies by partner countries were accepted as best practice for agrobiodiversity conservation at CBD. Work started on developing methods for participatory approaches to oases management and the genetic diversity of date palm.

Activity Manager:
P. Eyzaguirre

Legal issues in the conservation and use of PGR

Scope and intent
This activity analyses policy and legal trends and developments and their implications for the conservation, use and development of genetic resources.

Key results and achievements
The Swiss Indigenous Knowledge Project was launched. This is a project that IPGRI is participating in (in collaboration with Berne University, supported by SDC) regarding the protection of indigenous knowledge. An MoU was developed between IPGRI and the International Development Law Institute (IDLI) concerning inter-institutional coordination in training and policy building in PGR policy in developing countries, with the long range objective of creating positions for regional PGR policy trainers associated with both IDLI and IPGRI, working out of IPGRI's regional offices. 'Seeding Solutions. Volume 2: Options for national laws governing control over genetic resources and biological innovations' was published in English in 2001 and work started on the Spanish and French editions. The book was released at a meeting of TRIPS representatives from developing countries in Geneva in June 2001 and at the SBSTTA meeting in Montreal in November 2001. The activity team also contributed to the development of an IPGRI policy strategy.

Activity Manager:
M. Halewood

Participatory approaches to PGR conservation and use

Scope and intent
This activity emphasizes the role of farmer-managed crop and genetic diversity as a way to foster community development and sustainable management of natural resources. There are three major objectives: (1) to

document the state of the art of participatory approaches to PGR management; (2) to develop a comprehensive thematic participatory methodology for plant genetic resource management; and (3) to make policy recommendations for involvement of farmers in PGR for national programmes.

Key results and achievements
A book on 'Participatory approaches to the conservation and use of plant genetic resources (Esbern Friis-Hansen and Bhuwon Sthapit, eds) was published in 2000. Various participatory methods were developed in the global *in situ* crop conservation project in which community participation is integral part of the project implementation. Such approaches were tested in China and Nepal through small research contracts. In Nepal, the community biodiversity register concept and monitoring method was refined. Trials of promoting public awareness of the importance of PGR conservation through youth club mobilisation were conducted. Diverse public awareness activities such as theatre, poetry competitions and diversity fairs continued.

Activity Manager:
B. Sthapit

Policy activities under SGRP

Scope and intent
To develop, represent and contribute CGIAR genetic resources policies, policy analyses and assistance in support of international policy development and the strengthening of international and national policy capacity and implementation.

Key results and achievements
The International Treaty on Plant Genetic Resources for Food and Agriculture was adopted at the FAO Conference in November 2001. IPGRI, on behalf of the CGIAR, was involved in the final stage of the Treaty negotiations and provided technical inputs including analyses of the flows of germplasm from the in-trust collections and co-organized, with FAO, technical consultations on the list of crops for a multilateral system of access and benefit-sharing. Over the years, SGRP has developed a range of policy instruments and guidelines, in consultation with FAO and for formal approval through CGIAR channels, and monitored their implementation for System coherence. These were collated and jointly produced by SGRP and GRPC as a booklet in 2001. This booklet includes all the current policy statements and guidelines relating to genetic resources, biotechnology and intellectual property that have been endorsed for CGIAR System-wide use over the years. It is intended as a reference for Centers' managers, breeders and genetic resources staff; SGRP will issue updated versions as needed. It is available on the SGRP and SINGER Web sites at: http://sgrp.cgiar.org and http://singer.cgiar.org

Activity Manager:
C. Fowler

Project development/ linkages with partners

Scope and intent
This activity provides support for studies of socioeconomic and cultural aspects of PGR within IPGRI.

Key results and achievements
Several new project proposals and partnerships were developed, such as 'Addressing micronutrient deficiencies through improved use of PGR in foods', submitted to Micronutrient Initiative; and 'Integrating plant genetic diversity into human nutrition: researching food-based solutions to malnutrition in Bangladesh and Benin', submitted to SDC. A joint FAO Nutrition Department/IPGRI Workshop on PGR and Nutrition was organized and hosted by IPGRI in May 2001. A roundtable discussion was held on the 'Contribution of plant genetic diversity to food-based approaches for improved human nutrition'.

Activity Manager:
P. Eyzaguirre

Socioeconomic and development aspects of conservation and use of coconuts

Scope and intent
This activity coordinates work with farmers to derive greater value from their coconuts and to enhance the genetic bases for multiple uses of coconut. It is developing and applying participatory research methods to assess the constraints to and opportunities for the management and use of coconut diversity and users' perspective of farmers, household consumers and processors, in their management and use of multipurpose coconut palms.

Key results and achievements
A project funded by IFAD showed that deploying a broader range of coconut genetic resources to overcome production constraints while increasing income opportunities through multipurpose uses of the coconut met the explicit and priority needs of coconut farmers as captured and validated in the participatory project appraisal and design. Coconut farmers and scientists in the 14 participating countries identified 297 varieties and hybrids grown in farmers' fields and documented farmers' varietal preferences for specific uses. A database of farmers' coconut varieties and their multipurpose uses will be published and disseminated worldwide. A 'Catalogue of Farmers' Coconut Varieties' published and disseminated to coconut breeders, policy- makers and development organizations worldwide. The country project researchers return the data gathered to the communities in the form of posters, leaflets and extension materials written in the local languages. The project has started to initiate *in situ* conservation with farmer collaborators in 13 participating countries. Researchers documented 326 different food recipes using coconuts in the various coconut growing and consuming communities. A 'Catalogue of Coconut Food Recipes' is being prepared to promote the diverse uses of coconut. Based on the results of the project, COGENT has developed a 3-pronged strategy for enhancing incomes of coconut farmers and socioeconomically disadvantaged women that is based on (1) improved varieties, (2) improved intercropping systems and (3) development of new products for production at the household or community level.

Activity Manager:
P. Eyzaguirre

Traditional resource rights—ethical issues

Scope and intent
This activity documents and specifies the definition and scope of traditional resource rights from the perspective of the local and indigenous communities. It produces guidelines and issues papers on the topic, develops and tests protocols that affirm equitable and ethical conduct when formal PGR institutions work with local communities.

Key results and achievements
In 2000 a pilot study was conducted in the Cuzco valley of Peru. Traditional resource rights protocols were formulated and developed as procedures for PGR scientists working with local communities.

Activity Manager:
P. Eyzaguirre

Conserving and using specific crops

Conservation and use of specific crops in SSA

Scope and intent
This activity aims to improve the conservation and utilization of crops of sub-Saharan Africa neglected by research and with potential for greater utilization. This is achieved through promoting improved management of their genetic resources by farming communities and development institutions through increased research.

Key results and achievements
The ecogeographic distribution of five wild rice species in East and southern Africa was determined using GIS. The intra-specific diversity of *Oryza longistaminata* was assessed using AFLP molecular markers and association of this diversity with different environmental variables determined. An extensive literature study on Cucurbitaceae in Africa was carried out with an emphasis on *Cucumis melo*. A paper on *C. melo* was presented at the 7th EUCARPIA Cucurbitaceae meeting in Israel in March 2000. A draft descriptor list for *C. melo* was completed. Ecogeographic studies using FloraMap were started. The agromorphological characterization of 60 *Lagenaria* 'sub cultivars' was carried out at Sekou Research Station, in Benin.

Activity Manager:
E. Dulloo

Cocoa germplasm utilization and conservation: a global approach

Scope and intent
The activity supports a project part funded by CFC, to undertake coordinated efforts in evaluation, selection and conservation of cocoa genotypes. The work involves institutions in 10 countries who are collaborating on multilocational clonal trials, development of standardized procedures, characterization and evaluation of available germplasm, identification of disease and pest resistance, coordinated research and exchange of useful materials.

Key results and achievements
Cumulative achievements by the end of 2001 included establishment of about 80 ha of new trials, carrying out over 6000 disease and pest evaluations and identification of some 700 promising new selections for use in breeding programmes of the partner countries. The work undertaken during the period of the report has included international and local clonal trials (10 sites) internationally coordinated hybrid trials (5 sites), germplasm enhancement (CRU Trinidad), population breeding (4 sites — Brazil, Malaysia, Ghana, Côte d'Ivoire), germplasm conservation, characterization and evaluation (mainly in Trinidad), exchange of germplasm and exchange of information. The results of the work were presented at 13th International Cocoa Research Conference (October, 2000)

Activity Manager:
B. Eskes

Collecting and conservation of coconut genetic resources

Scope and intent
This activity promotes collecting and conservation of important coconut genetic diversity. Tasks include development and promotion of efficient techniques for locating genetic diversity and collecting it, conserving important accessions *ex situ* and *in situ*, and development and promotion of comprehensive collecting and conservation strategies.

Key results and achievements
By the end of 2001, 22 countries had established national genebanks to conserve their important coconut germplasm. In Bangladesh, 30 sites were surveyed and nuts were collected from 23 populations and planted in the nurseries. Additional collecting of coconut germplasm in the Indian Ocean Islands, Nicobar and Lakshadweep islands was undertaken. Four accessions were collected from Sri Lanka. In Indonesia, exploration and collecting missions were conducted in Molucas, East Timor and West Nusa Tenggara. A total of 238 populations were collected and 35 conserved from the Cook Islands, Kiribati, Marshall Islands and Tuvalu with assistance from CIRAD scientists; collected embryos were cultured *in vitro* at the Regional Germplasm Centre, Fiji before being transferred for field planting in the International Coconut Genebank for South Pacific in PNG. The three host countries of the International Coconut Genebank (ICG) (India, Indonesia and PNG) received assistance in coconut embryo *in vitro* culture technology and to improve their laboratory capability with the purchase of additional equipment, chemicals and

other supplies. Microsatellite markers developed earlier are being used in the Philippines and Sri Lanka to test their effectiveness in locating and characterizing diversity. Preliminary studies on genetic erosion were carried out by India and the Philippines and the information was shared with other partners. Several countries started preliminary work on *in situ* conservation of coconut genetic resources. A complementary conservation strategy for coconut was been developed and is being promoted among different countries.

Activity Manager:
R. Rao

Germplasm health in coconut

Scope and intent
This activity is developing and promoting a strategy for safe movement of coconut germplasm to permit progressive germplasm exchange with sound and adequate safeguards. The activity is also contributing to refining embryo culture and acclimatization techniques for coconut and promoting the development of key instruments for quarantine decisions based on the above findings. The activity coordinates the pest risk assessment of the International Coconut Genebank host countries (India, Indonesia, Papua New Guinea, Côte d'Ivoire and Brazil).

Key results and achievements
The pest risk assessment of the International Coconut Genebank (ICG) for Africa and the Indian Ocean and ICG–Latin America and Caribbean and ICG–Asia Pacific were conducted and reports were submitted to the ICG. The reports are being converted into a Coconut Germplasm Health Manual to guide the implementation of the ICG. A two-year research project in 14 countries led to the development of an improved coconut embryo culture protocol with 70% seedling recovery. Coconut researchers from Bangladesh, Malaysia, the Philippines, Thailand and Vietnam were trained on the use of this upgraded coconut embryo in *vitro culture* protocol and a manual is under development. The Coconut Embryo Culture Project Network is being strengthened and the third issue of their newsletter has been released.

Activity Manager:
F. Morales

Collecting *Musa* germplasm

Scope and intent
This activity aims to identify gaps in *Musa* collections and ensure that these gaps are filled through targeted collecting, especially in countries where *Musa* diversity has been recognized and useful genes are most likely to occur, both for the purposes of breeding and the conservation of biodiversity.

Key results and achievements
Collecting work in India continued in 2000 with 28 new accessions being collected in three states (Tripura, Mizoram and Southern Assam). A *Musa* germplasm collecting expedition, involving Dr Deborah Karamura (IPGRI–INIBAP), Dr Edmond De Langhe (KULeuven, Belgium) and Dr Alliy Mbwana (ARI, Tanzania) took place in Tanzania in July 2001, with support from IITA and the Rockefeller Foundation. The slopes of the Kilimanjaro and the Usambara Hills and, to a lesser extent, the South Pare Hills were explored and 21 cultivars were collected, of which 10 are most probably newly acquired diploids of potential interest for genetic improvement of the African Highland Bananas. An entirely new group of AAA-triploids, which are new to the Great Lakes region, was identified and was named the 'Ilalyi'-group. No wild (seedy) diploids were found; the chances that such varieties exist in this part of the African continent are considered extremely remote. For each accession collected, three suckers were obtained and planted at the Tengeru Horticultural Research Station, under the supervision of Dr A.S.S. Mbwana.

Activity Manager:
S. Sharrock

Characterization of *Musa* germplasm

Scope and intent
This activity characterizes *Musa* germplasm held at the International *Musa* Germplasm Collection through the use of molecular methods, flow cytometry and analysis of ploidy levels and through characterization in major field collections.

Key results and achievements
During 2000 and 2001, the large-scale ploidy screening of the INIBAP collection in collaboration with the Institute of Experimental Botany, Czech Republic, entered its 5th phase and around 670 accessions were sent for flow cytometry analysis. Eighteen accessions that had given unexpected or contradictory results during previous molecular characterization work were sent to BPI in the Philippines for field evaluation. CIRAD in Guadeloupe received 200 accessions in 2000 for molecular characterization using STMS markers. Accessions have been sent to NRCB, India, for taxonomic characterization and the first descriptions have been received. As part of an initiative to investigate diversity in *Musa balbisiana*, a scientist from the Philippines received training in Guadeloupe with CIRAD. This work will be continued in 2002 in collaboration also with scientists from India and Thailand.

Activity Manager:
J.–V. Escalant

Conservation of *Musa* germplasm

Scope and intent
This activity aims to ensure the introduction, safe conservation, shipment and replacement of germplasm in the International *Musa* Germplasm Collection. This includes the development of a complementary conservation strategy and various legal aspects of conservation and distribution.

Key results and achievements
During 2000 and 2001, eight new accessions were introduced into the collection, which now consists of 1144 accessions. Some 94% of the collection has been screened for bacterial contamination and bacteria-free lines have been established. Research to improve cryopreservation protocols continued and 68 accessions have now been cryopreserved. Technical guidelines describing cryopreservation methods developed for *Musa* at KUL, Belgium and JIRCAS, Japan were published. A CG-wide cryopreservation workshop was organized at KUL and an Indian researcher received training in cryopreservation of *Musa* germplasm. A strategy to rejuvenate accessions and identify somaclonal variants has been established. As part of the process, plants from 200 accessions in the INIBAP genebank were established in pots in the greenhouse in preparation for transfer to the field. These plants will be grown in the greenhouse for 6–9 months before they are decapitated in order to encourage the production of suckers. A number of experiments were carried out

to identify the optimum means of inducing shoot formation from the plants in pots. A conceptual schema for a data management system at the genebank and a prototype of this system were developed.

Activity Manager:
S. Sharrock

Distribution and safe movement of *Musa* germplasm

Scope and intent
This activity makes virus-tested germplasm available to users**.** This involves the testing of all germplasm accessions at the International *Musa* Germplasm Collection in Virus Indexing Centres according to the most recent methods, the certification of movement through Material Transfer Agreements and the promotion of regional distribution from national and regional multiplication centres.

Key results and achievements
A total of 282 accessions were supplied to the Virus Indexing Centres and results were made available for 244 accessions. By the end of 2001 the entire collection had been virus indexed at least once. Re-indexing older accessions with the new diagnostic tests is now a priority. Germplasm distribution from the International *Musa* Germplasm Collection continues at a rate of 100 accessions per month. There is an increasing demand for IMTP candidate clones and, as a response, extra multiplication of accessions was carried out. National multiplication centres are in the process of being established in Asia in order to speed up the distribution of germplasm within the region. LOAs were signed with 7 countries for such centres.

Activity Manager:
S. Sharrock

Development and diagnostic tests for banana viruses and therapy methods for their elimination

Scope and intent
This activity carries out research related to the diagnosis and elimination of viruses in *Musa*, including studies of BSV epidemiology determining the extent and nature of BSV DNA integration into the *Musa* genome, mechanisms giving rise to the episomal virus and consequences for breeding and virus indexing.

Key results and achievements
Protocols were developed for the elimination of CMV, BBTV and BSV. Results so far indicate that meristem culture alone is not sufficient to eliminate CMV from banana plantlets, but better results are achieved for the elimination of BSV. Thermotherapy or chemotherapy in combination with meristem culture can improve virus eradication levels, but the techniques are time-consuming and result in higher levels of plant mortality. The use of cryopreservation as a tool in virus elimination shows promise, with up to 30% (CMV) and 90% (BSV) of regenerated plants being virus-free. Research on BBrMV and BanMMV is ongoing. A strategy to minimize the risk of activation of BSV is being developed and CIRAD–FLHOR is collaborating in genetic studies of the activation and multiplication mechanisms of integrated BSV. A project to develop a diagnostic assay for banana dieback virus (BDBV) was completed. Based on etiological studies the virus still cannot be confidently linked to the spherical, nepovirus-related particle that was detected early in the project. The causal agent of the disease remains to be identified and a method for detection is, therefore, not yet in place.

Activity Manager:
E. Frison

International *Musa* Testing Programme

Scope and intent
This activity aims to identify high-yielding, pest- and disease-resistant banana and plantain hybrids in multilocational trials around the world and provide feedback on the performance of improved varieties to *Musa* breeding programmes.

Key results and achievements
The results from the IMTP Phase II trials from Australia, Brazil, Cameroon, Colombia, Costa Rica, Honduras, Indonesia, Malaysia, Nigeria, Philippines, Spain, Taiwan, Tonga and Uganda were analysed and published in 2000 in a book, 'Evaluating bananas: a global partnership'. FHIA hybrids were consistently the best yielding genotypes. Certain key criteria have been identified as reliable indicators of the tolerance/resistance of varieties to Sigatoka and *Fusarium* and their use will be recommended as minimum evaluation criteria for future evaluation trials. Collaborators provided QDPI with specimens of material infested with *Fusarium oxysporum* f.sp. *cubense* (*Foc)* for classification using vegetative compatibility group (VCG) and volatile compound production analyses. Phase III of IMTP consists of two levels of evaluation, involving in-depth studies, where detailed information will be collected on all aspects of the pathogen/host relationship, and simpler evaluations, focusing on the performance of the varieties/hybrids under local conditions. Nine countries are carrying out in-depth evaluations and 11 countries are participating in performance evaluation trials. INIBAP has received several new hybrids for evaluation. These and other varieties are being sent to evaluation sites and to regional distribution centres for multiplication and distribution. An IMTP database of evaluation data has been developed and a CD-ROM has been distributed, providing the IMTP database, a catalogue of IMTP III cultivars and reference clones, the compilation of IMTP II results, and the guidelines for the evaluation of resistance to black Sigatoka, *Fusarium* wilt and nematodes. A project for the evaluation of germplasm in seven countries in Latin America and Africa was approved by CFC.

Activity Manager:
J.–V. Escalant

Musa Germplasm Information System

Scope and intent
MGIS provides the authoritative source of information on *Musa* biodiversity and its study worldwide for reference in all aspects of *Musa* research. Through working in an entirely decentralized fashion, curators are responsible for managing and feeding in new information from their collections. INIBAP manages the central database, which allows the pooling, exchange and publication of all datasets.

Key results and achievements
Funds from the SINGER project and from the Funding Committee supported the short-term employment of a documentalist in 2000 to update the database with information on material exchange, origin of accessions and morpho-taxonomic descriptions. This improves the data content on designated accessions held

at the International *Musa* Germplasm Collection. The MGIS software was revised by CIRAD to include data on Material Transfer Agreements, analysis by molecular markers and cytometry and descriptors for East African Highland bananas. An addendum of East African descriptors was also produced for distribution with the booklet 'Descriptors for Bananas, *Musa* spp.' Updates of information were provided by CIRAD Neufchâteau, BPI, Philippines, NRCB, India, CIRAD Guadeloupe, CRBP, Cameroon, and QDPI, Australia. INIBAP and NRCB co-organized a training course on MGIS methodology for 12 Indian curators in May 2001 in Tamil Nadu and the opportunity was taken to resolve names and synonyms of Indian cultivars. The second edition of *Musa*logue was produced directly from MGIS, with co-authors from CRBP, CIRAD, QDPI, NARO–Kawanda, providing a unique publication on the diversity of the *Musa* genus. The provision of the SINGER toolkit for the web enabling allowed a draft MGIS Web site to be designed.

Activity Manager:
E. Arnaud

Research on new methods for *Musa* improvement

Scope and intent
This activity aims to develop an efficient protocol for the production of embryogenic cell suspensions (ECS) and to carry out genetic transformation for the introduction of useful traits into a wide range of *Musa* varieties and to build capacity in biotechnology to accelerate the development of East African Highland Bananas (EAHB) resistant to Sigatoka, nematodes and weevil.

Key results and achievements
At KUL, *Agrobacterium tumefaciens*-mediated transformation is being attempted on Three Hand Planty as an alternative to particle bombardment. The frequency of expression was comparable to that obtained by particle bombardment. Regeneration of cell aggregates is now in progress. Other transformation experiments using green fluorescent protein genes as a new method of gene expression reporting are under way. At NARO's Kawanda research station in Uganda the biotechnology research team working on EAHB is now in place. Cell suspensions are being initiated either from scalp meristem cultures or from embryogenic cultures derived from male flowers. A range of EAHB and other varieties of local importance have been selected and established in the field. Experts from KUL and CIRAD–FLHOR have trained four technicians and two researchers to initiate cell suspensions and the project supervisor was trained at CIRAD and KUL on further techniques. Work on genetic transforming EAHB started in January 2001 at KUL, where a Ugandan PhD student is working on an *Agrobacterium*-mediated transformation (A-MT) system. A-MT of four different cultivars has resulted in transient and stable expression of *gfp* and *gusA* reporter genes. The selection of suitable nematode resistance genes has begun at KUL. The genes have been introduced into *Arabidopsis thaliana* and *Nicotiana tabaccum* and selected according to their expression level in leaves and roots. The first phase of the project to map *Musa* translocation points has established a library of around 50 000 banana bacterial artificial chromosomes (BAC).

Activity Manager:
J.–V. Escalant

Support to *Musa* breeding programmes

Scope and intent
This activity provides support to initiatives that assist in the genetic improvement of *Musa* and the dissemination of improved varieties to ensure that a wide range of pest and disease resistant and high yielding varieties of *Musa* are available.

Key results and achievements
Activities are focused on segregating populations. More than 100 seeds have been obtained from a cross between Calcutta 4 x Pisang Berlin and sent to CORBANA. The embryos have been rescued and the plantlets are being grown. Results will be available in 2002 to assess the possibility of self-crossing F_1 individuals to develop an F_2 population. A list of other available seeds has been received from EMBRAPA and five new crosses have been identified by CIRAD–FLHOR to produce new segregating populations for the isolation of resistance to Black Leaf Streak Disease (BLSD) and nematodes (*R. similis*) and for fruit characteristics. The two first populations have been already sent as seeds to CORBANA. The establishment of a breeding programme in Asia is under discussion.

Activity Manager:
J.–V. Escalant

Tropical fruit trees in APO

Scope and intent
This activity addresses conservation, utilization and development needs in tropical fruits in Asia focusing on priority genepools of both major (mango, citrus, rambutan) and minor fruits (jackfruit, durian, litchi) and also with some attention to mangosteen, longan, duku, carambola and tamarind. Selected species of local importance are also included.

Key results and achievements
A 3-year project on tropical fruit species genetic resources with technical assistance from the Asian Development Bank (ADB) was initiated. A Project Planning Meeting of all 10 partners and a few collaborators was held in Malaysia in February 2000 and the workplan and budget were finalized. A Steering Committee was constituted to monitor the project activities. A regional training course on strengthening national capacity to manage information on fruit species genetic resources was held in October 2000. A sizeable number of accessions of different tropical fruit tree species were characterized and evaluated. Eco-geographic surveys were completed and distribution maps prepared and plans for collecting additional diversity were made. Work on adopting *in situ* conservation approaches to conservation of tropical fruit species is in progress. An MoU between UTFANET and IPGRI was signed and joint efforts on developing descriptors for mangosteen were initiated. Work on in vitro conservation in *Citrus aurantifolia*, *C. madurensis* and *C. medica* continued and protocols for desiccation and cryopreservation were developed. Jackfruit descriptors have been published and widely distributed. An Inventory of Underutilized Edible Fruit and Nuts has been published and distributed.

Activity Manager:
Bhag Mal

Underutilized crops in APO

Scope and intent
This activity aims at promoting the conservation and use of genetic resources

of underutilized crops in the APO region.

Key results and achievements
A study on ecobiology and conservation of tartary buckwheat in southwest China indicated that there might not be any association between ecology (mainly altitude) and bitterness of this crop. On-farm conservation efforts on of buckwheat (both cultivated and a wild relative) in Nepal and China continued. A collaborative project to study ecological adaptability of safflower varieties from different countries has been developed at the Institute of Industrial Crops of Xinjiang Academy of Agricultural Sciences, China. A Web site for information on safflower research was developed jointly with ISGAC (http://safflower.wsu.edu). Development of a core collection of Korean sesame landraces continued. A *Lathyrus* germplasm directory is under development. A revised draft of sesame descriptors was developed and circulated to reviewers for comments. *Lathyrus* descriptors were developed, published and distributed. A study on characterization/ documentation of *Lathyrus* genetic resources, especially on ODAP content, is in progress jointly with IGAU, Raipur, India. Some misidentifications of taro accessions were corrected in taro collections in Malaysia and Thailand through the taro taxonomic study, with the help of a consultant. APO staff continued to provide technical backstopping to TaroGen and helped to develop a core collection for the Pacific.

Activity Manager:
M.-D. Zhou

Conserving and using forest genetic resources

Effective conservation and use of intermediate and recalcitrant tropical forest tree seed

Scope and intent
This activity aims at enhancing the use of recalcitrant and intermediate forest tree species of high socioeconomic and commercial value in tree planting, forest management and conservation programmes in tropical countries. It will also contribute to the strengthening of capability of participating forest tree seed institutes to develop and implement optimal seed handling and storage methods on a large scale.

Key results and achievements
Three regional training workshops were held in Kenya, Costa Rica and Thailand to strengthen the capacity of national partners to carry out research on recalcitrant seeds. A total of 53 people representing 32 different institutions involved in forest tree seeds were trained. The project has supported the determination of desiccation tolerance and optimal storage condition for the seeds of nearly 40 tropical forest species. About 80% of the species targeted have been screened. The results have so far shown that 40% of the species screened tend to show orthodox behaviour in their desiccation tolerance. The project is also showing that many of the species are desiccation sensitive such as *Cinnamomum cassia* (Vietnam), *Madhuca indica* (India), *Hancornia speciosa* (Brazil) and the *Shorea* species (south east Asia). About 10% of the species are intermediate, meaning that they are desiccation intolerant to some extent. In 2000 and 2001, four newsletters (No. 6, 7, 8 and 9) were published in October 2000 and March 2001, respectively. The newsletters provide the partners with up-to-date information on project activities, and have helped in harnessing good collaboration among the participants. The project has also develop a Web site on the DFSC Homepage (www.dfsc.dk) with links to the IPGRI homepage (www.ipgri.cgiar.org), where more information about the project can be obtained and the latest results on the screening work is posted.

Activity Manager:
E. Dulloo

Forest genetic resources in SSA

Scope and intent
This activity focuses on strengthening national capacities and the development of strategies for the conservation of forest genetic resources in sub-Saharan Africa.

Key results and achievements
In collaboration with GRENEWECA, the SAFORGEN programme facilitated the development of a coordinating mechanism within the member countries of Benin, Burkina Faso, Chad, Congo, Gambia, Guinea, Senegal and Togo. An important meeting was organized on the Food Tree Species Network in December 2000 in Ouagadougou, Burkina Faso. A total of 20 participants from nine SAFORGEN members agreed to develop leaflets and posters on the mandate species. In collaboration with Benin, Kenya and Togo, and with the financial support of UNEP to develop options for conservation, an assessment was done on the genetic diversity and the level of threats of six SAFORGEN priority tree species. Several publications were produced, including a synthesis report on the status of FGR and the Plan of Action for their conservation and sustainable utilisation in Sahelian and North Sudanian countries, the Medicinal Tree Species Network proceedings, and the Food Tree Species Network meeting report (in collaboration with FAO); 18 SSA country reports on the status of FGR and a proceedings of 1999 regional training workshop for English speaking countries in SSA (in collaboration with FAO and ICRA, and with the financial support of Danida Forest Seed Centre).

Activity Manager:
O. Eyog-Matig

Developing decision strategies on priorities for conservation and sustainable use of forest genetic resources

Scope and intent
The effective conservation of forest genetic resources requires good methods for establishing priorities and tested procedures for supporting decision-making on resource allocation and on forest management programmes. This activity has the objective of developing a decision-support system for prioritizing species and ecosystems, populations and areas integrating genetic diversity, threat and management data.

Key results and achievements
A framework or decision tree for prioritizing species, populations, and conservation management interventions integrating genetic diversity, threat and management data was developed to assist decision-makers in evaluating their decisions and in assessing the cost-effectiveness of different options. Field testing was conducted in collaboration with ESALQ, University of Sao Paulo, Brazil. Two forest areas were chosen in Sao Paulo State, one in a tropical evergreen forest and another one in a tropical semi-deciduous forest. Main outcomes of the work were presented at the SAT 21 Conference in Kuala Lumpur, June 2000.

Activity Manager:
W.A.N. Amaral

Locating and assessing diversity in tropical forests

Scope and intent
The objective of this activity is to investigate the amount of spatial organization of genetic variation in species with contrasting modes of distribution, dispersion, pollination and seed-dispersal mechanisms. For rare and endangered species, genetic studies are integrated with demographic and ecological studies to develop management and restoration plans.

Key results and achievements
In Lebanon, a master study on *Pinus pinea* was finalized. An ecogeographical survey of *Ceratonia siliqua* was carried out. Studies on genetic diversity of *Pistacia atlantica* in Syria were undertaken. A socio economic study on the uses of *P. atlantica* was completed and a final report prepared. The study revealed a broad range of known and less known uses of this species and the discrepancies between current conservation efforts and species use by local communities for their subsistence. An eco-geographical survey and a genetic diversity analysis of *Pinus brutia* were carried out in Syria. A socioeconomic study assessing the importance of this species for local communities and the impact of current forest policies and regulations was initiated jointly with the Tishreen University, Syria. The genetic diversity of *Pistacia atlantica* was surveyed in Kazakhstan, Kyrgyzstan, Tajikistan and Uzbekistan, and material was grafted for conservation in the field collection at Galla Aral Station, Research Institute of Forestry, Uzbekistan. Training was offered to researchers and technicians from national programmes in Central Asia on survey, collecting, characterization of genetic material, GPS, PGR data analyses and establishment of databases in a course on 'Conservation through sustainable use of fruit genetic resources in Central Asia', organized jointly with FAO and Uzbek research Institute of Plant Industry, 21–25 August, Tashkent, Uzbekistan. 'Field hand notes for PGR Collecting', developed by Dr S. Padulosi, were translated into Russian. A manual on GPS management was produced in Russian. In APO, four natural populations of *Pterocarpus macrocarpus* were identified for conservation in Vietnam and seeds from these populations were collected for isozyme studies. In Panama, Brazil, Ecuador, French Guiana and Panama, DNA samples were collected from 70 trees species and a wide range of universal nuclear and plastid primers were tested. Genetic diversity parameters of populations of 8 species in Panama and Western and Amazonian Ecuador were compared.

Activity Manager:
W.A.N. Amaral

Developing genetic conservation activities on bamboo and rattan

Scope and intent
The objectives of this activity are to: identify priority bamboo and rattan species for conservation and use; assess genetic diversity levels of selected bamboo and rattan species; develop complementary conservation and sustainable use strategies for these resources; strengthen capacity of national programmes through research and training; disseminate scientific information on bamboo and rattan; collaborate with INBAR on defining strategies for conservation and use of bamboo and rattan.

Key results and achievements
Two studies on bamboo genetic resources and another on rattan genetic resources were completed in Vietnam. Country reports on the status of bamboo and rattan genetic resources in Vietnam and Thailand were edited. A guide to the economically important bamboo and rattan species in Indonesia was published in the Indonesian language; this has helped in bridging the gap in information on these two important groups of species in that country. A study on the population status and genetic diversity of *Calamus manan* in Sumatra Indonesia was established. A study in Vietnam on documentation of the distribution and genetic diversity of two economically valuable bamboos, *Neohouzeau dullooa* and *Dendrocalamus membranaceus* was implemented. Bamboo distribution and utilization in Nepal was studied in the Bardiya district. A study on genetic diversity and sustainable development of bamboo resources in Xishuangbanna in Yunnan, China was also initiated. Work on *ex situ* conservation of some important commercial bamboo species in Myanmar and Malaysia was initiated. A study on the impacts of human activities such as extraction and disturbance on conservation and genetic diversity of bamboo and rattan resources at the local and state level was conducted in Western Ghats, India. A protocol for gender determination in dioecious rattan was developed and tested.

Activity Manager:
L.T. Hong

In situ conservation of tropical forest species

Scope and intent
This activity seeks to develop methodologies for assessing the impacts of human activities on genetic diversity in tropical forests. It addresses the gaps in knowledge as well as methodology for measuring processes that regulate genetic diversity. This activity also encompasses studies of local community-based management practices and their effects on FGR, as well as the impact of conservation policies and practices on socioeconomic conditions of local communities and other stakeholders.

Key results and achievements
The project 'Conservation, management and sustainable use of forest genetic resources with reference to Brazil and Argentina', officially launched in August 1999, accomplished its first phase, with the gathering of relevant information on the selected model species and on the traditional practices and uses of forests and forest products by local communities and farmers. The exercise was conducted at each research site through local implementation workshops, with research partners and representatives of

collaborating organizations and local communities in Acre, Pontal, Curitiba (Brazil), Bariloche (Argentina) and Institute for Forests and Forestry Products (BFH, Germany). The impact of forest fragmentation on genetic diversity in riverine forests of Costa Rica was assessed through studies comparing the reproductive biology of *Enterolobium cyclocarpum* trees in continuous forests and those left in pastures in four different geographical areas. Methods to assess genetic variation and strategies for *in situ* conservation in Costa Rica in relation to deforestation, forest fragmentation and selective logging were developed. *In situ* conservation options for FGR in the Western Ghats, India, were examined by elaborating and incorporating information on vegetation types into a geographical information system (GIS). The development of a national plan for conservation of forest genetic resources was initiated.

Activity Manager:
W.A.N. Amaral

International cooperation and partnerships on forest genetic resources

Scope and intent
Coordination among international partners in the field of forest genetic resources is essential to ensure that the most pressing and critical research issues are addressed in a coordinated and cost-effective way. IPGRI is therefore developing close links with other CGIAR centres, FAO, IUFRO, IUCN, WWF, the Smithsonian Tropical Research Institute and regional institutes active in forest genetic resources.

Key results and achievements
IPGRI has collaborated with FAO in the establishment of the Sub-Saharan Africa Forest Genetic Resources Programme (SAFORGEN), the development of a global framework on FGR through the preparation of regional workshops on FGR in dry-zone Africa (with ICRAF) and the Pacific, and in the FAO Panel of Experts on FGR. IPGRI has participated in the review of several ARIs, such as CIRAD–Forêt, DANIDA Forest Seed Center and IUFRO. Collaboration also exists with CSIRO, the Oxford Forestry Institute, the Royal Botanical Garden at Kew and the World Forestry Institute in Germany. Collaboration is ongoing with CIFOR and ICRAF and was strengthened through the CG's Inter-Center meeting on forestry in October 1999 in Rome. An agreement was established between FORNESA, FAO, Thailand and the IPGRI FGR programme to contribute with technical backstopping in a restoration project in Sri Lanka. This project belongs to an umbrella of projects within South East Asia about restoration practices and alternatives. Lectures were given at different international fora on the FGR work, such as the REDBIO (Latin America Biotechnology Conference) meeting in Latin America; EUFORGEN meetings; and CATIE, Costa Rica. IPGRI participated to the Steering Committee Meeting of the DFID-funded project with Embrapa Oriental, Brazil, on the use of genetic indicators to complement other already adopted criteria for sustainable management practices. A training course on Forest Biotechnology and Genomics to be held at MAICh (Chania, Crete, Greece) was approved by the EU, and IPGRI took part in the first meeting of the Scientific Committee, in December 2001. More than 30 scientists were trained at a workshop in Austria and 17 graduate students attended a course on biodiversity and biotechnology given at the University of São Paulo in Brazil.

Activity Manager:
W.A.N. Amaral

Supporting regional initiatives and networking on forest genetic resources and strengthening of IPGRI's regional capacity on FGR

Scope and intent
This activity aims at strengthening the capacity of national programmes through networking, training and collaborative research, and strengthening the research capacity of national programmes in the field of forest genetic resources.

Key results and achievements
Genetic diversity and the level of threats of priority tree species for food, fodder and medicinal uses were studied in collaboration with the National University of Benin (UNB), the Kenya Forestry Research Institute (KEFRI) and the Togolese NGO, CERPHAPLTA. The work was sponsored by UNEP. Studies conducted included mapping current distribution of the selected species, dendrometric measurements, assessment of the level of threats according to IUCN criteria, and mapping of genetic diversity of different populations of the species. In addition, proceedings of the Guinea National FGR Workshop, Nairobi Training Workshop and Medicinal Tree Species Network meeting were published and distributed to partners in 2001. Areas of collaboration with Forestry Research Support Programme for Asia and the Pacific (FORSPA) were identified. Training cooperation with the Danish-funded FGR projects in the region (Forest Genetic Resources Conservation and Management Project (FORGENMAP)/Thailand; Indonesia Tree Seed Project; Indochina Tree Seed Programme/Vietnam, Lao PDR, Cambodia) was initiated. In April 2001, IPGRI joined the Asia Pacific Association of Forestry Research Institutions (APAFRI) and received a seat in the Executive Committee. A number of national and regional meetings were attended, including the workshop on 'Communication between Forestry Researchers and Policy Makers/Stakeholders'; the FORSPA Advisory Group meeting; the APAFRI Executive Committee meeting; a workshop on 'Trans frontier protected areas: From concept to actions'; a national seminar on biodiversity and education in Thailand; an MSc course on management of plant genetic resources; and a meeting of the Regional Network for Conservation and Use of Plant Genetic Resources in East Asia. IPGRI also supported the organization of a subregional workshop on FGR in Southeast Asia and a travelling workshop held in different parts of Thailand.

Activity Manager:
W.A.N. Amaral

Forest genetic resources information management

Scope and intent
This activity aims to establish a gateway to relevant information on FGR, providing information on IPGRI's research activities and easy linkages to information provided by other players. The focus is on FGR information of relevance for developing countries.

Key results and achievements
A feasibility study to identify, locate and analyse FGR information sources on the Internet indicated that there is already a wealth of information of interest to forestry genetic resources available and that many new information initiatives are forthcoming. Several organizations such the World Conservation Monitoring Centre (in collaboration with FAO, WFI, EFI and CIFOR), the Finnish Forestry Institute (METLA) and FAO with REFORGEN have already developed substantial information systems or have well-established projects to do so. Following the feasibility study a survey was conducted to identify FGR information users' needs. In addition, an inventory and an analysis of existing FGR information sources within CIFOR and ICRAF was carried out and a database of these products/publications was produced. A Web page providing information about IPGRI's FGR activities was prepared and launched. A virtual Institute of Genomic Research on Tree Species (NPGEF) was established (http://www.ipef.br/melhoramento/genoma/english.html) with a user-friendly database of genes useful for forest conservation and breeding. This database contains published and unpublished papers on genomics and their application to forestry. The Riogene pages also provide links that take the user to other pages of the Internet related to genomics and to genomic projects on tree species. More than 500 genes have been identified that could be of interest in forestry breeding and conservation and that could be used as adaptive markers. They are related to the different steps of cellulose synthesis, abiotic stress tolerance, disease resistance, biosynthesis of lignin, and involved in the different aspects of reproductive development. *FGR Highlights* was published in 2000 and distributed to some 500 addresses.

Activity Manager:
T. Metz

IPGRI's project portfolio (as at 1 Jan 2002)

Support to Plant Genetic Resources Programmes in the Americas
(D. Williams)

Plant Genetic Resources Programmes in Asia, the Pacific and Oceania
(V.R. Rao)

Plant Genetic Resources Programmes in Europe
(J. Turok)

Plant Genetic Resources Programmes in sub-Saharan Africa
(M. Grum)

Capacity Building for Effective Conservation and Sustainable Use of Plant Genetic Resources in CWANA
(S. Padulosi)

Global Capacity Building and Institutional Support
(I. Zoungrana)

Global Forest Genetic Programme
(W. Amaral)

Promoting Sustainable Conservation and Use of Coconut Genetic Resources
(P. Batugal)

Locating and Monitoring Genetic Diversity
(L. Guarino)

Ex situ Conservation Strategies and Technologies
(E. Dulloo)

In situ Conservation Methods and Strategies
(D. Jarvis)

Linking Conservation and Use
(T. Hodgkin)

Human and Policy Aspects of Plant Genetic Resources Conservation and Use
(P. Eyzaguirre)

Information Management and Service
(P. Neate)

Public Awareness and Impact Assessment
(R. Raymond)

Musa Genetic Resources Management
(S. Sharrock)

Musa Germplasm Improvement
(J.–V. Escalant)

Musa Information and Communications
(C. Picq)

Support to Regional *Musa* Programmes
(S. Sharrock)

CGIAR System-wide Genetic Resources Programme (SGRP) and Policy Support
(J. Toll)

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IPGRI. 2000. IPGRI Annual Report 1999. IPGRI, Rome, Italy. 36 pp.

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Acronyms

ACIAR	Australian Centre for International Agricultural Research
ADB	Asian Development Bank
AFLP	amplified fragment length polymorphism
AGM	annual general meeting
A-MT	*Agrobacterium*-mediated transformation
ANSWER	Asian Network on Sweetpotato Genetic Resources
APAARI	Asia–Pacific Association of Agricultural Research Institutions
APAFRI	Asia Pacific Association of Forestry Research Institutions
APO	Asia, Pacific and Oceania
ARI	agricultural research institute
ASARECA	Association for Strengthening Agricultural Research in East and Central Africa
ASPNET	Asia–Pacific Banana Research Network (now BAPNET)
BAC	bacterial artificial chromosomes
BADC	Belgian Agency for Development Cooperation
BAPNET	Banana Asia–Pacific network
BARNESA	Banana Research Network for East and Southern Africa
BBTV	banana bunchy top virus
BDBV	banana dieback virus
BFH	Institute for Forests and Forestry Products, Germany
BGCI	Botanic Gardens Conservation International
BLSD	black leaf streak disease
BMLFUW	Federal Ministry of Agriculture, Forestry, Environment and Water Management, Austria
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit, Germany [Federal Ministry of Economic Cooperation and Development]
BPI	Bureau of Plant Industry
BRIS	Banana Research Information System
BSV	banana streak virus
BVRC	Beijing Vegetable Research Center, China
CAAS	Chinese Academy of Agricultural Sciences
CABI	CAB International (Centre for Agriculture and Biosciences)
CAPGERNet	Carribean Plant Genetic Resources Network
CAPRi	Collective Action and Policy Rights
CATIE	Centro Agronómico Tropical de Investigación y Enseñanza. Turrialba, Costa Rica
CBD	Convention on Biological Diversity
CCS	Community Counselling Services
CDM	coconut data management (software)
CERPHAPLTA	Centre de Recherche Pharmacologique Appliquée sur les Plantes Thérapeutiques Africaines
CFC	Common Fund for Commodities
CGIAR	Consultative Group on Agricultural Research
CGN	Centre for Genetic Resources The Netherlands, Wageningen,
CGRD	coconut genetic resources database
CIAT	Centro Internacional de Agricultura Tropical, Colombia
CIFOR	Center for International Forestry Research, Indonesia
CIMMYT	Centro Internacional de Mejoramento de Maíz y Trigo
CIP	Centro Internacional de la Papa, Peru International Centre for Potato
CIRAD	Centre de coopération internationale en recherche agronomique pour le développement
CIRAD-FLHOR	Centre de coopération internationale en recherche agronomique pour le développement, Département des Productions Fruitères et Horticoles, France
CIRPS	Consortium of Italian Universities Internship Scheme
COGENT	Coconut Genetic Resources Network
COL	Commonwealth of Learning
COP	Conference of the Parties to the Convention on Biodiversity
CORAF	Conférence des Responsables de Recherche Agronomique Africains [Southern African Centre for Cooperation in Agricultural Research]
CORBANA	Centro de Eseñanza Técnica Agropecuria—Chinandega
CRBP	Centre Régional Bananiers et Plantains, Cameroon
CRU	Cocoa Research Unit, Trinidad
CSIRO	Commonwealth Scientific & Industrial Research Organization
CTA	Technical Centre for Agricultural and Rural Cooperation, the Netherlands
CWANA	Central and West Asia and North Africa
DANIDA	Danish Development Assistance
DFID	Department for International Development, UK
DFSC	DANIDA Forest Seed Centre
DIP	data interchange protocol
DIT	Documentation, Information and Training Group, IPGRI
DIVA	GIS software for diversity analysis
DSE	German Foundation for International Development
EAHB	East African Highland Bananas
EA-PGR	East Asia Network for Plant Genetic Resources
EAPGREN	East African Plant Genetic Resources Network
ECP/GR	European Cooperative Programme for Crop Genetic Resources Networks
ECS	embryonic cell suspension
EFI	European Forest Institute
EMBRAPA	Empresa Brasiliera de Pesquisa Agropecuária
EPCOT	Experimental Prototype Community Of Tomorrow (Disney)
EPGRIS	European Plant Genetic Resources Information Infra-Structure
EU	European Union
EUFORGEN	European Forest Genetic Resources Programme
FAO	Food and Agriculture Organization of the United Nations
FGR	forest genetic resources
FHIA	Fundación Hondureña de Investigación Agrícola, Honduras
FLHOR	Department of Fruits and Horticultural Products, CIRAD, France
FONTAGRO	Regional Fund for Agricultural Technology, Inter-American Development Bank, USA
FORAGRO	Forum for the Americas on Agricultural Research and Technology Development
FORGENMAP	Forest Genetic Resources Conservation and Management Project
FORNESA	Forestry Research Network in Sub-Saharan Africa
FORSPA	Forestry Research Support Programme for Asia and the Pacific
GATT	General Agreement on Tariffs and Trade
GCT	Global Conservation Trust
GEF	Global Environment Facility
GFAR	Global Forum for Agricultural Research
GIS	geographical information system
GRENEWECA	Genetic Resources Network for West and Central Africa
GPS	global positioning system
GRIS	genetic resources information system
GRIN	Genetic Resources Information Network
GRPI	Genetic Resources Policy Initiative
GRST	Genetic Resources Science and Technology group, IPGRI
GTZ	Deutsche Gesellschaft für Technische Zusammenarbeit, Germany
IAO	Instituto Agronomico Oltremare
IAR	Institute of Agriculture Research
IARC	International Agricultural Research Centre
IARI	Indian Agricultural Research Institute
IBGPR	International Board for Plant Genetic Resources (now IPGRI)

ICARDA	International Center for Agricultural Research in the Dry Areas, Syria
ICG	International Coconut Genebank
ICRA	International Center for Development Oriented Research in Agriculture
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics, India
ICW	International Centers Week
IDLI	International Development Law Institute (now IDLO)
IDMS	integrated document management system
IDRC	International Development Research Centre, Canada
IFAD	International Fund for Agricultural Development
IFPRI	International Food Policy Research Institute
IGAU	Indira Gandhi Agricultural University
IGM	integrated gene management
IITA	International Institute of Tropical Agriculture, Nigeria
IK	indigenous knowledge
IMTP	International *Musa* Testing Programme
INAT	Institut National d'Agronomie de Tunisie
INFOMUSA	International journal on *Musa* published by INIBAP
INIA	Instituto Nacional de Investigaçáo Agraria, Portugal
INIAP	Insitituto Naciaonal Autónomo de Investigaciones Agropecurarias, Ecuador
INIBAP	International Network for the Improvement of Banana and Plantain
INIDA	Instituto de Investigacão pelo Desenvolvimento Agricola, Cape Verde
INRAB	Institut National de Recherches Agricoles de Benin
INRM	integrated natural resources management
IPGRI	International Plant Genetic Resources Institute
IPM	integrated pest management
IRD	Institut de Recherche et Développement, France
IP	intellectual property
IPK	Institut für Pflanzengenetik und Kulturpflanzenforschung, Gemany
ISGAC	International Safflower Germplasm Advisory Committee
ITC	information technology and communication
IUCN	The World Conservation Union
IUFRO	International Union of Forestry Research Organizations
JIRCAS	Japan International Research Center for Agricultural Sciences
KEFRI	Kenya Forestry Research Institute
KUL	Katholieke Universiteit Leuven, Belgium
LARS	Long Ashton Research Station, UK
LCA	Lusophone Countries of Africa
LOA	letter of agreement
MAICh	Mediterranean Agronomic Institute of Chania
METLA	Finnish Forestry Institute
MGIS	*Musa* Germplasm Information System
MOU	memorandum of understanding
MTM	mid-term meeting
*MUSA*CO	*Musa* Research Network for West and Central Africa
*MUSA*LAC	Plantain and Banana Research and Development Network for Latin America and the Caribbean
*MUSA*LIT	INIBAP bibliographic database
NARI	national agricultural research system
NARO	National Agricultural Research Organization, Uganda
NBPGR	National Bureau of Plant Genetic Resources, India
NGO	non-governmental organization
NMK	National Museums of Kenya
NORGEN	Plant Genetic Resources Network for North America
NPGEF	Institute of Genomic Research on Tree Species
NRCB	National Research Center on Banana, India
NRC	National Research Council
NSSL	National Seed Storage Laboratory, USA
NUS	neglected and underutilized species
OAS-CICAD	Organization of American States—Inter-American Drug Abuse Control Commission
OAU	Organization of African Unity
ODAP	diamino-propanoic acid
OIC–COMSTECH	Committee on Science and Technology of the Organization of Islamic Countries
PA	public awareness
PAPA	Practical Aspects of Performance Analysis
PAPGREN	Pacific Agricultural Plant Genetic Resources Network
PARC	Public Awareness and Resource Mobilization Committee
PCRDT	Programme Cadre de Recherche et Développement Technologique
PDF	project development fund
PGR	Plant genetic resources
PGRC	Plant Genetic Resources Centre
PGRFA	Plant Genetic Resources for Food and Agriculture
PNG	Papua New Guinea
PROCICARIBE	Programa Cooperativo de Investigación Agrícola para el Caribe
PROINPA	Bolivia
PRO*MUSA*	Global Programme for *Musa* Improvement
PVP	plant variety protection
QDPI	Queensland Department of Primary Industries, Australia
REDBIO	Latin America Biotechnology Conference
REMERFI	Meso-American Plant Genetic Resources Network
SAFORGEN	Sub-Saharan Africa Forest Genetic Resources Programme
SANPGR	South Asian Network on Plant Genetic Resources
SAT 21	International Conference on Science and Technology for Managing Plant Genetic Diversity in the 21st Century
SBC	Sarawak Biodiversity Centre
SBSTTA	Subsidiary Body on Scientific, Technical and Technological Advice
SDC	Swiss Development Corporation
SGRP	System-wide Genetic Resources Programme
SIDA	Swedish International Development Agency
SINGER	System-wide Information Network for Genetic Resources
SOMEFI	La Sociedad Mexicana de Fitogenética
SPC	South Pacific Corporation
TRIPS	trade-related aspects of intellectual property rights
TROP	training opportunities
UNB	National University of Benin
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UPLB	University of Phillipines at Los Baños
UPM	University of the Philippines—Manila
USDA	United States Department of Agriculture
UTFANET	Underutilized Fruits in Asia Network
UWI	University of the West Indies
VCG	vegetative compatibility group
VIR	N.I. Vavilov Institute for Plant Industry, St Petersburg, The Russian Federation
WANA	West Asia and North Africa
WFI	World Forest Institute
WWF	World Wildlife Fund
YAAS	Yunnan Academy of Agricultural Sciences
YFSTA	Yunnan Farmers' Speciality Technique Association

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