Biodiversity is essential for food security and nutrition and offers key options for sustainable livelihoods. Since agriculture began some 12,000 years ago, approximately 7000 plant species and several thousand animal species have been used for human food. Today, certain traditional and indigenous communities continue to use 200 or more species in their diets but the general global trend has been towards diet simplification, with consequent negative impacts on human food security, nutritional balance and health.

The world has made great strides in reducing hunger, yet the problem of malnutrition, particularly the hidden hunger caused by missing micronutrients, constitutes a formidable challenge for the future. Biodiversity has a crucial role to play in mitigating the effects of micronutrient deficiencies, which are debilitating hundreds of millions of people in developing countries, particularly children and women. A more diverse diet is one key to combat this trend and to healthier lives.

A well nourished, healthy workforce is a precondition for successful economic and social development, and nutritional status is internationally recognized as a key indicator of national development. For developing countries, agriculture and its related activities constitute a major source, and often the main source, of employment and income. Thus, direct investment in improving the nutritional status of rural populations is likely to have a significant pay off in raising labor productivity and incomes.

Biodiversity, food and nutrition intersect on a number of key issues. Biodiversity contributes directly to food security, nutrition and well being by providing a variety of plant and animal foods from domesticated and wild sources.
Biodiversity can also serve as a safety net to vulnerable households during times of crisis, present income opportunities to the rural poor and sustain productive agricultural ecosystems.

In order to develop a world initiative linking biodiversity, food and nutrition, the Secretariat to the Convention on Biological Diversity, the Food and Agriculture Organization of the United Nations (FAO) and IPGRI recently forged a partnership to promote the sustainable use of biodiversity in programs that improve food security and nutrition in the human population. A subsequent objective of this effort is to contribute to the Millennium Development Goals, particularly to reducing to half, by 2015, the proportion of hungry people in the world.

Options to implement this initiative were discussed in a first expert consultation on biodiversity and nutrition, held in Brazil in March 2005, prior to a meeting of the United Nations’ Standing Committee on Nutrition. Participants at the consultation highlighted a number of issues and proposed to work on three areas: 1) substantiating and promoting awareness of the links between biodiversity, food and nutrition; b) mainstreaming the conservation and sustainable use of biodiversity into agendas and programmes related to nutrition, agriculture and poverty reduction; and 3) promoting activities that contribute to improving food security and human nutrition through enhanced sustainable use of biodiversity.

Participants in the consultation recognized the benefits of working together under a common framework, and committed themselves to carrying out an inventory of the existing knowledge base, including published scientific studies, indigenous and local knowledge and case studies, as well as preparing a policy-relevant review for publication in a scientific journal. They will also promote and facilitate the development of pilot activities, including an inter-sectoral project on biodiversity for food and nutrition in Brazil, with a view to carry out similar activities in other countries. Tools will also be developed to facilitate implementation of the proposed activities.

For further information contact Pablo Eyzaguirre <p.eyzaguirre@cgiar.org>, IPGRI Senior Scientist on Anthropology and Socio-economics, David Cooper <david.cooper@biodiv.org> at the Secretariat to the Convention on Biological Diversity, or Florence Egal <florence.egal@fao.org> and Barbara Burlingame <barbara.burlingame@fao.org> at FAO. It is also suggested to visit page http://www.biodiv.org/programmes/areas/agro/food-nutrition/default.shtml.
Towards a regional conservation strategy for the Americas

The countries of the Americas region are home to crop diversity that is vitally important to present day agriculture. The region is a primary or secondary centre of diversity for globally important crops such as maize, potato, tomato, cacao and peppers. Today, this diversity is under threat due to a variety of factors, such as population growth, urbanization, logging, ranching and intensive agriculture.

The national plant genetic resources programmes in the region have been hard pressed to match the pace of the genetic erosion taking place. Lacking adequate resources, the agricultural institutions in the region have limited capacity to conserve and use the rich agricultural biodiversity that is such an important part of their natural heritage.

Help could soon be on the way, thanks to the intervention of the Global Crop Diversity Trust. An initiative of the Food and Agriculture Organization of the United Nations (FAO) and IPGRI, acting on behalf of the Future Harvest Centres of the Consultative Group on International Agricultural Research (CGIAR), the Trust is an independent international organization whose goal is to provide financial support for the world’s most important crop diversity collections. At its centre is a $260 million endowment fund, the proceeds of which will go to fund ex situ conservation. Funds are also available to provide upgrading and capacity building support to priority collections. The Global Crop Diversity Trust is an important element of the funding strategy of the International Treaty on Plant Genetic Resources for Food and Agriculture.

The Trust came into legal being on 21 October 2004 when the Kingdom of Sweden signed the organization’s Establishment Agreement, bringing the number of signatories to twelve from five world regions. Today, twenty countries, including Colombia, Ecuador and Peru, have signed the Establishment Agreement. In addition, Colombia and Brazil are financial donors to the Trust.

Determining which crop diversity collections will be eligible for funding by the Trust is a major challenge. To do so, the Trust is supporting a series of initiatives to identify the world’s most critical collections of crop diversity and ascertain which of these should be given priority for funding. A process to develop regional and crop conservation strategies is currently underway with participation from stakeholders including holders of national and international collections, crop experts, policy-makers, non-governmental organizations, farmers’ organizations and others. The conservation strategies will be based on the principle of collaboration, that is, bringing together people and institutions to work collectively to conserve crop diversity. Together, the strategies will form the framework of efficient and effective global systems for conservation.

The process to develop a regional conservation strategy for the Americas was agreed in April at a meeting of sub-regional network coordinators and other stakeholders. The highly participatory process will involve the six networks (REGENSUR, REDARFIT, TROPIGEN, REMERFI, CAPGERNet, NORG) as well as the IPGRI Americas Office, CIAT, CIMMYT, CIP, FAO, IICA and the PROCIs. Currently, the network coordinators are gathering information on collections in the various countries of the region to help identify the most important collections for the region.

Assisted by a small task force, the countries will then work together to put into place a conservation strategy that is based on the twin pillars of rationalization and collaboration. In addition to establishing efficient and effective arrangements for conservation throughout the region, the strategy will identify collections that should be given priority to receive grants for upgrading and capacity building from the Trust. The regional strategy is expected to be completed by the end of the year. Global conservation strategies are also underway for a number of crops of importance to the region such as potato, cassava, banana and rice.

For further information, contact Ruth Raymond <r.raymond@cgiar.org> at the Global Crop Diversity Trust or Michael Hermann <m.hermann@cgiar.org>, Senior Scientist on Genetic Diversity at the IPGRI Americas Office. You can also visit the Web page http://www.startwithaseed.org.
Conserving the wild relatives of crops: a global perspective

In situ conservation of crop wild relatives through enhanced information management and field application is a project that addresses national and global needs to improve global food security through effective conservation of crop wild relatives. Wild relatives include the ancestors of modern crops and varieties and species related to them. The project, funded by the United Nations Environment Programme and the Global Environment Facility (UNEP/GEF) is a five-year initiative that will run until 2009.

The project brings together five countries—Armenia, Bolivia, Madagascar, Sri Lanka and Uzbekistan. Each country has significant numbers of important and threatened crop wild relatives. Each country is also among the world’s biodiversity hotspots—places that have the highest concentrations of unique biodiversity on the planet. Hotspots are also the places at greatest risk of loss of diversity. IPGRI is the executing agency for the project. Five other international conservation organizations are project partners—the Food and Agriculture Organization of the United Nations (FAO), the Botanic Gardens Conservation International (BGCI), the United Nations Environment Programme’s World Conservation Monitoring Centre (UNEP-WCMC), the World Conservation Union (IUCN) and the German Centre for Documentation and Information in Agriculture (ZADI).

Why a global project on conservation of crop wild relatives?

Wild relatives have contributed many useful genes to crop plants. Almost all modern varieties contain some genes that are derived from a wild relative. Valuable genes obtained from crop wild relatives have improved production in rice and contributed resistance to wheat against curl mite, to potato against virus and to rice against grassy stunt. Wild Aegilops tauschii is providing wheat with tolerance to drought and potentially salinity. Breeders have also used genes from crop wild relatives to boost the nutritional value of foods such as enhancing protein content in durum wheat from Triticum dicoccoides and increasing provitamin A in tomato from Lycopersicon pennellii.

The economic benefits of improved crop production and quality and reduction of risk of crop losses are highly significant. The desirable traits of wild sunflowers (Helianthus spp.) bred into cultivated sunflower, for example, is worth an estimated US$267 to US$384 million annually to the sunflower industry in the United States. A 0.1% increase in the solids content of a tomato is worth about US$10 million a year to the processing industry in the state of California alone. One wild tomato has contributed to a 2.4% increase in solid contents, worth US$250 million. Three different wild peanuts have provided resistance to root knot nematodes that cost peanut-growers around the world about US$1000 million each year.

Useful but threatened

The natural populations of many crop wild relatives are increasingly at risk. As is the case for many wild species and ecosystems, they are threatened primarily by habitat loss, degradation and fragmentation. The increasing industrialization of agriculture is reducing populations of crop wild relatives in and around farms. Management practices such as poor management of soil and water and unsustainable fire and grazing regimes can also have significant impacts on species abundance and persistence at a local scale.

The absence of an effective policy and legal framework and national plans to deal specifically with conservation of plant genetic resources has been identified as a significant obstacle to the
A global initiative to conserve species in situ

conservation and use of crop wild relatives. Another major constraint for successful conservation is the capacity to bring together and use information that does exist. A number of studies have shown that a substantial amount of information on wild species often exists but that it is dispersed among different institutions and agencies in different countries and international organizations.

Key elements to the project

Countries participating in the project will develop national information systems and decision-making processes that will help define priorities and conduct some urgent conservation actions. The five partner countries will develop their long-term national strategies to conserve their wild relatives and will raise awareness on the importance of these genetic resources.

International partners will develop a web-based information system integrating various data sources that will be accessed through a single portal. With better information and access to it, researchers and breeders will be able to use crop wild relatives. These, in turn, will have added value and will be more attractive for conservation.

The results of the project will be extensively disseminated at the national and global levels and best practices or successful strategies will be transferred immediately to other countries with significant crop wild relatives. This will boost global efforts to conserve biological diversity in general and crop wild relatives in particular for the benefit of local users and the international community.

The project in Bolivia

The location of Bolivia in the centre of the South American continent and the large variation in altitude, topography and climate mean that Bolivia is one of the most diverse countries in the world, both in terms of species and eco-regions. Due to a relatively low population, large areas of Bolivia are in excellent conservation condition. Almost 40% of this country is covered by native forests.

Bolivia is an important centre of origin and diversity of a number of wild relatives of economically important cultivated plants including potato, peanut, sweet potato, beans, cassava, pineapple, chili peppers and passion fruit. Quinoa (Chenopodium quinoa), a crop native the Bolivian Puna, distributed from Colombia to Chile, is gaining in global acceptance and importance as a nutritious grain.

The Crop Wild Relatives project is being executed in Bolivia through the General Directorate on Biodiversity (DGB). FUNDECO (Foundation for Ecological Development) is administering the project funds. Multiple stakeholders are involved in project activities according to their expertise and experience. Among the major partners are the National Service of Protected Areas (SERNAP); the Technological Development Office of the Ministry of Agriculture, Livestock and Rural Development; the Confederation of Bolivian Indigenous People (CIDOB); the Biodiversity and Genetics Center from Universidad Mayor de San Simón; the Center for Plant Genetic Resources Research in Pairumani; the Andean Products Promotion and Research Foundation (PROINPA); the Bolivian National Herbarium; the Noel Kempff Mercado Natural History Museum; the Friends of Nature Foundation (FAN); the Bolivian Research Center for Tropical Agriculture (CIAT) and the Institute for Ecological Research (IE) from Universidad Mayor de San Andrés.

For further information on the project on wild crop relatives, contact Annie Lane, Global Project Coordinator in IPGRI <a.lane@cgiar.org>, or Beatriz Zapata, National Coordinator in Bolivia <beazafe@megalink.com>.  

Annie Lane, IPGRI
Countries in the tropics are rich in edible plants that can improve health and diversify the diet of urban dwellers. Developed countries demand more and more exotic foods and ingredients derived from biodiversity products that are cultivated by small scale developing country farmers. This demand offers many opportunities for farmers to improve their income, that are not often materialized because of the unfavorable conditions that biodiversity products face to enter into upscale markets.

This situation is common in Europe, where public debate on genetically modified food and organisms has made consumers wary of what they eat. European Union’s (EU) strict legislation to regulate testing, labelling and admission to the market of foreign food products, to ensure their safety for human consumption has created a new barrier to the trade of biodiversity products from developing countries.

EU Regulation 258/97 on Novel Foods and Novel Food Ingredients requires that food products not in the EU market before 1997 be submitted to a rigorous process to demonstrate that they do not pose any hazards on human health, such as toxicity or allergies, among others. The process to request admission of a new product is long, complex, and expensive because it requires support information and investing in complex scientific studies. In the case of traditional exotic food products, the scientific documentation that would prove their safety is nonexistent or insufficient. The long history of safe use in their places of origin is not recognized as evidence to support applications for the European market.

In the seven years in which EU Regulation 258/97 has been in place, several applications for exotic traditional foods have been declined or challenged, arguing insufficient documentation on their safety for human consumption.
consumption. Such is the case of the natural sweetener Stevia rebaudiana, of the nangai nuts from a Pacific genus of trees (Canarium spp.), and of the Andean root maca (Lepidium meyenii). Edible products obtained from these species have a long history of safe human use. Nangai nuts, for example, have been consumed since prehistoric times and are marketed widely in their native Asia. Maca, in turn, has been part of the Peruvian diet since pre-Incaic times.

As a consequence to the rejection of these applications, European importers, raw material traders and distributors of specialty foods feel discouraged about the length, uncertainty and high costs of the application process and scientific evaluations required. Regardless of how attractive or convenient the new products look for the market, companies do not want to invest because they fear that their efforts might be useless.

As an incentive or compensation for the investments made to scientifically prove traditional product safety, EU Regulation 258/97 grants requestors of successful applications the privilege of distributing their products exclusively and temporarily in the EU market. This, in practice, creates a monopoly because a product that has been in public domain in its place of origin becomes a product protected by intellectual property rights in the EU market. In addition, products derived from the same raw material approved but with different characteristics or for which different levels of intake are suggested, have to be submitted to a separate procedure of risk analysis, which implies providing evidence for all to endorse their use.

IPGRI and the Global Facilitation Unit for Underutilized Species, acting jointly on behalf of a partnership of the public sector that includes the International Potato Center (CIP), the German Technical Agency for Cooperation (GTZ), and the PhAction Consortium, are working with policy makers in the EU to modify this Regulation and facilitate the entry of non-traditional foods to the EU, without risks for consumers. Suggestions to amend the Regulation include 1) recognizing traditional food products as a separate category of innovative foods, taking into account their history of use; 2) simplifying safety testing and putting it in the context of risks associated with foods in use in the European Union; 3) facilitating the acquisition of entry permits after the first safety demonstration for the consumer; and 4) allowing the generic admission of traditional foods, that is, of groups of products obtained from the same plant species through traditional processes considered safe.

Due to the importance of documenting product safety for consumers in the developed world, countries that would like to introduce their products in markets like that of Europe should have information systems in which they document the composition, nutritional content and tradition of use of their products. Unfortunately, in the case of many conventional products, this information is currently not available and should be taken into account in project design, product development, and in trade promotion activities.

For further information contact Michael Hermann <m.hermann@cgiar.org> at the IPGRI Americas Office or Irmgard Hoeschle-Zeledon <i.zeledon@cgiar.org> at the Global Facilitation Unit for Underutilized Species. It is also suggested to visit page http://www.underutilized-species.org/the_latest/archive/pop_up_/eu_nfr.html.
On-farm conservation is a form of in situ conservation in which farmers maintain diversity in use as part of their subsistence, and enhance it using their knowledge of crop diversity. In this process, farmers use agromorphological characters to test and adapt varieties to their conditions and preferences, and decide whether they maintain them.

Within the framework of an IPGRI project to strengthen the scientific bases of on-farm conservation of agrobiodiversity, which started in 2002, maize and chili pepper varieties from Yucatan, Mexico, are being evaluated to assess why Mayan communities maintain them and how they contribute to the diet of these communities. Farmers and scientists, both male and female, are doing this evaluation together. They have also compiled information on how maize and chili pepper varieties are used in the preparation of food, mainly meals for traditional celebrations. Samples of maize grains and chili peppers have also been tested in laboratories to determine their nutritional content.

Both maize and chili peppers are part of the Mayan diet and culture since pre-Hispanic times. According to the Popol Vuh, the sacred book of Mayas, human beings were made of corn after the gods failed in their attempts with other materials. Maize is for the Maya people a gift from the gods, as precious as jade. Ancient Mayas believed in growing maize as a sacred duty. Chili peppers, in turn, were practically used in every meal, from breakfast with pozoole, a mixture of maize cereal dressed with chili peppers, to dinner with preparations containing various species of chili peppers. Healing and mystique properties have also been attributed to chili peppers. They have been used in hunting rituals, as an anti-inflammatory drug, and as a cure cramps and evil eye.

The Mayan diet is rich and diverse. Besides the traditional tortillas, there are more than four hundred different preparations for maize. Together with beans, pumpkin and chili peppers, maize makes a balanced diet, rich in carbohydrates, with some protein, iron, vitamins and minerals, that Mayan farmers complement with animal protein, fruits and vegetables from their milpas and home gardens.

Through interviews to Yaxcaba farmers, information was compiled on which maize and chili pepper varieties were used to make meals for various celebrations, including altars for the dead festivity (hanal pixan in Mayan language), observed in November of every year, a ritual to request rain (ch’a’ chàak), the Holy Week and other family parties. This survey made evident the variety of Mayan dishes and some physical and organoleptic properties valued by women, such as pungency in chili pepper varieties, and texture and yield in maize dough to make tortillas and tamales.

Classifying local chili pepper and maize varieties in terms of their cooking attributes revealed that some are preferred for specific dishes because they contribute the desired flavor or dough texture. Preference for certain variety attributes was the same for those who made the dishes and those who ate them. For example, flavor in the relleno negro (black filling), a dish prepared with chili peppers, maize and other ingredients, is given by the local chili pepper Ya’ax iik. Yellow maize gives more dough for tortillas, which explains why varieties Tsiit bakal and Xnuuk nal are preferred.

Preferred maize and chili pepper varieties were tested in labs to determine their overall (fats, carbohydrates and proteins) and specific (amino acids in maize and vitamin C and capsaicinoids in the chili pepper) nutritional contents. For example, chili peppers ‘Habanero’, Sukurre,’ Peak Pigeon,’ and ‘Ya’ax iik’ exhibited a greater amount of dihydrocapsaicin, which is reflected in the flavor and aroma of the dishes or sauces made.
with them. As to vitamin C content, a variation of between 105 and 206 mg/100 g per sample was observed, suggesting that preferred varieties have an intermediate degree of pungency and may account for a person’s daily requirements of vitamin C (50-60 mg/day).

In the case of maize, preferred local varieties were compared with a group of modern varieties and advanced lines from formal breeding. Results showed that farmer varieties have the same or greater content of tryptophan than improved varieties (Figure 1).

Interestingly, the study revealed that although farmers expressed their preferences in association with dish flavor or dough texture, the chemical analyses of the preferred varieties showed favorable nutritional characteristics. This explains in part why farmers continue to maintain them and ratifies that varieties are not always maintained because of their productivity. Although farmers participating in the study did not mention nutrition in their preferences, they were pleased to know that their varieties are nutritious and felt proud of the contribution Mayan communities can make to the Mexican market.

For further information contact to José Luis Chávez-Servia <j.l.chavez@cgiar.org>, Specialist on Conservation of Cultivated Genetic Resources at the IPGRI Americas Office, Esmeralda Cázares-Sánchez <esmecaza@yahoo.com.mx> at the Mexican Colegio de Postgraduados or Devra I. Jarvis <d.jarvis@cgiar.org>, Scientist on Diversity and Ecosystems at IPGRI in Rome.

Buut’bil bu’ul waaj
Recipe for stuffed tortillas

Ingredients (for 50 pieces)

- 2 kg of maize dough
- 1/2 liter of cooked, ground and strained beans
- 1/4 of a cabbage head
- 2 tomatoes
- 1 onion
- 2 habanero chili peppers
- 1 sour orange or 2 lemons
- 1/2 a hen, roasted or shredded (optional)
- Salt to taste
- Oil

Preparation

Chop cabbage, add the juice of the sour orange or lemons and salt to taste. Let marinate. Cut the tomatoes, onion and chili peppers in thin slices. Cover chopped onion with boiling water and let rest for three minutes. When these ingredients are ready, make small tortillas with the dough and add a tablespoonful of strained beans within the layers of the tortilla. Fry the tortillas in hot oil without letting them harden. Serve them with a bit of cabbage, tomato, onion, chili pepper and shredded hen. If desired, add some sliced avocado.

Figure 1. Average content of lysine and tryptophan of maize varieties from Yucatan, compared to those of varieties from formal breeding. QPM-3 and Opaco2-3 are modern varieties released for their high protein quality.

Stuffed tortillas as per a recipe by Mrs. Rosenda Kuxim Uk, from Yaxcaba, Mexico.

Esmeralda Cázares
The American continent is home to many fruit species, whose potential is realized depending on how much they are studied and known by the international community. Papaya and pineapple, for example, are well known and cultivated. Sweet granadilla, sapodilla and babaco are less known, yet have valuable potential to diversify crops, generate income for farmers and improve people’s diets.

After several years compiling information on edible tropical American fruits, IPGRI recently launched the New World Fruits Database, as an outcome of its collaborative work with the Centre for International Cooperation on Agricultural Research for Development (CIRAD) and the International Center for Tropical Agriculture (CIAT). This database is an update of the former ethno-botanical inventory on tropical American fruits, available in html format.

The new database is available at http://www.ipgri.cgiar.org/Regions/Americas/programmes/TropicalFruits/. It has information on 1256 species from 303 genera and 69 families. It is adjusted to the standards of the International Working Group on Taxonomic Databases for Plant Sciences (TDWG). When available, data are included on species taxonomy, common names in eight languages and dialects, uses of the fruits and other plant parts, photographs, sources of bibliography, contacts with experts and links to sources of additional information in the Internet.

For 805 species, data on origin and geographic distribution is available and complemented with maps. Locations for potential cultivation or conservation are included for 415 species. Considering that predicting potential sites for cultivation depends on the quality and reliability of external data, this information is given just as indication.

The New World Fruits Database is a practical tool for researchers, breeders, students and fruit growers. It can be easily accessed through a user-friendly interface that allows single or multiple criteria searches, using entire words or a few of the initial letters of the criterion selected.

The new database illustrates the diversity of fruits from the American continent, and hopefully the potential of many fruit species that need to be promoted, studied and cultivated. Data on marketing, nutritional content, chemical-bromatological analyses and soil requirements will hopefully be included in the near future.

Suggestions or comments to improve the database are welcome. Contributions in data and photographs will also be appreciated and their contributors given credit. For further information contact Xavier Scheldeman, Scientist, Conservation and Use of Tropical Genetic Resources <x.scheldeman@cgiar.org>, Dimary Liberos, Information Assistant <d.liberos@cgiar.org> or Daniel Jimenez, Agricultural Engineer, CIAT-IPGRI <d.jimenez@cgiar.org>.

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Biodiversity loss is one of the most important ecological problems of our time. Various conservation strategies have been developed to counteract it, including ex situ conservation, in which plants or parts of them are kept in genebanks, outside their natural habitat.

Like tissue explants, isolated DNA samples can be stored, allowing the conservation of species that would be difficult or impossible to maintain otherwise. The difference between maintaining tissue explants and DNA samples lies in that maintaining the former in vitro or in liquid nitrogen (N₂) allows restoring the original plant, while storing the latter retains the molecule components that determine original plant traits. Thus, although DNA storage does not allow regenerating original organisms, it preserves the species genetic information that is useful to manage germplasm collections efficiently, whether these are in seed, in the field, in vitro or in N₂. DNA is also used for safety duplicating germplasm collections.

Molecular markers make it possible to detect variability in the DNA molecule. They can identify and taxonomically classify germplasm, to detect potential duplicates in a collection, to confirm sample stability and integrity, to quantify genetic diversity within and between samples, to look for historical relations and to detect evolution and selection patterns. For these reasons, they make DNA banking useful. Stored DNA promotes the genetic characterization of collections, either generically or by locating genes of interest.

In 2004, IPGRI conducted a survey on the extent and use of DNA storage worldwide. The survey was sent to 816 national and international institutes, botanical gardens, universities and private sector companies working with plant genetic resources, in 134 countries. The results showed that storing DNA is not a frequent practice; only 20% of the 243 organizations that completed the survey store DNA. Reasons for not doing it included lack of knowledge on why and how to do it as well as limitations in budget, equipment and trained personnel. More than half of the organizations that responded the survey would be interested in storing DNA in the future, provided they have adequate conditions. They would do it for research, for conserving genes and genomes and for safety duplicating germplasm collections.

Responses to the survey also included requests for information on protocols and procedures to store DNA, legal issues regarding exchange, limitations and opportunities offered by DNA storage, and funding sources. Respondents also mentioned the need for coordination and standardization of activities as well as having access to sources of DNA samples that could be accessed through the Internet.

DNA banking is also an effective tool to manage germplasm collections and study conventionally conserved material. Some respondents to the survey suggested that IPGRI lead the standardization of protocols to extract, amplify and store DNA, and the preparation of a manual on DNA banking, with theoretical information on objectives, applications, procedures, and legal issues such as exchange and intellectual property. Some respondents expressed concern for urgent research to fill existing policy gaps.

For further information, contact Meike Andersson, Biologist <m.andersson@cgiar.org> or M. Carmen de Vicente, Senior Scientist, Molecular Genetics <c.devicente@cgiar.org> at the IPGRI Americas Group.
Genetic diversity results from a complex interaction of environmental and socioeconomic factors. Genetic erosion is the loss of genetic diversity and has a negative impact on the productivity and sustainability of agricultural systems. Knowing the factors that affect diversity and how they interact helps us understand why diversity can be lost and what to do to maintain it. This knowledge also allows to develop models to predict diversity in extensive areas or when there is a risk of genetic erosion.

Genetic diversity is usually determined through the morphological or molecular characterization of a germplasm collection. Although characterization is a reliable method, it is not practical when applied to large geographical areas because of the time and resources it requires. In a project conducted by IPGRI and the Peruvian Instituto Nacional de Investigación y Extensión Agraria (INIEA), funded by the German Agency for Technical Cooperation (GTZ), the processes that influence diversity and the presence genetic erosion were studied. The purpose of this project was to develop models to estimate diversity in a large geographical areas, using environmental and socioeconomic variables rather than characterization.

The project was carried out between 2001 and 2004 in the Department of Ucayali, located in the Peruvian Amazon, selecting crops with different uses and environmental requirements such as cassava, chili peppers, peanuts and maize as indicators. The Amazon region was chosen because of its high diversity, that is also quickly disappearing, and because there was a solid basis of spatial information for this region.

The goal of the project was to estimate diversity on the basis of socioeconomic data. For this reason, several sources of data were taken into account, including among others, censuses, maps of roads, cities, deforestation, climate, rivers and distance between the communities in the area under study and the market of Pucallpa. These data were complemented with a survey.

Map of the Department of Ucayali in Peru. White spots indicate the communities where the study to determine diversity and genetic erosion of cassava was conducted. The size of the white spots indicates concentration of cassava diversity in the communities studied.
among 451 farmers from 60 communities in Ucayali, in which farmers were asked to indicate how they managed the selected crops, which varieties they maintained, what are the cultural characteristics of their communities, what trends they perceived in agriculture, and if they had noticed a loss of diversity in their farms. A total of 40 variables were used, and the data were analyzed with statistical methods and geographic information systems (GIS).

The diversity present in Ucayali was determined by selecting a set of indicators representing the greatest target crop variability. Significant relationships between crop diversity and socioeconomic and environmental factors were identified. Using the data compiled for cassava as an example, 15 traits were found to determine diversity, including leaf shape, stem color and root weight.

At the level of community, factors related with diversity were distance from the community to Pucallpa, if the area where the crop was planted was flat or mountainous, and farmers’ perception of where diversity was available and loss of varieties. Ethnicity and farm size did not have a significant effect on diversity; in fact, settlers and natives have similar conservation patterns, regardless of the size of their farms.

In order to determine genetic erosion in communities, data from the survey was used to determine what percentage of farmers had perceived diversity loss. Factors associated with loss of varieties identified included distance from the community to a road, presence of ranching activities in the area and whether planting material was obtained from a local market.

Contrary to what could be expected, factors that had a negative relation with diversity did not show a positive relation with genetic erosion. In other words, according to the study, factors that contribute to diversity maintenance in one area are different from those causing genetic erosion. Evidence of this is the fact that communities with little diversity are different from those in which a high percentage of farmers reports perceiving losses in biodiversity. Understanding which processes determine diversity and its loss is a complex task that has not yet been fully studied. The results of this project will allow refining methodologies to develop models that estimate diversity and risk of genetic erosion. Estimates resulting from applying these models will obviously be valid in certain areas and for a given crop. Likewise, as the processes that determine diversity are likely to differ from one region to another (Amazon vs. Andes, for example), conducting more studies in places for which historical data are available is suggested.

For further information contact Xavier Scheldeman, Scientist, Conservation and Utilization of Neotropical Genetic Resources <x.scheldeman@cgiar.org> or Wieteke Willemen, Associate Expert on GIS <d.willemen@cgiar.org>.
The first-ever winner of a new M.Sc. scholarship programme, Linking Africa and Brazil in PGR education, is José Pedro, a scientist working with the Angolan Plant Genetic Resources Center (CNRF) in Luanda. The programme is funded by the government of Brazil and developed collaboratively by IPGRI and the M.Sc. Post Graduate Programme on Plant Genetic Resources of the Federal University of Santa Catarina (UFSC), in Florianopolis, Brazil.

José Pedro’s research work will involve the characterization of varieties of cowpea (Vigna unguiculata) held at the CNRF genebank in Luanda, which is home to nearly 3000 samples of crops important to Angola’s food security. These include, in addition to cowpea, beans, corn, millet, peanut, sorghum and rice.

Cowpea is a grain legume of the family Fabaceae, also known as black-eyed pea. In addition to being rich in protein, it is drought tolerant and because of its ability to fix nitrogen, it can grow on and improve poor soils. It is used for human and animal consumption and has proved particularly lucrative for Angola’s small farmers. However, only a very small portion of the cowpea germplasm maintained at CNRF has been characterized, and this information is needed by farmers and breeders to identify materials that are more productive and resistant to pests and diseases.

José Pedro will also be trained in the use of relevant information tools and software for analyzing and documenting characterization data. When he returns to Luanda, he will bring with him the knowledge and skills necessary to strengthen the plant genetic resources activities of his country and of CNRF, in particular.

IPGRI and UFSC have worked together since 2003, when they established a partnership to strengthen research, education and professional development in the field of plant genetic resources. One component of this partnership has involved the development of strategies for supporting genetic resources programmes in Lusophone African countries (Angola, Cape Verde, Guinée Bissau, Mozambique, São Tomé and Principe) and for strengthening linkages between academic and national agricultural research sectors. The new biennial scholarship is part of this effort and is open to genetic resources professionals working in the countries mentioned.

To find out more about the scholarship, contact Elizabeth Doupé Goldberg <e.goldberg@cgiar.org>, Head, Capacity Development Research and Support Unit at IPGRI in Rome, or Margarita Baena <m.baena@cgiar.org>, Public Awareness and Capacity Development Specialist at the IPGRI Americas Group.
In 2004, four researchers supported by IPGRI were awarded grants from IFAR, a foundation that promotes scientific excellence among the Future Harvest Centres of the Consultative Group on International Agricultural Research (CGIAR) and their partners. These grants are intended to contribute to the professional development of researchers from developing countries.

Helga Rodríguez von Platen, a Costa Rican biologist and biotechnologist working at the Centro Agronómico de Investigación y Enseñanza (CATIE), was one of the grantees. Her research consisted in developing molecular fingerprints to identify banana hybrids produced by the Honduran Foundation for Agricultural Research (FHIA) with microsatellites and to validate their usefulness in identifying hybrids from the Costa Rican Musa collection.

Although banana hybrids are widely distributed, their identity can sometimes be in doubt. Helga developed a method to effectively identify very closely related Musa hybrids. With ten microsatellites, Helga could distinguish effectively between the full-sib hybrids FHIA-01 and FHIA-18, and with another set of these markers she could differentiate hybrids FHIA-25, FHIA-21, FHIA-20, FHIA-26 and FHIA-03. She could not, however, find a microsatellite to distinguish between FHIA-17 and FHIA-23 nor could she identify polymorphism between them, despite that found in their parents. For this reason, she suggests conducting studies to overcome the great genetic similarity between FHIA-17 and FHIA-23, with a technique named representational differential analysis (RDA), that helps find differences in complex and nearly identical genomes such as that of Musa.

Besides helping determine the integrity of some Musa hybrids from FHIA, Helga’s work will help researchers on plant tissue culture and nursery professionals eliminate not-true-to-type plants, and will also serve to develop a bar code for all hybrids. This technology will benefit the small banana growers from Asia and Central America that will now have a guarantee on the material they purchase.

Getting an IFAR grant has given Helga the perspective and techniques to help a wide spectrum of users to maximize FHIA hybrid purchase guarantee. In Helga’s opinion, the grant helped her professionally and as an individual and farmer. This experience also allowed her to bring to Costa Rica new materials that she will be able to share with labs in Latin America.

For further information, contact Helga Rodríguez von Platen, INIBAP-CATIE, <laselva@racsa.co.cr>, visit IFAR’s web site (http://www.ifar4dev.org/index.htm).

Vavilov-Frankel Fellows 2005

Gideon Njau Mwai from Kenya and Narayandas Laxminarayan Mantri from India are the winners of this year’s Vavilov Frankel Fellowships, IPGRI’s annual awards for young scientists.

Mwai’s research on varieties of African nightshade (Solanum) a popular, highly nutritious, yet scientifically neglected indigenous vegetable—will help to promote use of the crop in Kenya, thereby contributing to local farmers’ incomes and well-being as well as enhancing its conservation. Mantri hopes to boost chickpea (Cicer arietinum) production in India and Australia by developing a tool that will make it easy for breeders to screen varieties of chickpea for resistant traits.

Mwai, a tutorial fellow at Maseno University in Kenya, believes that African nightshade, a ubiquitous plant in East Africa, can improve the nutritional and economic status of marginalized communities in the region. “I am keenly interested in researching African indigenous vegetables, which I strongly believe need not only to be conserved, but have the potential to significantly contribute to resolutions of the problems of poverty and malnutrition that are so widespread amongst our
Mr. Gideon Mwai of Maseno University, Kenya, will study the diversity, nutritional value, alkaloid content and organoleptic quality of vegetable nightshades (Solanum section Solanum), with support from Pioneer Hi-Bred International, Inc.

Mr. Narayandas Laxminarayan Mantri of the Marathwada Agricultural University, Parbhani, India, will analyze the stress-related genes of chickpea (Cicer arietinum) using microarrays. This research is supported by the Grains Research and Development Corporation (GRDC), Australia.

people,» he said. Mwai is pursuing his PhD in collaboration with the Asian Vegetable Research and Development Centre (AVRDC) in Arusha, Tanzania, which has a large collection of vegetable nightshades.

Despite its popularity among local people and its high nutritional value, African nightshade, like many other African leafy vegetables, has been somewhat neglected scientifically. As a result, existing taxonomic information about the plant is complex and confused. At the Botanical and Experimental Garden and the Laboratory of Plant Cell Biology at the Radboud University in Nijmegen, the Netherlands, Mwai will work on the taxonomy of African nightshade. He will also assess existing varieties for nutritional value and taste to identify the best ones for farmers to use now and as the basis for improving the crop. More accurate taxonomic information will make it easier for future workers to improve the vegetable nightshades.

Mantri is currently pursuing a PhD at the School of Applied Sciences, Biotechnology and Environmental Biology of the Royal Melbourne Institute of Technology (RMIT) in Australia. His research will use DNA microarrays to identify genes responsible for disease and stress resistance in chickpea varieties. The ultimate output of his project, Mantri hopes, will be a model tool for screening chickpea varieties for resistance traits.

India is the world’s largest producer of chickpea, accounting for 75% of world production. A popular ingredient in Indian cuisine, chickpeas also provide consumers with a vital source of protein as well as playing a key role in rotational cropping systems, adding nitrogen to the soil. However, an increase in droughts, caused by irregular monsoon rains, has caused a drastic drop in the country’s chickpea production.

Delegates attending the International Pulse Trade Conference in May of 2001, predicted that India would need up to 2 million tonnes of imported chickpeas to make up for expected deficits. Other stresses, including the widespread Ascochyta blight—a common disease affecting chickpea—have contributed to the poor harvests. Australia, the world’s largest exporter of chickpea, also witnessed a catastrophic decline in production following an outbreak of Ascochyta blight in 1998.

By developing a tool that will enable breeders to easily screen chickpea varieties for resistance to drought and disease, Mantri hopes that new and improved varieties of chickpea can be developed and distributed to farmers in India and elsewhere, thereby promoting chickpea production in a sustainable and environmentally friendly manner.

The Vavilov Frankel Fellowships programme aims to enable outstanding young scientists from developing countries to carry out research that is relevant and innovative outside of their own countries, thereby contributing to the scientist's professional development, and to the country's ability to effectively use and conserve its crop diversity. Since 2004, the Grains Research and Development Corporation (GRDC) of Australia and Pioneer Hi-Bred International Inc., a DuPont company, have been supporting the fellowships. The annual call for applications opens in July every year; applications are received until November and fellows are announced in April of the following year.

For further information about the Vavilov Frankel Fellowships, contact Dimary Libreros <d.libreros@cgiar.org> at the IPGRI Americas Group or visit the Web page http://www.ipgri.cgiar.org/training/vavilov.htm where you will find detailed information on the dates and how to apply to the 2006 call.
PGR in the Web

Genetic resources portals

**http://www.scidev.net/ms/biofacts/**
This is the site of the Science of Development Network. It provides information on the current status of biodiversity in the world, on topics including the value of biodiversity, the threats to biodiversity and the conservation of it. The site has links to other sites related to genetic resources conservation.

**www.ileia.org/**
The site of the Centre for Information on Sustainable Agriculture gives access to Leisa, a magazine on low external input and sustainable agriculture, and to a documentation center with nearly 10,000 records. It also has a contacts database and information on crop systems, organic agriculture and agroforestry.

**http://www.ukabc.org/**
This is the site of the UK Agricultural Biodiversity Coalition, a network of non-governmental organizations in agrobiodiversity in England. The site contains information on sustainable agriculture, biodiversity, genetic engineering, intellectual property rights and benefit sharing. It has links to genebanks, crop information systems and organizations that work with animal and plant genetic resources.

**http://www.iisd.ca/**
This portal on agrobiodiversity, hosted by the International Institute for Sustainable Development, includes information on sustainable development, wild life, climate, forestry, desertification, land, water, wetlands and human development. Within each topic, there are links to events and relevant organizations.

**http://www.itis.usda.gov/**
The Integrated Taxonomic Information System is a database with authoritative taxonomic information on plants, fungi, animals and microbes of North America and the world. It allows searching by common and scientific name. Data on species includes genealogy and geographical distribution. It is linked to other web sites with relevant information and is useful for those undertaking taxonomic revisions.

FAO-BioDeC is a database meant to gather, store, organize and disseminate updated baseline information on the state-of-the-art of crop biotechnology products and techniques in use in developing countries. The database includes about 2000 entries from 70 developing countries, including countries with economies in transition. It contains profiles of national research capacity, including key organizations, the political framework of biotechnology, the biotechnology applications and reference sites with information to support biotechnology activities.

Research support databases

**http://www.programalban.org/**
The Alban programme promotes cooperation between the European Union and Latin America in higher education. It covers graduate studies and specialized training for professionals from Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay y Venezuela.

**http://www.helmholtz.de/**
This is the site of the Helmholtz Association of National Research Centers of Germany. It offers scholarships to young researchers to pursue doctorate and post doctorate studies in environmental and biological sciences.

**http://www.ecofondos.net/**
Ecofondos is a portal of information on sources of funding for projects on natural resources conservation and sustainable development focused in Latin America. It provides information on scholarships and contains a database of services that can be searched by topic.
Readings on PGR
Books


Because of their physical characteristics, some species require to be propagated vegetatively and to be maintained in the field or in vitro. Maintaining field collections is costly and carries a high risk of losing materials while in vitro conservation allows better control of germplasm collections. The need to develop strategies and procedures to manage collections in vitro and in the field motivated the development of this guide. Divided in two sections, the first section describes general considerations for the establishment and management of germplasm collections, including acquisition and entry of the material into the collection, germplasm health issues, conservation methods available and management procedures. The second section focuses on establishing and maintaining field and in vitro collections. Procedures are given for the former and the basic lab requirements and standards for the latter. The guide includes 13 appendices with examples of data that can serve to develop a system to document and manage field and in vitro collections.


This guide is the first volume in a series of three booklets that deals with the conservation of forest (tree and shrub) genetic resources. This volume gives an overview of concepts and systematic approaches to the conservation and management of forest genetic resources. It outlines the need to conserve these resources and focuses on some of the strategies that may be employed in doing this. In addition, the volume focuses on planning national conservation of forest genetic resources, identification of research needs in forest resources, people’s participation in the conservation of forest genetic diversity, and regional and international approaches to the conservation of forest genetic resources.


These modules, developed jointly by IPGRI and the Institute for Genomic Diversity, Cornell University, aim to promote capacity building and research on biodiversity use and conservation worldwide through the application of molecular markers. They discuss the fundamental principles of genetic diversity, the qualities of the markers used to measure it and the most widely used technologies, including those based on proteins, DNA and the polymerase chain reaction. Explanatory graphics and photographs illustrate key experimental procedures, and real-life examples are given of applications to particular cases of genetic diversity studies and/or germplasm management. These should help in the use of the modules as a useful educational resource, whether as a self-tutorial or incorporated into a university curriculum. They also compare the various techniques in terms of their advantages and disadvantages, as well as the relative costs of each procedure to help the beginning scientist understand the key components for selecting those procedures most appropriate for a given research. The modules are intended for scientists with a minimal background in genetics and plant molecular biology, but with a working knowledge of plant genetic resources and issues concerning their conservation and management.

This publication, in Spanish, contains 29 articles that describe the state of on-farm conservation of genetic resources in Mexico and Latin America. Articles in this book are grouped in three sections. The first part is about crop diversity and agroecosystems, especially maize, beans, chili peppers, chayote and some local varieties. The second part describes in situ management of crop diversity, seed systems, on-farm breeding and how farmers participate in conservation. The third part deals with the social, cultural and economic aspects involved in the conservation of genetic diversity in home gardens. This book is available in hard copy only.


This book contains 13 chapters dealing with access to biodiversity and benefit sharing. It includes information on policy as well as regional and national laws on genetic resources. Case studies are included describing political processes and implementation of access regimes and benefit sharing in Colombia, Costa Rica, Mexico, the Philippines, the United States, Australia, Chile and Malaysia. The last chapter includes conclusions on the progress of countries in establishing policies after the Convention on Biological Diversity and some recommendations to define policies regarding access to genetic resources according to national laws. It also has three annexes with the conclusions of an international workshop on access and benefit sharing, the biodata of authors that have written on access and benefit sharing, and a list of contacts. The book is available in pdf format.


This series, in Spanish, compiles ten years of research results on Andean roots and tubers from a project sponsored by COSUDE and conducted by the International Potato Center (CIP) and the national plant genetic resources programs of Ecuador, Peru and Bolivia, with some participation from IPGRI. The series contains eight publications on several aspects of Andean roots and tubers, including sustainable management of tuber agrobiodiversity, in situ conservation of oca, ulluco cultivation, alternatives to conservation and sustainable use, economic potential of ulluco cultivation and marketing, and some uses of yacon. The series also includes a catalog of local varieties of potato and oca from Bolivia. These publications are available at CIP’s web site.

Articles

Genetic diversity


Molecular genetics


**Tropical fruits**

