The Conservation and Sustainable Use of the Crop Genetic Resources of Central America

A Darwin Initiative funded project at WCMC

Phase 1 documents

WORLD CONSERVATION
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The mission of the
World Conservation Monitoring Centre is to provide
information on the status, security and
management of the Earth's biological diversity.

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Phase 1 documents

* Project proposal

* Appraisal meeting agenda

* Delegates at appraisal meeting

* Draft discussion paper

* Project summary March 1994 (English and Spanish)

PROJECT PROPOSAL

WORLD CONSERVATION
MONITORING CENTRE

Unique Identifier: 120.4

1. Project Title: THE CONSERVATION AND SUSTAINABLE USE OF THE PLANT GENETIC RESOURCES OF CENTRAL AMERICA

2. Submitted by: World Conservation Monitoring Centre, 219 Huntingdon Road, Cambridge CB3 0DL, UK, in collaboration with the Royal Botanic Gardens, Edinburgh and Kew, and a consortium of North and Central American and European agencies that will participate in the project (see Section 11)

3. Objectives:

i. to assess the status, distribution and threats to the most economically important plants and their wild relatives in Central America

ii. to determine current and potential uses and economic benefits of the plant genetic resources of the region

iii. to promote the conservation of genetic variation amongst the wild progenitors and landraces of agricultural crop plants in the region

iv. to reinforce the economic values of plant genetic resources as an incentive for countries in the region to conserve their biodiversity

v. to build the capabilities of the national institutions within the region to identify, evaluate and utilise their plant genetic resources as a key component of the biological wealth of the countries

vi. to develop a methodology and operational practice for quantifying the status, use and economic values of plant genetic resources that can be applied in other regions of the world

4. Timetable:

Phase 1: Feasibility Assessment	January 1994 - April 1994
Phase 2: Scoping Workshop	April 1994 - October 1994
Phase 3: Pilot Project, Central America	November 1994 - December 1995
Phase 4: Global Application	1996-2000 (uncosted)

5. Executive Summary:

The accelerating erosion of the genetic diversity of plants of current or potential economic value represents a wasting opportunity for farmers, local communities and governments to benefit from their sustainable utilisation. The need to conserve genetic resources for their use in food production, sustainable agriculture and new pharmaceuticals is widely recognised by governments and provides a powerful incentive for the conservation of biodiversity. This realisation is reinforced by the provisions of Agenda 21 and the Biodiversity Convention, both of which stress the need to identify and monitor the status, threats to, and utilisation of plant genetic resources.

A study is proposed of the *in situ* plant genetic resources of Central America, focusing particularly on the wild progenitors and landraces of agricultural crop plants. A broad-based consortium of developed and developing country agencies will be established with a strong emphasis upon building the capabilities of the institutions within the region. The project will develop, field-test and refine a methodology for in-country gathering of data and assessing national priorities, which will be presented to the FAO 1995 Conference on Plant Genetic Resources. It is envisaged that this methodology will then be applied throughout the world at the country level as a key input to the year 2000 Global Plan of Action. Central America has been identified for the pilot study because of its high level of indigenous crop genetic diversity - the region is recognised as a Vavilov Centre - and its well established network of agricultural, botanical and ethnological expertise.

The loss of genetic diversity in agricultural crop plants is one of the most serious, but often overlooked, issues in the conservation of biodiversity, not least because of the need to maintain maximum diversity in the context of global climate change. This study will develop the tools and operational procedures for countries to identify and assess their own genetic assets as the basis for recognising their economic benefits and conservation priorities.

6. **Relevance to the Darwin Initiative**

The proposal fulfils the Darwin Initiative Committee's recommendations: 4(i) funding would have a catalytic role constituting only 25% of the pilot project costs and a considerably smaller proportion of total project costs; 4(ii) this research is not funded through traditional channels; 4(iii) the project focuses on conservation and sustainable use of biodiversity in areas rich in genetic resources; 4(iv) the project directly addresses obligations under the Biodiversity Convention; 5(i) the project is collaborative and will use existing links and develop additional links with institutes in developing countries; 5(iv) it will provide information on wild progenitors of crop plants which may have direct benefit to in-country commercial activities; 5(v) it will involve local communities outside the UK specifically developing a methodology that will be applied not only to wild relatives of crops in South America, but also to those in Africa and Asia.

7. **International Context:**

7.1 The key principle underlying the **Convention on Biological Diversity**, signed by 158 countries at the 1992 Earth Summit in Rio de Janeiro, is the need to generate economic incentives through sustainable use programmes for countries to conserve their biological resources. Because of the potential provided by biotechnology to develop such economic benefits, the Convention gives specific attention to the issues of access to genetic resources, the transfer of relevant skills and technologies, and the fair and equitable sharing of economic benefits, arising from the exploitation of genetic materials.

7.2 Clearly, this focus on biotechnology and commercial exploitation assumes that a country has the capability to recognise and evaluate the genetic resources it has at its disposal. The Convention therefore places particular emphasis on the need to identify genetic materials that offer the greatest potential for sustainable use, and on monitoring processes and activities that are likely to have a significant adverse effect upon their conservation (Article 7).

7.3 This emphasis upon the use of genetic resources is reinforced by Resolution 3 of the **Conference for the Adoption of the Convention on Biological Diversity**

(May 1992), which "recognises the benefits arising from the care and improvement by the peoples of the world of animal, plant and microbial genetic resources to supply their basic needs...". Resolution 3 goes on to propose:

- the identification and monitoring of plant genetic resources of potential value for food and sustainable agriculture
- the promotion of genetic diversification in crop production in agricultural systems
- the promotion of research on, and utilisation of, poorly known but potentially useful plants and crops
- the strengthening of national capabilities for the identification and utilisation of plant genetic resources

7.4 These measures are strengthened by the section on the Conservation and Sustainable Utilisation of Plant Genetic Resources for Food and Sustainable Agriculture included in **Agenda 21** (chapter 14) of the Earth Summit. This statement recognises the accelerating rate of genetic erosion of crop species, and amongst other activities calls for:

- the characterisation, evaluation and utilisation of plant genetic resources for agriculture, particularly for the minor crops and other under-utilised or non-utilised species, including tree species for agro-forestry
- the establishment of mechanisms to assess, study, monitor and use plant genetic resources to increase food production
- the establishment of joint activities, including training, for research on plant genetic resources through networks of collaborating institutions
- the development of regional and global networks for the protection of plant genetic resources *in situ* in conservation areas
- the building of in-country capabilities through training, raising awareness and technology transfer
- the preparation of periodic state-of-the-world reports on plant genetic resources

7.5 Agenda 21 also makes the specific proposal (paragraph 14.62) to develop major collaborative projects involving developed and developing countries for the advancement of basic scientific research in plant genetic resources, particularly for the enhancement of poorly known or neglected crops.

7.6 It can be seen, therefore, that there is an internationally recognised need to develop a collaborative programme with a global application to identify, study and monitor the status and use of plant genetic resources, particularly the wild relatives of economically important and poorly known crop species. This proposal has been developed in response to that challenge.

8. Project Overview:

8.1 It is proposed to establish a broad-based consortium involving developed and developing country agencies drawn from both the governmental and private sectors to undertake the project. The main focus will be to gather baseline data on the status, distribution, and utilisation of plant genetic resources throughout Central America as the basis for their conservation and sustainable use.

8.2 The data collection will be undertaken by appropriate in-country organisations using a standard methodology. All participating agencies will contribute to the

development of this methodology through a workshop to be held at the commencement of the project. The primary role of the developed country participants will be to contribute their data holdings, to assist the in-country agencies in implementing the methodology, to provide training and skills transfer, and to contribute to the process of building capacity within the region. In addition, WCMC will serve as the catalyst for the development of the project, will coordinate the activities of the agencies in-country, and will synthesise the final regional report.

8.3 The information generated by the project will reside in an appropriate database format within the countries, and will provide the basis for quantifying the diversity and potential value of their genetic resources. Such recognition of their genetic materials will reinforce the strategies and action plans that the countries will be preparing under the terms of the Biodiversity Convention.

8.4 Although the full scope of the project will be agreed collectively by all the participating agencies, it is envisaged that the primary orientation will be focused towards the wild relatives and landraces of commercial crops, particularly those that are:

- of economic significance, particularly at the farm level
- important for maintaining *in situ* genetic diversity
- threatened with extinction or serious exploitation in the wild
- of limited geographical distribution
- experiencing severe genetic erosion
- poorly researched and little known
- protected within existing conservation areas
- included in *ex situ* programmes

8.5 The project is envisaged as comprising four distinct phases:

Phase 1: Feasibility Assessment

- explore the need, practicalities and logistics of undertaking the study with the main international agencies working in the genetic resources sector, particularly the UN Food and Agriculture Organization (FAO) and the International Board for Plant Genetic Resources (IBPGR), both based in Rome
- identify the relevant collaborating agencies, both international and from within the region, and seek their participation
- convene a small pre-workshop appraisal meeting of the main participating agencies at which to assess the strategic planning, operational procedures and achievability of the project

Phase 2: Project Scoping

- prepare a detailed proposal based on the appraisal meeting as input to a scoping workshop
- convene a planning workshop within the region involving all the participating agencies for the purpose of agreeing the scope, practicalities and procedural arrangements for the project, including the drafting of a methodology for the data gathering and assessment
- formalise and agree the methodology with a set of user guidelines for in-country implementation
- agree the options and procedures to safeguard the intellectual property rights of farmers, local communities and nations in the Central American region

- develop a full operational plan for Phase 3 agreed by all participants which will be used to secure the necessary funds

Phase 3: Pilot Project, Central America

- undertake the study within the Central American region as agreed at the scoping workshop, applying the methodology and guidelines
- assess the national needs and priorities for the conservation and sustainable use of plant genetic resources
- demonstrate the potential benefits and values of genetic variability at the farm, community and government levels as an incentive for genetic resource conservation
- establish the in-country capability to monitor the status, threats and use of plant genetic resources
- synthesise a report on the conservation and sustainable use of the plant genetic resources of Central America
- revise the methodology and guidelines in the light of the experience of the pilot study for promulgation throughout the world

Phase 4: Global Application

- assess the conservation status, sustainable use and economic benefits of the plant genetic resources of the regions of the world through the application at the country level of the methodology and guidelines revised in context of the experience of the Central American pilot study

8.6 The UN Food and Agriculture Organization is convening in mid-1995 the **Fourth International Technical Conference on the Conservation and Sustainable Use of Plant Genetic Resources for Food and Sustainable Agriculture**, which is likely to call for a Global Plan of Action and a State-of-the-World Report. It is proposed that the Central American report be tabled at this FAO Conference, and that the revised methodology be promulgated for adoption by countries as part of the Global Plan of Action.

8.7 Agenda 21 calls for countries to adopt policies and programmes for the *in situ*, on-farm, and *ex situ* conservation and sustainable use of plant genetic resources by the year 2000. Such national programmes must be based upon a rational assessment of the status, use and values of their genetic resources. It is the goal of this project to stimulate the compilation of the data necessary for determining national priorities under the Global Plan of Action. The project will therefore contribute directly to the *in situ* assessment of plant genetic resources as a key contribution to the 1995 FAO Conference.

9. Project Content:

9.1 The work programme and institutional responsibilities will be agreed at the scoping workshop. The emphasis will be to facilitate the national agencies to undertake the in-country data gathering and priority assessments with the international agencies providing technical and scientific support as appropriate. The existing national capabilities vary considerably - some countries such as Costa Rica and Mexico already have substantial programmes under way for prospecting and assaying plant genetic resources, whereas others have little or none. In so far as is possible, the experience of agencies within the region, such as Instituto Nacional de Biodiversidad (INBio) of Costa Rica, and the Universidad Nacional Autónoma de México (UNAM), will be mobilised for

training and capacity building in other countries, supplemented by the international agencies as appropriate.

9.2 It is anticipated that the scoping workshop will want to consider the following aspects of the work programme, although this list is not intended to be exclusive:

i. **determine what information on plant genetic resources of Central America is available and in what format**

survey the existing data sets held by such institutions as WCMC; Missouri Botanical Garden; Royal Botanic Gardens, Kew; Royal Botanic Garden, Edinburgh; Conservatoire et Jardins Botaniques, Genève; ILDIS; Conservation International; INBio; UNAM, and other national and international data centres (see Section 10 for full names of acronyms); ascertain best method of sharing data through common file structures or through agreed transfer formats

ii. **determine which plant genetic resources are of the highest priority for conservation and sustainable use**

on the basis of the data collected and the perspectives of the in-country institutions, determine the taxonomic groups and geographical locations for priority assessment

iii. **develop a standard methodology for gathering the data in-country, and prepare guidelines to facilitate national agencies undertaking this work**

to ensure comparability in the national assessments, it is intended to develop a common methodology with accompanying guidelines for the data management; the outline of this method will be agreed at the workshop with the final version endorsed by the participating agencies as the mechanism for data gathering

iv. **establish a procedural and financial mechanism to honour intellectual property rights of the suppliers of the information**

work with in-country experts and institutions as well as international bodies to create a structure in which information on plant genetic resources can be shared; this will include identifying the relevant in-country institutions to coordinate data gathering activities and to establish an appropriate mechanism to ensure that the farmers and local communities providing the information share in any commercial benefits; the mechanism must recognise the intellectual property rights inherent in the information, particularly relating to traditional uses by indigenous peoples, farmers and local communities whose interests must be fully considered. The process of gathering data on traditional plant uses and plant genetic resources must not be allowed to create opportunities for unscrupulous collectors to benefit without adequate safeguards of the interests of the information sources

v. **establish a cooperative network of campesinos, in-country and out-of-country experts, national biodiversity centres, and international agencies to share existing information and to gather the information**

that is not available

facilitate the cooperative ties and information sharing amongst institutions and researchers, and make the information available to all interested parties in a variety of appropriate formats - reports, diskettes, and on global electronic networks, such as the Internet; sharing this information - including bibliographic data, ongoing projects, and geographic and taxon-based data (these data sets will, therefore, be textual as well as graphic, such as maps and images) - will help reduce duplication of effort, better focus and integrate existing research programmes in different countries, and identify the gaps in the existing information; technical assistance will also be offered for the development and expansion of plant genetic resources databases being developed in-country

vi. **map the distribution of plants deemed to be of highest priority; correlate these maps with maps of human populations and settlement patterns**

using Geographic Information Systems (GIS) technology, map the overlap of species diversity, cultural diversity, human population demography, and the development pressure upon biological resources; utilize this information to fine-tune the priorities set in ii. above

vii. **provide training to in-country personnel**

work with national institutions and international agencies to train personnel in conservation and genetic sampling techniques as part of the process of building the in-country capacity for the improved management of plant genetic resources

viii. **sample the genetic diversity of the priority species, restricting initial activities to a small number of taxa in a few areas**

using in-country scientists, students, and parataxonomists, carry out intensive studies on the genetic variability and stability of several priority species; it may be possible to develop a coefficient of kinship as a measure of genetic diversity in major crop types in specific localities as a baseline for monitoring genetic erosion

ix. **collect and maintain appropriate material in local and international gene-banks and seed-banks**

incorporate material into appropriate facilities and ensure its long-term storage, curation and access; the project will not include sufficient resources to support the *ex situ* facilities themselves, but will ensure that the species and varieties are included in *ex situ* collections

x. **assess or facilitate floristic checklists, inventories, and floras for the conservation areas of the region to determine which species are protected in those areas and which are not**

assess the extent to which the plant species are already protected within conservation areas through the completion of surveys and floristic inventories; ensure that the management plans for protected areas give full recognition to the conservation of plant genetic resources within their boundaries; compare the distribution of species of high conservation concern for their genetic importance with their presence in protected areas, and work with the relevant national authorities to ensure the adequate protection of such species that lie outside conservation areas; promote the establishment of new protected areas in identified centres of high genetic diversity

xi. **coordinate the conservation activities of the botanic gardens and similar organizations in the region to carry out *in situ* and *ex situ* conservation programs**

work with Botanic Gardens Conservation International (BGCI) to ensure that the botanic gardens in the region are working in a coordinated fashion to preserve and study as much of their plant genetic resources as possible; this conservation work will include both *in situ* and *ex situ* activities, and will need to encompass a wide variety of kinds of plants - wild species (used both for extractive and non-extractive purposes), landraces, semi-domesticates, and cultivated plants

10. Project Outputs:

10.1 At the farm and local community level:

- a greater appreciation of the uses and benefits of maintaining genetic diversity in agricultural crops
- an improved realisation of the economic values of plant genetic resources as an incentive for their conservation
- a contribution to the on-going debate about farmers' rights, the commercial applications of traditional knowledge of indigenous peoples, and intellectual property rights

10.2 At the national government level:

- a greater awareness of the economic benefits of the sustainable use of genetic resources as an incentive for their conservation
- an improved ability to identify priorities for the conservation and sustainable use of biological resources to be incorporated in national biodiversity strategies and action plans
- an increased capability to plan and manage national genetic resources, based upon a comprehensive database of the status, distribution and use of plant genetic resources and the improved skills for their evaluation
- a re-appraisal of national agricultural policies and fiscal policies that impact genetic diversity
- an improved recognition of the national biological assets of the countries as an input to their negotiations with overseas companies for the commercial exploitation of their genetic resources
- a contribution to the debate about access to genetic resources, transfer of biotechnology, and the equitable showing of benefits arising from the commercial use of genetic materials

10.3 At the regional level:

- a regional review of the status, distribution and use of the most economically important plant genetic resources of Central America
- a regional assessment of the priorities for the conservation and sustainable use of the plant genetic resources of Central America, based on the national analyses
- a contribution to the regionally-based initiatives for crop improvements and sustainable agriculture

10.4 At the global level:

- a contribution to the identification and assessment of *in situ* plant genetic resources for the FAO 1995 Conference
- a tried and tested methodology with accompanying user guidelines for application by countries as a contribution to the proposed FAO Global Plan of Action

11. Participating Agencies:

This project is inherently collaborative in nature, and much effort will be needed to organize and manage an international network of institutions and individual researchers working in this area. A partial list of proposed collaborating institutions includes:

11.1 International agencies:

Botanic Gardens Conservation International (BGCI), UK
Comisión Nacional de Recursos Fitogenéticos de Costa Rica (CONAREFI)
Conservation International (CI), US
Conservatoire et jardins botaniques, Genève, Switzerland
Consortium on Plant Resources of the Americas (COPRA), US
Food and Agriculture Organization of the UN (FAO), Italy
International Board for Plant Genetic Resources (IBPGR), Italy
International Legume Database and Information Service (ILDIS), UK
International Maize and Wheat Improvement Centre (CIMMYT), México
IUCN - The World Conservation Union, Switzerland
Mesoamerican Plant Genetic Resources Network (REMERFI)
Missouri Botanical Garden, US
New York Botanical Garden, US
Organization of Tropical Studies (OTS), US
Royal Botanic Gardens, Kew, UK
Royal Botanic Gardens, Edinburgh, UK
Smithsonian Institution, US
The Nature Conservancy (TNC), US
U.S. Department of Agriculture, US

11.2 National agencies:

Asociación para la Conservación de Naturaleza (ANCON), Panamá
Asociación para la Investigación y Propagación de Especies Panamenas (AIPEP), Panamá
Center for Agricultural Technology (CENTA), El Salvador
Centro Agronómico Tropical de Investigación y Enseñanza (CATIE), Costa Rica
Commission on Plant Genetic Resources, Costa Rica
Forage Legume and Pasture Research Program, Ministry of Agriculture, Belize
Institute of Agronomic Research, University of San Carlos, Guatemala
Institute of Science and Agricultural Technology (ICTA), Guatemala
Instituto Interamericano de Cooperación para la Agricultura (IICA), Costa Rica
Instituto Mexicano de Recursos Naturales Renovables (IMERNAR), México
Instituto Nacional de Biodiversidad (INBio), Costa Rica
National Autonomous University of Honduras
Nicaraguan Genetic Resources (REGEN), Nicaragua
Panamerican Agricultural School El Zamorano, Honduras
Secretary for Natural Resources (SRN), Honduras
Universidad Nacional Autónoma de México (UNAM), México

12. WCMC data holdings:

12.1 WCMC manages substantial data holdings on the status, distribution, threats, management and utilisation of biodiversity, sorted at the country or state level. Of these, the following holdings are likely to be the most important for this project:

Threatened plants

WCMC holds information on nearly 69,000 taxa (species, subspecies, and varieties) of plants, making this one of the largest such data sets in the world. For each of these plants, computerised records are kept for the scientific and common name(s), important synonyms, source of name, life form, endemism, world distribution, and conservation status (using the IUCN Red Data Book categories at both the global level and for each country in which the plant is native). This information is linked to the plants bibliographic database. Although the database is composed in large part by threatened plants, the same structure is used to store information on other groups of plants - such as taxa covered under CITES, tropical timbers subject to international trade, and single-country endemics.

Bibliography

The WCMC plants bibliographic database is the world's largest computerised bibliography dealing with plant conservation issues. Its 15,000 records are linked extensively to other parts of the plants databases.

Plant species richness / endemism

WCMC holds tabular information on floristic richness for virtually all countries of the world, and in connection with the IUCN Centres of Plant Diversity project, has access to textual and georeferenced data on centres of endemism and high species richness.

Habitats

Using GIS (Geographic Information Systems) technology, WCMC holds digital data on a wide variety of topics: tropical moist forests (management, locality, extent, type, threats) at the national, regional, and global levels; wetlands of international importance; coastal areas of ecological vulnerability; global vegetation classifications; information on centres of plant and avian diversity; other habitat types at the national, regional and global levels.

Protected Areas

WCMC holds computerised information on the name, location, size, and management of over 32,000 protected areas. Each country has a data file describing the national system of protected areas, including its legal and institutional base, supported by individual site files providing detailed data on the main areas. This information includes all sites listed under the World Heritage Convention (natural sites), Ramsar wetland sites, and Biosphere Reserves.

Floristic Inventories of Protected Areas

WCMC maintains lists of plant species occurring in national parks and protected areas for those few areas that have undertaken botanical inventories. This work is being expanded to enable the plants database to track species protected in more than one area, and to record the species each area contains.

Through an on-going contract with the CITES Secretariat, WCMC holds 1.6 million transaction records of CITES-regulated organisms or derivatives.

460,000 of these transaction records relate to plants, linking country of export, import, taxon, quantity, and unit. These species represent an important economic asset, which, if managed on the basis of sustainable use, can provide a real conservation incentive to the exporting country.

12.2 Approximately 12,000 flowering plant species have been used by people as food, but only about 150 have been cultivated to any extent, and today only 20 species are responsible for supplying 90% of the world's food. An estimated 30,000 to 70,000 plant species have been used medicinally by local peoples, yet despite the fact that approximately 80% of the world's population relies entirely on local medicines made almost exclusively from plants, only about 5,000 species have been scientifically analyzed for their pharmaceutical properties. A recent request from IBPGR to WCMC asked for information on threatened species in 351 genera of economic importance; these genera belong to 95 families of higher plants (gymnosperms and angiosperms), and they are currently represented by 9,825 taxa in WCMC threatened plant database.

12.3 According to the WCMC Plants database, 24,000 taxa of higher plants are threatened at the world level, and another 10,000 taxa are threatened at the national level in one or more countries where they are native. These 34,366 threatened plants represent over 12% of all higher plants. They are distributed in 6,079 genera in 405 families. The largest number is found in the tropics and subtropical zone.

12.4 Wild species are generally more variable than their corresponding crop, despite often being known from smaller numbers of samples, and have larger and/or different spectra of alleles. Even though 24,000 taxa are known to be threatened with extinction, there is an unknown, but presumably much larger, number of taxa whose genetic variability is being irreversibly lost. Thus, the study and preservation of wild species in gene-banks, field gene-banks, seed-banks, and botanic gardens is of critical importance.

13. Why Central America for the Pilot Study?

13.1 The Mesoamerican Region is recognised as being one of the nine Vavilov Centres of the world, areas of exceptional concentration of crop plant variation. The area of southern Mexico/Guatemala is also recognised as one of four nuclear centres from which agricultural practices have spread throughout the world (see attached map). The reasons for its crop diversity include the great age of cultivation in the region, the wide range of ecological conditions and farming practices, and the processes of natural selection caused by the presence of many different pests and diseases.

13.2 These Vavilov Centres are of immense conservation importance because of their crop genetic variability, and are of major cultural significance because of the diversity of agricultural practices. Both are now under threat with serious genetic erosion arising from the accelerating destruction of natural habitats and from the widespread adoption of genetically uniform crop varieties. There is an urgent need to document and preserve this diversity.

13.3 Central America is home to several major food crops of regional and global importance - *Capsicum annuum* (chili pepper, sweet pepper), *Carica papaya* (papaya), *Dioscorea*

spp. (yam), *Ipomoea batatas* (sweet potato), *Persea americana* (avocado), *Phaseolus lunatus* (lima bean), *Phaseolus vulgaris* (haricot bean), *Zea mays* (sweet corn, maize), and *Zea perennis* and *Zea diploperennis*. *Lycopersicon esculentum* (tomato), a native of Andean South America, was probably first domesticated in Mexico, while the centre of cultivation of the South American *Theobroma cacao* (cocoa) is in Central America.

13.4 There is a good basis of botanical knowledge for Central America on which to base this project. This information base comes from **nationally and regionally based initiatives** (e.g., Consultative Group on International Agricultural Research (CGIAR)-supported international agricultural centres; International Maize and Wheat Improvement Center (CIMMYT), Mexico; Centro Agronómico Tropical de Investigaciónes (CATIE); Comisión Nacional de Recursos Fitogeneticos de Costa Rica (CONAREFI)); **multinational initiatives** (e.g., Flora Mesoamericana (a collaborative effort of Missouri Botanical Garden, Universidad Nacional Autónoma de México, and the Natural History Museum, London); Flora Neotropica (coordinated by The New York Botanical Garden); IUCN-Smithsonian Institution-World Conservation Monitoring Centre Latin American Plants Project; IBPGR; FAO); and **predominantly North American initiated work** (e.g., the Conservation Data Centers (CDCs) of The Nature Conservancy; the Rapid Assessment Program of Conservation International; Institute of Economic Botany (IEB) of the New York Botanical Garden; Organization of Tropical Studies (OTS)).

13.5 There is also a long history of strong botanical networks involving Central America, resulting in several modern regional and national floras mentioned above. The calibre of in-country botanical and technical expertise is high, and there are a great many national initiatives already under way. None of them, however, directly address the issues of plant genetic resources on a regional basis.

13.6 Central America is an excellent region for the pilot project because of its strong existing knowledge-base, because it is has been extensively surveyed (unlike South America), and because it is a relatively small (only nine countries) but floristically rich (over 20,000 species) area. The methodologies developed will undergo extensive and appropriate field testing in this pilot project before they are promulgated on the global scale.

14. **Project Schedule**:

Phase 1	commence	January	1994
	appraisal meeting	March	1994
Phase 2	commence	April	1994
	scoping workshop	June	1994
	methodology and guidelines	August	1994
	full operational plan	October	1994
Phase 3	commence	November	1994
	interim report	June	1995
	FAO Conference	mid	1995
	final Central American report	October	1995
	revised methodology and guidelines	December	1995
Phase 4	commence		1996
	State-of-the-World report		2000

The Conservation and Sustainable use of the Plant Genetic Resources of Central America

AGENDA

Planning Appraisal Meeting
8-10 March 1994
WCMC Cambridge

Tuesday 8 March

10am-1pm	Introductory Session	
	1	Welcome and introduction to WCMC - Harriet Gillett
	2	Introduction to the project - Sara Oldfield
	3	Smithsonian Institution's Latin American Plants Program - Jane Villa-Lobos
	4	The work of IPGRI in Central America - Dr Daniel Debouck
	5	The work of CONAREFI and REMERFI - Luis G. González
	6	The role of the Royal Botanic Gardens, Kew - Roger Smith
	7	The work of CAB International - Dr Shaun Hobbs
1-2pm	Lunch	
2-2.45pm	Demonstration of BG Base	
3-5pm	Discussion	
	8	The availability of data on in situ conservation of plant genetic resources of Central America
	9	Refining the focus and objectives of the project

- geographical coverage
- habitat coverage
- species coverage
- inclusion of landraces

Wednesday 9 March

9-11.30am Discussion

10 Refining the focus and objectives of the project (cont'd)

11.30am-12.30pm Demonstration of GIS

12.30-1.30pm Lunch

1.30-5.30pm Discussion

11 Data collection and exchange - technical aspects

12 Institutional arrangements for collaboration and data exchange

13 Technology transfer and training

Thursday 10 March

9-11am Discussion

14 Planning of scoping workshop - venue, participants, finance, preparation of key discussion documents

11am-1pm Conclusions

The afternoon will be free for further informal discussions and demonstrations at the Centre.

Participants

Dr Daniel Debouck, International Plant Genetic Resources Institute (IPGRI)

Harriet Gillett, WCMC

Mr Luis Guillermo González, President of the National Commission for Plant Genetic Resources of Costa Rica (CONAREFI).

Sara Oldfield, WCMC

Dr John Peacock, International Centre for Agricultural Research in Dry Areas (ICARDA)

Sir Ralph Riley, Consultative Group on International Agricultural Research.

Chris Sharpe, WCMC

Dr Roger Smith, Royal Botanic Gardens, Kew.

Jane Villa-Lobos, Smithsonian Institution.

Dr Kerry Walter, Royal Botanic Gardens, Edinburgh.

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DRAFT

CONSERVATION AND SUSTAINABLE UTILISATION OF PLANT GENETIC RESOURCES OF CENTRAL AMERICA

Discussion paper

Introduction

The project, *Conservation and sustainable utilisation of plant genetic resources of Central America* focuses on the identification, management and economic valuation of in situ plant genetic resources of Central America. The project aims to mobilise the existing network of botanical expertise, together with a large consortium of governmental and non-governmental agencies, to build the capacity of in-country institutions to monitor, manage and evaluate their plant genetic resources. The information generated will remain with the national agencies, but arising out of the regional assessment will be a set of guidelines and database tools for assisting other countries to undertake reviews of their own *in situ genetic* resources. These guidelines will then be promulgated through the 1996 FAO Conference on the Conservation and Sustainable Use of Plant Genetic Resources for Food and Sustainable Agriculture.

As specified in the project proposal, the objectives of the project are:

i. to assess the status, distribution and threats to the most economically important wild plants and their wild relatives in Central America.

ii. to determine current and potential uses and economic benefits of the plant genetic resources of the region.

iii. to promote the conservation of genetic variation amongst the wild progenitors and landraces of agricultural crop plants in the region.

iv. to reinforce the economic values of plant genetic resources as an incentive for countries in the region to conserve their biodiversity.

v. to build the capabilities of the national institutions within the region to identify, evaluate and utilise their plant genetic resources as a key component of the biological wealth of the countries.

vi. to develop a methodology and operational practice for quantifying the status, use and economic values of plant genetic resources that can be applied in other regions of the world.

The project is thus broad in its scope and ambitious in its objectives. If the objectives are to be reached, careful planning and extensive collaboration will be essential. Funding for the

initial phase of the project provides a valuable opportunity to prepare for this major initiative in plant genetic resource appraisal and conservation. The first phase of the project is essentially a feasibility exercise. Preliminary discussions have been held with IPGRI, FAO, and RBG Kew. InBio, COPRA, RBG Edinburgh, WWF, IUCN and others have been contacted to introduce the project and invite participation. Consultation is currently being extended to a wider network including the organisations listed in Annex 1. The planning and appraisal meeting brings together a small selected group of experts to discuss the scope and practicalities of the project.

The meeting will identify further participating organisations and the working relationships between them. It will also refine the scope of the project in terms of the species, habitats and geographical area to be covered. This discussion paper has been prepared as a background document for the meeting, to identify the key issues involved and to provide information, in the Annexes, to substantiate the discussions.

Issues

Participants and Networking

Discussions with IPGRI and FAO have emphasised the fundamental need to ensure full involvement with national partners in Central America from the outset of the project. The main national organisations have been identified. They will be invited to join the initiative following the development of a preliminary strategy at the planning and appraisal meeting. It is anticipated that all relevant national agencies will be invited to the scoping workshop to be held in Central America later in the year. Full NGO involvement will be encouraged, with further consultation to identify the relevant organisations to invite.

Networking between the genetic resource community in Central America is developing effectively with the recent creation of REMERFI and COPRA.

Networking between conservation agencies active in the region operates on various levels. Intergovernmental cooperation is, for example, promoted by CICAD, the Central American Council for Environment and Development. IUCN's regional office for Meso-America (ORMA) also has a key role to play in promoting collaboration within the region.

Networking between botanists is also well-established within the region. The preparation of *Flora Mesoamericana* is a major collaborative venture between botanists inside and outside the region. The botanical community has also collaborated very effectively in the collection of information on threatened plants. One result is the development of the major review, *Threatened plants of Central America*, which is being published by the Smithsonian Institution and WCMC.

The extent to which farmers and local communities can be reached by the project will need to be further considered. Discussions with RBG Kew have initially emphasised the difficulties of trying to involve local people in a broad initiative of this nature, particularly where they are not involved in the NGO networks. It may however be possible to link with existing initiatives such as the Plants for People initiative of UNESCO, WWF and RBG Kew.

The current project allows the opportunity to bring together the different interest groups, to facilitate information exchange and action planning. Preliminary discussions have indicated that the development of complementarity of studies and closer collaboration should be one of the main benefits of this initiative.

Species coverage

One of the key objectives of the project is to assess the status, distribution and threats to the most economically important plants and their wild relatives in Central America. There is an extensive and growing body of literature on the economic and other useful plants of the region from which species lists can be drawn. From such information it may be necessary to select certain genera and/or species for priority consideration and various plant groups have been suggested.

1. Fruit trees and vegetables.
2. Groups considered as priorities for attention by REMERFI, as identified at the Second Preparatory meeting. (see Annex 2).
3. Wild relatives of crop species.
4. Timber species.
5. Threatened wild plant species.

The project's emphasis on economic plants has been questioned with the suggestion that socially important plants should also be considered.

Data collection and exchange

A clear need has been recognised during preliminary project discussions for coordination of information collection and storage for the in situ conservation of plant genetic resources. Whereas common formats for data collection and procedures for data exchange are weil-established on an international basis for ex situ plant conservation, particularly for crop genetic resources, this is not yet the case for in situ conservation.

Priorities for discussion at an early stage will be mechanisms and formats for exchange of information, the extent to which it is practical and desirable to compare and link the datasets of key organisations and existing networks, and how major gaps in the existing data can be filled. It will be useful to discuss the respective roles of different organisations

Methodologies

Procedures for the collection of field data need to be addressed. Methodologies are, for example, needed to locate populations to be conserved in situ, and also methods for monitoring and managing these populations once located.

In general it would appear that inventory of the plant genetic resources within protected areas remains a priority in Central America. Once this information is collected and collated it will be important to assess to the extent to which the genetic resources of a particular species are effectively conserved.

The Genetic Diversity Group of IPGRI plays a key role in the development of methodologies for collecting for ex situ conservation. Ecogeographical survey methodology is being developed for collecting purposes and has been tested in Morocco, Pakistan and Syria on vegetable species. The relevance of such techniques for in situ conservation purposes could be considered. IPGRI is also looking at the prediction and measurement of genetic erosion and the social and economic aspects of collecting formats.

It is intended that a forestry expert based in the Latin American Office of IPGRI, will work on the development of ecogeographical surveys for individual timber species. The species chosen will be decided locally by collaborating institutions.

Organisations involved in Plant Genetic Resource Conservation in Central America

This overview is far from complete, but indicates the range of key organisations, which are likely to be involved in the project, outlining their current activities.

Regional Organisations

REMERFI
A recently established regional network which promotes the conservation and, through plant breeding and biotechnology, the utilisation of plant genetic resources. REMERFI is sponsored by CATIE, FAO, IPGRI and ICCA.

Consortium on Plant Resources of the Americas (COPRA)
The intention of COPRA is to promote and enhance cooperation in the study, rational use and conservation of useful plant resources of the Americas. An information system is planned to:

- develop and maintain relevant databases and directories of plant resources projects
- develop a network index to plant resource databases
- identify gaps in knowledge with regard to plant resources

The Smithsonian Institution (Department of Botany) is providing an interim base for COPRA. Other organisations involved in the creation of COPRA include: AID, Office of Forestry, Environment & Natural Resources, USA; BGCI; IUCN/SI Latin American Plants Project; Instituto Nacional Indigenista, Mexico; Missouri Botanical Garden; New York Botanical Garden; The Nature Conservancy Latin America Program; USDA, National Germplasm System; WCMC; WRI; WWF-US, Biodiversity Support Program.

It is intended to involve all relevant national organisations in the countries concerned and regional bodies such as REMERFI.

The Tropical Agricultural Research and Training Center (CATIE):

CATIE plays a central role in the coordination of research and training in relation to the biodiversity of Central America. The member countrie of CATIE are Costa Rica, Dominican Republic, Guatemals, Honduras, Nicaragua, and Panama. One of CATIE's technical activities is the REnewable Natural Resources Department, which has four programmes: agroforestry, silviculture, wildlands and watershed management. One of the primary objectives of the wildlands programme is managing protected areas in Central America and elsewhere in Latin America, including in situ genetic resource conservation. Other services provided by CATIE include maintenance of the Central America regional fruit germplasm collection; and Información y Documentación Forestal para América Tropical (INFORAT).

CATIE, with technical support from IUCN, is currently managing a project called "Conservation for sustainable development in Central America." Activities under this include

the planning of an integrated system of protected areas for the Department of El Peten in Guatemala and the sustainable use of non-timber products by local communities in the area of Talamanca in Costa Rica.

IUCN Regional Office for Meso-America (ORMA)

ORMA is responsible for regional; programmes on wetlands, wildlife management and marine and coastal resources. In 1992 the Regional Office set up a GIS Unit. Geographical databases have been prepared for projects in Nicaragua and Costa Rica and a general database for Costa Rica which includes information about protected areas and forest cover for the whole country. Databases are currently being prepared for the Forestry Pilot Project in Peten, Guatemala; for Trifino, between Guatemala, Honduras and El Salvador; and for the Lago Atitlan Basin in Guatemala.

International organisations

Consultative Group for International Agricultural Research (CGIAR)

CGIAR was founded in 1971 as an independent, international consortium sponsored by FAO, the World Bank and UNDP. The CGIAR, which is serviced by a Secretariat (based at the World Bank, Washington, DC) and advised on scientific issues by a Technical Advisory Committee, TAC (based at FAO, Rome) carries out agricultural research through activities of its 17 International Agricultural Research Centres including CIAT, and CIMMYT.
CIAT - Centro Internacional de Agricultura Tropical. Apartado Aereo 6713, Cali, Colombia. A CGIAR Centre, founded in 1967. Focuses on germplasm development (with global mandate for beans, cassava and tropical forages) and on resource management research in Latin America and the Caribbean.

The *Phaseolus* bean collection consists of about 36,000 accessions, both cultivars and wild species. CIAT has preserved more than 20,000 forage accessions of more than 750 wild legume and grass species. The 5500 cassava accessions are mostly cultivated clones of *Manihot esculenta*, collected in primary centres of genetic diversity in South and Central America. CIAT conserves cassava germplasm both in the field and as an *in vitro* collection.

CIAT emphasises a better understanding of the genetic diversity of the germplasm collections. Intensive research is under way in areas such as the origins of crops, improved observation methods, numerical taxonomy of key species, use of isozymes to study genetic structures, and molecular and biochemical finger printing (FAO, 1993).

CIMMYT - Centro Internacional de Mejoramiento de Maiz y Trigo. PO Box 6641, Mexico 06600 DF, Mexico.

A CGIAR centre, founded in 1966. Focuses on crop improvement, research covers maize, wheat, barley and triticale. CIMMYT collects, evaluates, documents and maintains maize and wheat genetic resources for future and current use by agricultural researchers worldwide. CIMMYT staff monitor populations of landraces and teosinte through regular visits to farmers' fields and natural habitats in Mexico and Guatemala.

UN Food and Agriculture Organisation (FAO)

The mandate of FAO is to support development efforts in fisheries, forests and agriculture. It provides technical assistance in its fields of competence; facilitates the free exchange of information and know-how between nations and assists member countries in the execution of field programmes in support of sustainable agricultural development.

In 1962, FAO established a Panel of Experts on Plant Exploration and Introduction. This Panel was mandated to advise FAO on matters relating to plant genetic resources, and to help develop international guidelines for the collection, conservation and exchange of crop germplasm. A Panel of Experts on Forest Gene Resources was established in 1968 and remains active. One of its tasks is the regular updating of a list of species and provenances for which priority action is recommended in the field of exploration, conservation, collection, evaluation and utilisation.

FAO's work on plant genetic resources encompasses the following activities:

i. provision of an intergovernmental forum for discussion and negotiation - the Commission on Plant Genetic Resources.
ii. provision of policy guidance through internaitonlly agreed documents (eg International Undertaking on Plant Genetic Resources approved in 1983)
iii. collection, analysis and dissemination of information through its World Information and Early Warning System on Plant Genetic Resources.
iv. provision of technical assistance to developing countries.

FAO has convened three International Technical Conferences on plant genetic resources and a fourth is planned for 1996. This Conference, at which documentation on the State of the World's Plant Genetic Resources will be examined and an Action Plan presented, will include forest genetic resources as an explicit component of its programme.

The International Plant Genetic Resources Institute (IPGRI)

IPGRI is an independent institute of the Consultative Group on International Agricultural Research (CGIAR), which has developed from the International Board for Plant Genetic Resources (IBPGR). The mandate of IPGRI is to advance the conservation and use of plant genetic resources for the benefit of present and future generations. The objectives of IPGRI are:

i. to assist countries, particularly developing nations, to assess and meet their needs for conservation of plant genetic resources, and to strengthen links with users of plant genetic resources.

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

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

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

IPGRI's work is carried out through collaboration with national institutions and research bodies. Providing technical support and training for national programmes is the basis for the work of the Institute.

The focus of IPGRI's work is shifting to *in situ* conservation and the current WCMC project is seen as an essential next step in the collation of the necessary data. IPGRI is also expanding its role to cover forest genetic resources and again *in situ* is going to be the priority. Particular emphasis will be given to species with commercial and socio-economic importance.

United Nations Environment Programme (UNEP)

UNEP was established in 1973 and charged with working with governments, other UN organisations and NGOs around the world to coordinate and catalyse action on the global environment.

UNEP coordinates the Global Environment Monitoring System (GEMS) and the Global Resource Information Database (GRID), elements of the United Nations Earthwatch programme. GEMS is a collective international programme to acquire, through global monitoring and assessment, the data that are needed for the rational management of the environment. GRID provides an environmental data management service throughout the United Nations. Data from satellites, aircraft and ground survey are incorporated into the system. WCMC is currently negotiating formal status as the biodiversity node of GEMS.

UNEP Harmonization of Environmental Measurement office (UNEP-HEM) as part of GEMS is involved in a number of catalytic and coordinating activities aimed at improving the compatibility of environmental data on a global coverage. UNEP-HEM has recognised the importance of developing an improved, practical and widely-acceptable global classification scheme for vegetation classification. It has been considering various approaches to this problem in close cooperation with WCMC and also the International Geosphere Biosphere Programme core project Global Change and Terrestrial Ecosystems (IGBP-GCTE).

United Nations Development Programme (UNDP)

UNDP has developed Environmental Management Guidelines, as a means of incorporating principles of environmental management into its work. UNDP funds a wide range of environmental projects including those which encourage sustainable development and the improvement of the 'quality of human life'.

Unesco

Unesco has responsibility for the World Heritage Convention (The Convention concerning the protection of the World Cultural and Natural Heritage). This aims to protect natural and cultural areas of 'outstanding universal value' as World Heritage Sites.

The conservation of tropical forests is an integral part of the Unesco Man and the Biosphere (MAB) Programme. A set of five interlinked types of tropical research activity is undertaken within the framework of the MAB Programme and related Unesco activities:

- biological diversity, traditional ecological knowledge, and integrated conservation in the humid tropics
- ecological and economic sustainability of tropical rain forest management
- forest regeneration and ecosystem rehabilitation in the humid tropics
- tropical soil fertility and its biological management
- savanna ecology and management; responding to stress and disturbance.

The overall objective of this work is to contribute to the development of sustainable land-use systems appropriate for the social, cultural and biological characteristics of the peoples and ecological systems of the humid and sub-humid tropics. Under the MAB Programme, internationally important areas are protected as Biosphere Reserves. These are selected and managed as natural or minimally-disturbed representative examples of the world's ecosystem types. They are also selected to demonstrate the relationship between conservation and development and may include buffer zones with varying levels of human use and exploitation.

It is proposed that biosphere reserves be considered as a key element in the establishment of the FAO network of in situ conservation areas for plant genetic resources and be incorporated in the FAO Global Plan of Action.

The World Conservation Monitoring Centre (WCMC):

WCMC is an independent charity established by IUCN, UNEP and WWF. Its aim is to support conservation and sustainable development by providing comprehensive and up-to-date information. WCMC's information resources relevant to this project include: plant species of conservation concern; important natural habitats and areas of special biological richness; protected areas; data on plant utilisation and trade and plant conservation bibliography.

Information on Central American plant species has been collected through liaison with local botanists by the IUCN-WCMC-Smithsonian Institution Latin American Plants Project in Washington DC. These data have all recently been included in the Plants Database of WCMC.

WCMC also receives information on the conservation status of plant species through the IUCN/ Species Survival Commission (SSC) network of specialist group members, for example experts of the Palm Group and Cactus and Succulent Group. Both these groups are preparing Action Plans which include information and recommendations of relevance to the project.

Information on plant utilisation and trade relates, for example to plants listed under the CITES Convention and also to international trade in timber species. WCMC holds all the records of plant trade recorded in the Annual Reports of CITES member states on behalf of the CITES Secretariat.

Information on the conservation status and trade in tropical timber species has been collected under contract to the International Tropical Timber Organisation (ITTO); European Union and National Governments. Further development of the timber data holdings is planned with financial support expected from the Dutch Government. A particular focus of this work will be timbers of Latin America through regional collaboration and data exchange.

At present, the WCMC Plants database has over 3900 species recorded as tropical timbers or trees, 2560 of which are timbers and 600 recorded as threatened at a global level. A list of trees of Central America produced as an output of the Database is given as a supplement to this paper.

WCMC maintains comprehensive data on protected areas of the world. Information is obtained from official sources (government agencies responsible for administering protected areas) and elsewhere, through a global network of contacts ranging from policy-makers and administrators to land managers and scientists. Supporting information is obtained from published and unpublished literature and other media. A list of the protected areas of Central America is given in Annex X . Management of information on natural World Heritage sites and biosphere reserves is undertaken in collaboration with IUCN and UNESCO. Data sheets on biosphere reserves and World Heritage Sites are given as a supplement to this paper.

Links have been established between the WCMC Plants database and datasheets on protected areas. Presence within protected areas has been recorded for some plants species, for example, on tropical timber species as part of the work for ITTO.

A review of floristic inventories for protected areas in the Tropics was undertaken by WCMC in 1992, based on information held by the Centre. The following are some of the protected areas of Central America for which WCMC held plant inventory data.

COUNTRY	PROTECTED AREA	PLANT INVENTORY
Costa Rica	Guanacaste NP	Comprehensive tree list (215 spp.)
Guatemala	Atitlan NP	Extensive higher plant list (290 spp.)
Honduras	Rio Platano Biosphere Reserve	Preliminary higher plant list (114 spp.)
Mexico	El Cielo Biosphere Reserve	Preliminary higher plant list (167 spp.)
Mexico	Reserva de la Michila	Preliminary higher plant list (209 spp.)
Mexico	Sierra de Manantlan	Comprehensive higher plant list (1958 spp.)
Mexico	Sian Ka'an Biosphere Reserve	Comprehensive higher plant list (850 spp.)
Nicaragua	Volcan Masaya NP	Preliminary higher plant list (228 spp.)
Panama	Darien NP	Extensive tree list (290)
Panama	Isla Maje Reserve	Preliminary higher plant list (219 spp.)

WWF

WWF is the world's largest private international conservation organisation with 28 Affiliate and Associate National Organisations around the world and over 4.7 million regular supporters.

WWF's three primary goals are the preservation of global biodiversity, the conservation of forests, and the conservation of wetlands and coasts. WWF seeks to promote the conservation and sustainable use of annual, perennial, wild and cultivated plants through practical field programmes and policy work. One of its four themes in reaching these plant conservation goals is: germplasm conservation of economically important plants, notably in situ conservation of wild crop relatives, medicinal plants and species useful for land reclamation and agroforestry.

Plants for People Programme: this is a joint programme of UNESCO, WWF and Royal Botanic Gardens Kew. The programme supports ethnobotanists to work with local communities in tropical countries to record and study the use of wild and semi-cultivated plant resources and to promote the sustainable use of such resources.

WWF supported projects:

Ethnoflora of the Chinampa Agricultural System, Mexico (Project 6284): WWF is funding a project to highlight the advantages of this traditional farming system. Based in San Andres Mixquic, the project has already examined the flora and its uses by local people. Plant species of global importance have been documented, including teosinte.

Threatened plant uses in protected areas (Project 6466): US/Mexican border.

Ethnobotany in Oaxaca: Since 1985, WWF has been supporting ethnobotanical work in the state. Research on useful plants has been carried out by Chinantec, Mixtec and Mixe people who are sponsored by the *Sociedad para el Estudio de los Recursos Bioticos de Oaxaca, Asociacion Civil (SERBO A.C.)*, a Mexican NGO that combines participatory studies of ecology and ethnobotany with communal management of forest resources.

Central America: Forest Ecological Development of Large Scale Forestry Concessions. (Project 9647)

Costa Rica: Osa Peninsula Forest Conservation and Management Project (BOSCOSA). (Project CR0025)

Guatemala: People centred ecodevelopment - Sierra de las Minas Reserve. (Project GT0012)

Guatemala: Agroecosystems as Conservation Resource in Neotropics. (Project GT0013)

Guatemala: Participatory forestry planning for Mayan comuniites. (Project 9626)

Honduras: documentation of resources of Rio Platano Biosphere Reserve. (Project HN008)

Honduras: Integrated management of the northern zone of the Rio Platano Reserve. (Project HN0851.01)

Mexico: Conservation and sustainable use of resources in Sian Ka'an Reserve. (Project MX0025)

Mexico: Sierra La Laguna Biosphere Reserve Establishment and Management. (Project MX0030) - work has included evaluating and researching the flora associated with honey bee production; and the pigeon pea *Cajanus cajan* populations. (Project MX0030)

Mexico: Diagnostic study and evaluation of El Ocote Ecological Reserve. (Project MX0032)

Mexico: Community development and natural resource management in the Calakmul Biosphere Reserve. (Project MX0853.1)
Mexico: Planning and managing the Sierra de Manantlan Biosphere Reserve. (Project MX0856)

Mexico: Conservation of tropical rain forests in Chiapas. (Project 3246)

Mexico: Community development and natural resource management in El Ocote, Chiapas. (Project 9513)

Panama: Management and sustainabl;e development of Darien Biospohere Reserve. (Project PA0002)

Panama: Management of La Amistad National Park. (Project PA0004)

National Organisations

INBio:

The National Biodiversity Institute (INBio) is a non-profit and private Costa Rican institution established in 1989. InBio is dedicated to the conservation of wild land biodiversity through facilitating its nondestructive intellectual and economic uses both nationally and internationally. INBio operates under the assumption that a developing tropical society will only conserve a major portion of its wild biodiversity if this area can generate enough intellectual and economic income to pay for its own upkeep and also make a contribution to the national economy.

The INBio Association is governed by an Assembly of Founders and a Board of Directors. INBio works closely with many other public and private institutions, both in Costa Rica and overseas.

The divisions of INBio are:

- The Division of National Biodiversity Inventory
This Division is undertaking a comprehensive inventory of all taxa through broad participation. The basic field work is conducted by "parataxonomists" working out of local Biodiversity Offices. They are guided by INBio curators who work with a network of national and international curators and taxonomic specialists. Identified reference collections, field guides and electronic identification services such as expert systems are being developed. All information on the species, geographic distributions, and natural history are in the public domain and will be freely networked internationally.

The Division of Biodiversity Prospecting

Biodiversity prospecting is focused on the search for interesting chemicals produced by plants, insects and micro-organisms, that may be of use to the pharmaceutical and medical industry. Expansion is anticipated in areas such as pesticides and other industrial chemicals, and in the search for potentially valuable genes.

The biodiversity prospecting and research process is carried out both in Costa Rican institutions, and in collaboration with foreign institutions of higher education and companies.

The recent contract between INBio and Merck, Inc., is an example of collaboration with the commercial sector. Research samples collected in government-owned conserved wild lands are managed under a specific agreement with the Ministry of Natural Resources, Energy and Mines (MIRENEM). These samples are passed to the commercial user under contract, who in turn pays INBio's costs - and therefore, indirectly the conserved wild lands' costs. Ten percent of all fees paid by the commercial user are paid directly into MIRENEM's budget. Half of any royalties will go directly to MIRENEM; the other half will be used to maintain the INBio process.

The Division of Biodiversity Information Management

INBio's biodiversity information (specimen data, literature and field data) is growing rapidly, and when coupled with relevant supporting information such as topographic maps, soil maps, climate data, land use, and much more, the data package is extremely complex. Data management, including the development of GIS, is being undertaken in collaboration with Intergraph Corporation of Huntsville, Alabama, USA, and various other agencies. New technologies, including artificial intelligence and field data collection devices such as GeoPositioning Systems are being researched.

The Division of Biodiversity Information Distribution

Through this Division, INBio distributes biodiversity information widely throughout society. Activiites include making available natural history and taxonomic information to schools and universities, commenting on commercial development of conserved wild lands, working with legislators, being a member of policy-making commissions and symposia, training staff of conservation areas, producing hard copy field guides and other kinds of biodiversity literature and holding national and international planning meetings.

The Nature Conservancy

Established in 1951, The Nature Conservancy is an international, non-profit environmental organisation, sited in the USA, which is committed to the protection of natural diversity. The Nature Conservancy works with local conservation organisations throughout Latin America, helping to build their conservation capacity. A current cooperative campaign involving more than 30 conservation organisations, is 'Parks in Peril'. This aims to improve management of 200 key protected sites in Latin America and the Caribbean by the end of the century.

The Nature Conservancy is involved in the establishment and operation of a network of Conservation Data Centres (CDCs), through the provision of technical, scientific and administrative support and training. The Conservancy also makes available the computer technology, data inventory and management methodology and procedure manuals on which the CDC network is based.

Conservation Data Centres

The CDCs in Central America are:

CDC-Guatemala: Universidad de San Carlos
CDC-Panama: ANCON
CDC-Costa Rica: Programa de Patrimonio Natural (Fundacion Neotropica).
Centro de datos para la conservacion de la naturaleza en Sonora, Mexico.

World Resources Institute (WRI)

WRI, sited in Washington DC, is an independent research and policy institute founded in 1982 to help governments, environmental and development organisation and the private sector, address sustainable resource use and development issues. The work of WRI focuses on six broad areas: climate, energy and pollution; forests and biodiversity; economics; technology; resource and environmental information; and institutions.

RBG Kew

The mission of the Royal Botanic Gardens, Kew is to ensure better management of the Earth's environment by increasing knowledge and understanding of the plant kingdom. Kew is involved in major biodiversity research programmes in many parts of the world and has collaborative links with botanical institutions worldwide. In the Central American region, for example, Kew has strong links with InBio in Costa Rica and UNAM.

The focus for collaboration in this project will Kew's interdepartmental Drylands Group. Included within this are the Seed Bank and SEPASAL project. The Seed Bank stores and assesses the conditions of storage for wild species with a focus on arid and semi-arid land plants. The staff have extensive collecting experience and knowledge of policy issues relating to genetic resource conservation.

The Plants for Arid and Semi-arid Lands (SEPASAL) project, within Kew's Centre for Economic Botany, brings together diverse traditional and academic knowledge on useful plants of drylands. The database is used to provide development organisations and individual research workers with information on useful plants and to target species for germplasm collection and storage. At present the database contains information on approximately 6000 dryland species, excluding major crop species. About 2000 of these are Central American plants, with a particular focus on Mexican species.

Data currently held in the SEPASAL database include: scientific name (including synonyms); geographical distribution (to country or state level); life form and life cycle; habit; uses (linked to plant part used) and site and climate tolerances. An extensive upgrade of the database has recently begun. The number of species covered is being increased, and additional information on the species and use groups of particular interest is being added. The upgraded database will run on desk-top computers.

Alongside the SEPASAL database, Kew maintains an Economic Botany Bibliographic Database which currently contains citations to more than 150,000 references dealing with plants of economic value.

Natural History Museum

The Natural History Museum is the main focus for Central American botany within the UK. Flora Mesoamericana is a collaborative project organised by the Museum, UNAM and Missouri Botanical Garden. The Flora will be a concise guide to the identity and distribution of the approximately 18,000 species of flowering plants and ferns in tropical Middle America, from the Isthmus of Tehuantepec in southern Mexico to the Panama/Colombia border.

Other work being carried by Museum staff in relation to Central America include close collaboration with INBio and work on forest management in Belize. Scientists from the Museum have worked with Cost Rican biologists at InBio since its inception. They have made a considerable training input to the parataxonomists and curatorial staff. External funding has been secured for young Costa Rican biologists to work in the Natural History Museum to gain experience in collections management and familiarity with a wide range of biodiversity.

The Oxford Forestry Institute (OFI):

OFI is a world centre for forest research, development and education. The Institute's Forest Genetics Group, has established over three decades of activity, expertise in most key issues of forest genetic resources, in collaboration with many national agencies and institutions. The Group's programme areas are:

i. exploration, acquisition and systematics
ii. population genetics and reproductive biology
iii. distribution and evaluation
iv. quantitative genetics and breeding strategy

Central America has been one of the two main geographical focuses for the work of the Forest Genetics Group. Since 1963, OFI has made collections in the entire Central American region for provenance and progeny trials, especially of pines. Since 1980 it has also made collections of tropical broadleaf trees from arid and semi-arid zones of Central America.

Recent and current research projects relating to Central America include:

Intensive study of Leucaena genetic resources in Central America and Mexico. ODA-funded project R4524 from 1.1.90 to 31.12.94.

Intensified transfer of forest genetic technology and information in C. America. (CATIE Tree Improvement project) ODA-funded project from 1.11.92 to 31.10.95.

Exploration and collection of Calliandra calothyrsus. ODA-funded project R4485 from 1.10.90 to 30.9.93. - This project involved field collecting in Mexico and elsewhere in Central America.

Evaluation of geentic variation in Gliricidia sepium. ODA-funded project R4525 from 1.11.89 to 31.9.92.

Other work includes collaboration with staff of the ODA-funded COSEFORH (Conservación y Mejoramiento de Recursos Forestales de Honduras) project in Honduras on biodiversity of the coniferous forests of Central America.

BRAHMS (Botanical Research and Herbarium Management System) is an information system which has evolved in association with the forest genetics programme. The system stores and monitors species information and botanical data derived from herbarium specimens. It has a broad range of routine and research oriented management functions, such as preparing species checklists and distribution maps. Applications of BRAHMS (which runs on FoxPro software) include the compilation of species checklists for the states of Oaxaca and Nayarit, Mexico undertaken by the main herbarium in Mexico (MEXU). Also under this project BRAHMS is used to study areas of special interest in the Tehuantepec region and the Tehuacan Valley. In Honduras, a project to establish a national data collection network at five sites was initiated in 1992, using the BRAHMS system. This links in with an existing project at the Paul C. Standley herbarium at El Zamorano.

Universidad Autónoma Nacional de México (UNAM)

UNAM is a leading centre of excellence for botanical and ethnobotanical research and plant conservation activities.
A wide range of field projects are undertaken with, for example, botanical research being undertaken in the Lacandon Region, and studies of the biogeography, distribution and conservation status of the cacti of the Chihuahuan Desert.

US Department of Agriculture (USDA):

USDA is actively involved in the assessment of plant genetic resources and biodiveristy. The USDA Economic Botany Laboratory in Beltsville, Maryland, maintains a database on minor economic plant species.

New York Botanical Garden

(Michael Balick, Director of Economic Botany) has a collaborative project with the Belize Ministry of Health, the Departments of Archaeology and Forestry and the Belize Centre for Environmental Studies. The Belize Ethnobotany Project involves screening of medicinal plants for active ingredients based on ethnobotanical uses and traditional knowledge.

Desert Botanical Garden, Phoenix, Arizona.
FLORUTIL Project - surveying the rare and useful plants of the border states of US and Mexico.

Annex 2

Economically and socially important plants of Central America

Fruit crops

Anacardium excelsum (marañón)

Annona muricata (soursop) REMERFI priority

A. purpurea (soncoya)

A. scleroderma (posh-te)

Ananas comosus (pineapple) REMERFI priority

Bactris gasipaes (peach palm) REMERFI priority (IPGRI neglected crop project)

Byrsonima crassifolia (nance)

Carica papaya (papaya): originated in lowlands of eastern central America but is no longer known in the wild. REMERFI priority

Casimiroa edulis (white sapote, zapote blanco)

Coccoloba uvifera (sea-grape)

Diospyros digyna (black sapote)

Hylocereus ocamponis (pitaya) REMERFI priority

Inga edulis (ingá-cipó)

Leucaena leucocephala (leucaena, guaje)

Malpighia emarginata (Barbados cherry, acerola)

Muntingia calabura (Jamaica cherry)

Myrciaria floribunda (Rumberry)

Passiflora edulis REMERFI priority (IPGRI neglected crop project)

Passiflora ligularis (sweet granadilla)

P. quadrangularis (giant granadilla)

Persea americana (avacado): Primitive wild relatives are restricted to small areas in Central America. *Persea americana* continues to exist as a wild plant in small areas of Central America, occurring for example in the Monteverde Cloud Forest Reserve, Corcovado National Park and La Selva Biological Reserve of Costa Rica. REMERFI priority

Pouteria campechiana (yellow sapote, zapote amarillo)

Pouteria sapota (zapote mamey)
- The Sapotaceae in general are a REMERFI priority

Prunus salicifolia (capulín)

Rollinia mucosa (biribá)

Psidium guajaba (guava) REMERFI priority

Spondias purpurea (Jamaica plum) REMERFI priority

Spices and stimulants

Bixa orellana (annatto) REMERFI priority

Capsicum annuum (chili pepper): wild peppers are still collected and sold locally.

Eryngium foetidum (culantro) REMERFI priority

Fernaldia pandurata (loroco) REMERFI priority

Pimenta dioica (pimento, allspice): pimento is derived from the dried unripe fruits of *Pimenta dioica* a small evergreen tree of Central America and the Caribbean. Jamaica is the main country of commercial production and allspice is also collected from the wild in Central America. Currently Guatemala (and Mexico) supply almost 30% of the international market.REMERFI priority

Theobroma cacao (cocoa): Centre of cultivation is Central America. REMERFI priority

Theobroma angustifolium (cacao silvestre)

Vanilla planifolia (vanilla): is the most important spice of the New World. Native to Central America, this climbing orchid was used in pre-Colombian times by the Aztecs as a flavouring for chocolate. It was first introduced to Europe in around 1510. Now countries which grow vanilla include Madagascar, the Seychelles, Reunion and the Comoros Islands. REMERFI priority

Vegetables

Arracacia xanthorrhiza Peruvian carrot REMERFI priority

Capsicum spp. (capsicum peppers) REMERFI priority

Chamaedorea tepejilote (pacaya) REMERFI priority

Chenopodium berlanderi (huanzontle) REMERFI priority

Cnidoscolus chayamansa (chaya) REMERFI priority
(see also *Cnidoscolus* spp. under miscellaneous below)

Crotalaria spp. (chipilin) REMERFI priority

Cucurbitaceae (cucurbits) REMERFI priority

Lycopersicon esculentum (tomato): land races. All wild relatives (spp. in South America) have limited ranges. REMERFI priority

Opuntia spp. (nopal) REMERFI priority

Physalis philadelphica (Mexican husk tomato) REMERFI priority (IPGRI neglected crop project ?)

Sechium edule (chayote) REMERFI priority (IPGRI neglected crop project)

Solanum americanum (yerba mora) REMERFI priority

Solanum spp.: One of the main centres of diversity of wild species of potato is in central Mexico.

Roots and tubers

Dioscorea spp. (yam): REMERFI priority

Ipomoea batatas (sweet potato): REMERFI priority

Manihot spp.: Southwestern Mexico is one of the main centres of diversity for wild spp. with 16 spp (FAO, 1984). *Manihot esculenta* is a cultigen unknown in the wild.

Xanthosoma sagittifolium (tiquisque) REMERFI priority

Xanthosoma sp. (malanga) REMERFI priority

Beans and other legumes

Pachyrhizus erosus (Mexican yam bean): native to SW Mexico. See NAS (1979) - and also for other legumes of the region. REMERFI priority

Phaseolus lunatus (lima bean): populations of several taxa are being lost to overgrazing in northern Mexico.

Phaseolus vulgaris (haricot bean): some wild relatives in Mexico are in need of conservation attention.

Cereals

Zea mays, Zea perennis, Zea diploperennis (maize):
The two wild subsp. of maize, *Zea mays* var. *mexicana* and *Zea mays* var. *parviglumis* are vulnerable. The three other *Zea* spp. should probably be considered endangered, two having highly restircted distributions in Jalisco, Mexico and the third in southeastern Guatemala and northern Honduras the closest to extinction because of grazing pressures (FAO, 1984).

Zea diploperennis is protected in the Sierra de Manantlan Biosphere Reserve (Mexico.).

Tripsacum spp. (relative of maize):
Several species with limited ranges in Mexico may be at risk (FAO, 1984).

Timbers

There are many economically important timber species in the region. Two examples which have been heavily exploited and are now listed on CITES Appendix II are:

Swietenia mahagoni, a species of true mahogany generally known as American mahogany, Cuban mahogany, or Honduran mahogany is native to Central America and the Caribbean. It has been important in international commerce since the sixteenth century. Stocks are now severely depleted and the species provides an extreme example of genetic erosion.

Lignum vitae or guayaco *Guaiacum officinale*, a species of dryer tropical forest areas of Central America and the Caribbean.

Other timber species, many of which are threatened in all or part of their range, are listed below. A more comprehensive list of the threatened tree species of Central America is given as a supplementary document.

Abies guatemalensis (Guatemalan fir)
Alfaroa manningii (Gavilán colorado)
Alnus jorullensis (Jaul)
Aspidosperma megalocarpum (Chichique)

Astronium graveolens (Goncalo alves)
Batocarpus costaricensis (Ojoche macho)
Bombacopsis quinata (Pochote)
Brysonima crassifolia (Nance)
Calophyllum brasiliense (Santa María, jacareuba)
Campnosperma panamensis (Sajo, orey)
Carapa guianensis (Crabwood, andiroba)
Caryocar costaricense (Ajo, ají)
Castilla elastica (Balata)
Cedrela odorata (cigarbox cedar)
Ceiba pentandra (Ceiba)
Cordia alliodora (Pardillo)
Cupressus lusitanica (Mexican cypress)
Cynometra hemitomophylla (Guapinol negro)
Dalbergia retusa (Coccoloba)
Dalbergia stevensonii (Honduras rosewood)
Dialium guianense (Jutahy)
Didymopanax morototonii (Jeretón)
Enterolobium cyclocarpum (Guanacaste)
Guaiacum sanctum (Lignum vitae, guayacán blanco)
Guarea grandifolia (Muskwood)
Guazuma ulmifolia (Guácimo)
Hymenaea courbaril (Courbaril, guapinal)
Juglans olanchana (Nogal)
Mora oleifera (Nato)
Myroxylon balsamum (Bálsamo)
Oreomunnea pterocarpa (Palo colorado)
Pinus ayacahuite (Mexican white pine)
P. caribaea
var. *hondurensis* (Caribbean pine)
P. chiapensis (Pinabete)
P. oocarpa (Pino colorado)
P. pseudostrobus (Pino blanco, ocote)
Pithecellobium dulce (Manila tamarind)
Platymiscium pleiostachyum (Cristóbal)
Podocarpus guatemalensis (Podo)
Quercus copeyensis (Roble, Copey oak)
Spondias mombin (Hog plum, ciruela)
Swietenia humilis (Pacific Coast mahogany)
S. macrophylla (Bigleaf mahogany, caoba)
Tabebuia guayacan (Cortéz)
Tachigali versicolor (Caña fístula)
Terminalia amazonia (Almendra)
Vantanea barbourii (Caracolillo)

Medicinal plants

Annona glabra (Anona)
Aristolochia odoratissima (Amargosa, bejuco mágico)
Casimiroa edulis (Chapote)
Cecropia peltata (Guarumo)
Chrysobalanus icaco (Icaco, coco plum)
Curatella americana (Sandpaper tree)
Jatropha curcas (Physic nut, piñoncillo)
Myroxylon balsamum
var. *pereirae* (Peruvian balsam)
Piper tuberculatum (Buttonwood)
Rauvolfia tetraphylla (Devil pepper)
Strychnos panamensis (Guaco, snale seed)
Talauma mexicana (Flor del corazón)

Until quite recently 95% of all steroids were obtained from extracts of neo-tropical yams of the genus *Dioscorea*. Diosgenin derived from the Mexican yam, a rainforest species, has been the basic material for the production of many steroidal drugs including the birth control pill. Price increases imposed by the Mexican Government stimulated synthetic production of diosgenin by pharmaceutical companies and have also led to the search for new natural sources.

Ornamental plants

Ornamental plants of economic value in Central America include orchids, bromeliads, foliage plants, cacti, agaves and other succulents. Many of these are covered by the CITES Convention.
The main exporting countries for the genus *Tillandsia* are Guatemala and Honduras. Data from World Wildlife Fund-Germany indicates that from January 1988 to March 1988, c. 6 million plants were exported from Guatemala, primarily to Germany and the Netherlands. Plants exported include both wild-collected specimens and plants produced in the local horticultural industry.

Chamaedoreas and their products are used extensively in the floricultural and horticultural industries. Cut leaves of several species are a staple item in the florist trade of the USA; many leaves also are imported by Europe. Most of the leaves appear to originate in Mexico, but some come from Guatemala, Honduras and Costa Rica. In 1986, an estimated 359,219,000 leaves were imported by the USA (314,419,000 from Mexico; 40,179,000 from Guatemala; 4,145,000 from Costa Rica) (Hodel 1992).

Cycads are traded internationally for specialist horticultural collections. Although many of the species (Zamiaceae) are exported by Mexico, countries such as Guatemala, Nicaragua, Costa Rica and Panama are also trading in their various native species. Many of the Central American species are commercially exploited due to the proximity of the U.S. horticultural market.

Other Species

Agave spp.: sisal, tequila etc. REMERFI priority. An Action Plan for the conservation of *Agave* spp. has been prepared by members of the SSC Cactus and Succulent Specialist Group.

Amaranthus spp. (amaranth) REMERFI priority (IPGRI neglected crop project)

Avicennia germinans (Black mangrove)

Brosimum alicastrum (Ramón)

Bursera simaruba (Palo mulato)

Carludovica costaricensis (Cuajiote)

Carnegiea gigantea (saguaro): Many local uses as described in: *Desert Plants* 2(1) Spring 1980.

Chamaedorea spp. (Parlor palms)

Cnidoscolus elasticus; Cnidoscolus tepiquensis (chilte): overtapping and habitat destruction have destroyed many Mexican populations (FAO, 1984).

Cyperus canus (Tule)

Euphorbia antisyphilitica (Candellila) - significant source of income to rural communities. Many populations lost (FAO, 1984).

Genipa americana (Jenipapo)

Geonoma hoffmanniana

Laguncularia racemosa (White mangrove)

Luchea candida (Algodoncillo)

Manilkara zapota (chicle)
Chicle, the latex of the Central American sapodilla tree *Manilkara zapota*, is included in most good quality chewing gums. Long appreciated by Mayan people chicle was first sweetened and processed for commercial use in the late nineteenth century. Today "chicleros" still tap wild trees but the the trees are no longer so abundant in the wild. In Mexico and Guatemala many sapodilla trees are dying prematurely because younger trees are being tapped and the recovery period between tapping has been reduced. (IPGRI neglected crop project)

Neonicholsonia watsonii

Protium copal (Copal)

Reinhardtiana koschnyana (Window palm)

Rhizophora mangle (Red mangrove)

Schippia concolor (Pimento palm)

Styrax argenteus (Resino)

Trema micrantha (Capulín, white bay-cedar)

CENTRES OF PLANT DIVERSITY

The IUCN Plant Conservation Programme has undertaken a project with collaboration from botanists around the world to identify the several hundred major Centres of Plant Diversity (CPD). These are defined as places particularly rich in plant life which would, if protected, safeguard the majority of wild plants in the world. A three volume publication is being prepared jointly with WWF. The information collected during the CPD project will reside at WCMC and the maps are stored in the Biodiversity Map Library.

Central American centres of plant diversity selected for the publication are listed below with brief notes on their useful plants. Selection of sites and preparation of the data sheets has been undertaken primarily by botanists within the region.

MEXICO

1. Lacandon Rain Forest Region.

This region occurs in eastern Chiapas between, between the Usumacinta River and the Perlas and Lacantún rivers. It covers an area of about 6,000 km² of which reserves account for 4,122 km².
The vegetation consists of: tropical and montane rain forests, cloud forest, semideciduous tropical forest, savanna, pine-oak forest, seasonally flooded forest, gallery forest, open wetlands.
There flora shows high species diversity, with about 4,000 species of vascular plants and some endemics.

Useful plants

The Lacandon forest contains important reserves of timber, such as *Calophyllum brasiliense* var. *rekoi*, *Cedrela odorata*, *Cordia* spp., *Dialium guianense*, *Lonchocarpus castilloi*, *Swietenia macrophylla*, *Tabebuia guayacan*. Other species of economic importance include *Manilkara zapota*; *Castilla elastica* var. *elastica*, latex used as a source of rubber; *Cymbopetalum penduliflorum* — the flowers are used among the Maya Amerindians for flavouring and medicine; *Pimenta dioica* (allspice), *Poulsenia armata*, *Pouteria mammosum* and many other trees with edible fruits. *Brosimum alicastrum* has promising economic potential; the fruits, seeds, leaves, wood, latex and bark all being used.

Several species of palms (e.g. *Geonoma oxycarpa*, *Scheelea liebmannii*) are used by the local inhabitants for roofing. Additionally, seeds, seedlings and leaves of some small palms called xate (e.g. *Chamaedorea tepejilote*, *C. oblongata*, *C. elegans*) are collected for horticulture and exported to the USA.

2. Uxpanapa-Chimalapa Region.

An area of evergreen, semi-evergreen and montane rain forest, covering about 7,700 km²in Southeastern Veracruz and eastern Oaxaca. There are no areas set aside for conservation. The flora has high species endemism.

Useful plants

The region contains important timber resources, including high quality tropical woods as *Cedrela odorata* (tropical red-cedar), *Calophyllum brasiliense* var. *rekoi* (Santa María) and *Swietenia macrophylla* and endemics such as *Sterculia* new sp., much used locally in the manufacture of fine plywood. A large native population of the important fruit tree *Pouteria sapota* (the zapote mamey) is present; there are few such populations elsewhere. Several non-timber montane species are important in the local economy, especially palmita (*Chamaedorea* sp.).

3. Sierra de Juárez, Oaxaca.

An area of mainly montane cloud forest covering about 1,700 km² in northeastern Oaxaca state, Southern Mexico. The flora consists of around 2000 spp. with many endemics. There are currently no protected areas.

Useful plants

In the Sierra Norte of Oaxaca, which includes the Sierra de Juárez, several indigenous peoples (Chinantec, Mixe and Mixtec) have extensive knowledge and uses of the flora, which have been receiving thorough study (Martin and de Avila-B. 1990; Martin 1992). In the 1970s there were large-scale collections of *Dioscorea* tubers, used in the synthesis of birth-control pills. The Sierra de Juárez contains rich timber resources such as *Abies*, *Pinus*, *Liquidambar*, *Quercus*. Among the region's various ornamental species are tree ferns, cycads, pipers, aroids, bromeliads and orchids.

4. Tehuacán-Cuicatlán Region.

This area of about 9000 km² southeast of Mexico City in southeastern Puebla and northern Oaxaca states, has around 2700 plant spp. with about 30% endemic. The vegetation consists of
several dryland scrub formations with many xerophytic species and some deciduous forest. The only conservation area is a Botanical garden (1 km²).

Useful plants

Many native species are used traditionally for example as medicinals, food (e.g. cactus fruits), fibres, fuelwood, living fences, and ceremonially; some are sold in local markets. Various succulent species and bromeliads are of considerable horticultural value, for example, cacti, *Nolina*, *Beaucarnea*, *Dasylirion*, *Agave*, *Hechtia*, *Tillandsia*.

5. Canyon of the Zopilote Region.

An area of mixed scrub and forest vegetation, covering 4,383 km² south of Mexico City in central Guerrero state. There are over plant 2,000 species, with high diversity and endemic genera and species. Part of the area is protected in the Omitelmi Ecological State Park and three other areas for reserves have been suggested.

Useful plants

The region is very rich in timber resources. For general purposes including fuelwood, the following species are used *Pinus ayacahuite*, *P. devoniana* (*P. michoacana*), *P. chiapensis*, *P. herrerae*, *Quercus uxoris*, *Q. laurina*, *Abies religiosa*, *A. guatemalensis*; for construction, the palm *Brahea dulcis*, *Cordia elaeagnoides*, *Pithecellobium dulce*; and for artisanry and carvings, the latter two hardwoods and *Actinocheita potentillifolia*.

Some species are used in local ceremonies, such as *Bursera copallifera* (copal) and *Solandra* spp. (copa de oro). Among medicinals are *Ternstroemia pringlei* (té de tila), *Juniperus flaccida*, *Magnolia schiedeana* and *Chiranthodendron pentadactylon* (flor de la manita), which is now cultivated in Europe and USA.

6. Sierra de Manantlán Region and Biosphere Reserve.

Situated in southwestern Jalisco and northeastern Colima, with an area of 1396 km². The vegetation consists of various forest types including tropical dry forest (which may be the most diverse in woody species in the world) tropical subdeciduous forest, mesophyllous montane forest. There are about 2,800 vascular plant species. Endemics reported only from the Sierra de Manantlán include *Zea diploperennis*, *Agrostis novogaliciana*, *Populus guzmanantlensis*, *Croton wilburii*, *Cnidoscolus autlanensis*, *Vernonia pugana*.

Useful plants

Wild taxa's germplasm for important crop and tree species (*Zea*, *Phaseolus*, *Pinus*, *Abies*); over 500 species used traditionally.

Some species threatened due to selective exploitation are *Cedrela odorata*, *Swietenia humilis*, *Fraxinus uhdei*, *Juglans major*, *Tilia mexicana*, *Abies religiosa*, *Guaiacum coulteri*, *Talauma* sp., *Magnolia iltisiana*.

7. Pacific Lowlands, Jalisco: Chamela Biological Station and Cumbres de Cuixmala Reserve.

A region of c. 350 km² in coastal Jalisco southwest of Guadalajara. An area of 8.6 km² is conserved. The vegetation is mainly tropical deciduous forest. The flora shows high diversity especially of woody plants; 1,120 vascular plant species in 544 genera of 124 families known from region; about 16% of the species are regionally endemic.

Useful plants

The region only has been easily accessible to settlement since a coast highway opened in 1972, there is no local tradition of useful plants. Many residents are from upland Jalisco or neighboring states (mostly Colima and Michoacán), and have brought common names and uses from their home areas for application to these sometimes different species. Examples include *Plumeria rubra* leaves used to relieve earache, *Spondias purpurea* fruits used in a drink, *Stenocereus chrysocarpus* fruits eaten as a delicacy, and *Hura polyandra* used for timber *Hintonia latiflora* and *Physodium adenodes* var. *adenodes* have ornamental potential.

Various timber species occur and their woods are locally marketed: *Cordia alliodora*, *C. dentata*, *C. elaeagnoides*, *C. seleriana*; *Dalbergia congestiflora*; *Guaiacum coulteri*; *Platymiscium lasiocarpum*; *Swietenia humilis*. Already *Celaenodendron mexicanum* is a locally choice timber tree for roof beams and building posts.

8. Upper Mezquital River Region, Sierra Madre Occidental.

Western Sierra Madre mountains in the south of Durango state, covering c. 4,600 km². The vegetation consists principally of conifer, pine-oak and oak forests, tropical dry forests, and patches of tropical subdeciduous forest. La Michilia Biosphere Reserve (700 km², 70 km² as core). live in the temperate forest area.

Useful plants

Out of c. 2,900 species of vascular plants, more than 450 wild species used for medicinal, food and other purposes by local people including Tepehuan Amerindians. Many timber species are extracted. Among the species with economic value, are *Pinus durangensis*, *P. cooperi*, *P. teocote* and *P. ayacahuite*. *Quercus* spp. have economic value for charcoal, and lumber potential. Wild crop relatives include *Phaseolus* and *Solanum* spp.

A few species, such as *Laelia speciosa*, are collected to sell in nearby cities as ornamentals, whereas others such as *Senecio sessilifolius* (peyotillo) and *S. albo-lutescens* (matarique) are sold for medicinal purposes in local markets (*cf.* M. González 1984).

The ethnobotany of the region's mestizos and Tepehuanes has been studied by M. González and R. Galván (1984, 1991, 1992), and additional works on the useful plants and agro-ecological practices are in preparation.

9. Gómez Farías Region and El Cielo Biosphere Reserve.

An area of around 2,400 km² in southwestern Tamaulipas state.
Vegetation consists of tropical dry forest; tropical semideciduous forest; cloud forest; oak, pine, and mixed oak and pine forests; desert scrubs or brushlands; riparian vegetation. There are over 1,000 vascular plant species. 60% of region is in El Cielo Biosphere Reserve (1,445 km²).

Useful plants

From a report on useful plants of Tamaulipas (Hernández *et al.* 1991), the many following species and uses were derived for the Gómez Farías region: 167 medicinals, 98 edible, 11 fodder, 5 energy sources, 84 timbers, 16 industrial usage, 69 ornamentals. Several native species are grown in family gardens to provide spices or medicinals. In the past, cloud forest and oak and pine forests were exploited for their timber; these forests harbor at least fourteen oak and four pine species.

In the tropical forests are several species with commercial value, such as *Bursera simaruba* (gumbo limbo) — wood, resin, incense; *Enterolobium cyclocarpum* (guanacaste) — timber, fodder; *Cedrela odorata* (cedro) — cabinet wood; *Tabebuia pentaphylla* (cinco hojas) — timber; *Brosimum alicastrum* (ojite or ramón) — wood, food (edible seeds, potable latex); *Lysiloma divaricata* (rajador) — timber.

The desert scrublands have various species of local importance, such as *Helietta parvifolia* — timber; *Acacia berlandieri, Gochnatia hypoleuca, Opuntia* spp. — fodder; *Dasylirion* spp. — edible, alcohol fermentation, ornamental; *Brahea berlandieri* — house building; *Agave* spp. (e.g. *A. lechuguilla*), *Yucca carnerosana* — fiber; *Quercus* spp., *Rhus microphylla, R. virens, Krameria ramosissima* — tannin; and *Turnera diffusa, Chrysactinia mexicana, Hesperozygis marifolia, Jatropha dioica, Larrea tridentata* — medicinal (Chimal *et al.* 1989).

Leaves of the small *Chamaedorea* palm (e.g. *C. radicalis*, palmilla) are collected and exported to the USA for floral arrangements. On a much smaller scale, *Magnolia schiedeana* flowers and *Ternstroemia sylvatica* (trompillo) fruits are occasionally collected.

10. Cuatro Ciénagas Region.

An intermontane basin area of c. 2,000 km² in central Coahuila, northern Mexico. Vegetation consists of grasslands with aquatic, semiaquatic and gypsum-dune habitats in valley; desert scrub and chaparral on mountain slopes, with oak-pine woodlands and montane forests of pine, fir and Douglas-fir. The area has a flora of 860 species in 458 genera of 114 families, 23 species are endemic.

Useful plants

Many plants of this flora are part of traditional medicine used in the rural communities. The extraction of wood from the Sierra de la Madera is the most extensive exploitation and threatens the population of *Abies durangensis* var. *coahuilensis*.

11. Apachian/Madrean Region of Southwestern North America, including Northwest Mexico

Phytogeographic province is the Sierra Madre Occidental, where the Apachian and Madrean floristic districts interdigitate. Situated largely in northwest Mexico, as far south

as the Sinaloa border with Sonora and Chihuahua, and northward along the continental divide (Sonora-Chihuahua border region) to southwestern New Mexico and southeastern Arizona of the United States. The region is approximately 300 km from east to west, centered on the divide, and 600 km long, from the Chiricahua and Animas mountains in the United States, to the Río Mayo, Río Fuerte, and Río Verde drainages in Sonora and Chihuahua, Mexico.

The vegetation consists of Madrean montane coniferous forests; oak-coniferous woodland; tropical deciduous forest; barrancan oak woodland; oak savanna; Madrean chaparral; short-grass prairie; subtropical thornscrub; and desert fringe.

There are an estimated 3,500-4,000 species of vascular plants. Chiricahua Mountains support 1200 species, and the Animas Mountain 450 species. The flora of the upper Río Mayo region in southeastern Sonora and southwestern Chihuahua includes about 2100 vascular plant species; the flora of the Río Bavispe region in northeastern Sonora contains at least 1200 species. High species endemism (on the order of 20-50 percent), and a large number of species at their northern limits. Many at their eastern or western limits on the "Deming Bridge."

Most of the region in the United States has some form of protection; National Monument and Forest Service protection of the Chiricahua Mountains, private foundation protection of the Animas Mountains, Forest Service protection for other montane habitats. Less than 10 percent of the area in Mexico is currently protected; small areas in national parks and some mountains under the jurisdiction of the Subsecretary of Ecology (SEDESOL). Several mountain and other regions protected by private owners. Additionally several significant areas designated for protection by the state of Sonora.

Threats to the area include a World Bank project, planned $90 million logging; another $400-600 million of pulping and lumber development already funded or anticipated as a result of the U.S./Mexico free trade zone agreement.

Useful plants

An estimated 60-80 wild congeners of major crops, about 10 percent at risk; the highest diversity of crop land races of 18 pre-Columbian cultivated species anywhere north of the tropics; and 600-1000 wild useful plants. One globally-endangered domesticate, Panicum sonorum, and several endangered medicinal plants.

The ethnobotany of the Tarahumara, Guarihio, Mountain Pima, and Sonoran mestizos has been studied by Bye (1976), Gentry (1942, 1963), Laferriere (1991), Pennington (1963), and others. An estimated 300 food plants and 450 medicinal plants from this region have been ethnographically documented. These include large ethnofloral representations of the Agavaceae, Cactaceae, Fabaceae, and Solanaceae.

It has been estimated that among the regional floras in arid and semi-arid southwestern North America 18 percent of the species have been utilized by people for food and 20 percent for medicinal purposes (Baker & Felger in prep.; Felger & Nabhan 1978). About 10 percent of the edible species, or 1.8 percent of the flora, served as major food

resources (Felger 1979). These estimates, based on compilation of known data, are verified by individual ethnobotanical studies (e.g., Bye 1976, 1985; Felger & Moser 1985; Gentry 1942, 1963; Laferriere 1991; Rea in prep.). For example, the Tarahumara utilized at least 220 species of plants for food. Their pharmacopoeia includes about 300 plant species (Bye 1985) of which 47 are collected and sold in the urban markets of northern Mexico (Bye 1986).

As noted above, the region is the richest in wild congeners of domesticated crops of any area north of the Tropic of Cancer. The genera of Agave, Cucurbita, Phaseolus, Prunus, and Solanum are well-represented in the region, and 60-100 such species are found exclusively in the region, about 10 percent of them at risk. At Nabogame, Chihuahua, the northernmost population of teosinte is disjunct several hundred km from the tropical range of these wild and weedy corn relatives, where they infrequently introgress with cultivated maize (Doebley & Nabhan 1989). Native Seed/SEARCH has distributed the seed of the Nabogame teosinte to make it available for plant breeders. In fact, the mosaic of wild montane vegetation and Indian fields has provided ideal settings for studying introgression between wild and domesticated Capsicum, Cucurbita, Phaseolus, and Zea.

Nabhan (1990a) identified the geographic patterns of eighteen wild Phaseolus species in the Sierra Madre Occidental. There are several of these bean species endemic to the Sierras, and yet the region remains undercollected with regard to germplasm resources. Preliminary results from pollination, DNA and isozyme studies by Robert Bye suggest reciprocal gene flow between wild Phaseolus coccineus ssp. formosus and the special domesticate "tekómari," the P. coccineus ssp. coccineus of the Tarahumara. The maintenance of gene flow between the wild and the cultivated forms by Tarahumara agroecological practices (which include the management of nearby forest) may account for the evolution of this productive scarlet runner bean that is adapted to high mountain areas with short growing seasons.

Land race diversity of native crops is also richer here than in any other American region north of the tropics, but this crop variation is rapidly being eroded. Eighteen crop species, including endemic domesticates of Agave, Lepidium, Hyptis, and Panicum, are regionally represented in native fields. Wild relatives of domesticated crop plants in the Apachian-Madrean Region comprise a large list (Nabhan 1991; Nabhan & Felger 1985).

12. Central Region of Baja California.

Southern Baja California Norte and northeastern Baja California Sur statesc, an area of 36,000 km² The vegetation consists mainly of xerophilous scrubland or brush. About 40% of the region, 15,000 km², falls within the El Vizcaíno Biosphere Reserve.There are over 500 species of vascular plants; 496 species in El Vizcaíno Biosphere Reserve — 8% locally endemic, others endemic to peninsula.

Useful plants

The region is no longer occupied by indigenous people and there is only very limited indirect evidence to indicate how they utilized the natural resources. Nevertheless, based

on ethnobotanical information from elsewhere, a good many plants represent potential genetic reserves with for example succulents valued for horticulture.

13. Sonoran Desert, including Baja California

GUATEMALA

14. Petén Region and Maya Biosphere Reserve

Situated in northern Guatemala, the Department of Petén has an area of about 36,000 km², and the Maya Biosphere Reserve covers 15,000-16,000 km². The vegetation consists of subtropical semideciduous moist forest, savanna, wetlands. Maya Biosphere Reserve includes five national parks, three biotopes and a multiple-use area — Laguna del Tigre is recognized under RAMSAR, and Tikal is a World Heritage site.There are about 3,000 plant species in Maya Biosphere Reserve with distinct regional endemism.

Useful plants

The Petén region is rich in useful plants such as thatching palms, construction materials, fuelwood, fibers — e.g. *Desmoncus* sp. (bayal) and *Philodendron* sp. (mimbre) for basketry and furniture, forest fruits, medicinal plants, *Manilkara zapota* (chicozapote), *Chamaedorea* spp. (mostly two understory palms) and *Pimenta dioica*. A few studies have analyzed the economic benefits of a conserving, sustainable use of Guatemala's tropical forests and renewable resources (Nations *et al.* 1988; Reining and Heinzman 1992; Salafsky *et al.* 1993). An estimated 80% of the hardwoods in Guatemala are found in the Petén, such as *Swietenia macrophylla*, *Cedrela odorata*, *Calophyllum brasiliense* var. *rekoi*, *Pouteria* spp., *Bursera simaruba*, *Spondias*, *Ficus* (Leyden 1984). The Maya BR contains more than 300 species of useful trees (CONAP 1990).

A potentially important forest resource is foliage and seeds of *Brosimum alicastrum* (ramón). The seeds were an important food source in pre-Colombian times, but present human consumption is quite low (Heinzman and Reining 1990); the fruits, foliage and bark are gathered as forage for mules and horses.

Economic Assessment of Nontimber Forest Products

Heinzman and Reining (1990) analyzed some potentially sustainable rural extraction practices in the northern Petén. Collecting several products more or less sustainably for export represents a wage resource for over 6,000 people who otherwise subsist mainly on slash-and-burn ('milpa') agriculture. The total economic return from these nontimber forest products is greater than if the forest were converted to pasture (Heinzman and Reining 1990; Nations *et al.* 1988).

In 1990 Guatemala passed a law (Decree 5-90) for a Maya Biosphere Reserve, designating 7,500 km² of it for extractive industry based on nontimber forest products. Such activity for 30-100 years has harvested three products: (1) xate palm leaves

(*Chamaedorea elegans*, *C. oblongata*) are exported through the year for floral arrangements, producing US$ 4-6 million annually ; (2) Extraction of chicle, the latex of *Manilkara zapota*. The largest concentration of high-grade chicle is found in the Maya BR and sold primarily to the Japanese. Small quantities of latex from *Ficus lundellii*, *Bumelia mayana* and *Stemmadenia donnell-smithii* may be used as enhancing supplements. In 1990-1991 the high quality latex sold for US$ 3.75 per kg (Reining and Heinzman 1992); (3) Another important annual product harvested on a rather sustainable basis is allspice (pimienta gorda, *Pimenta dioica*).

15. Sierra de las Minas Region and Biosphere Reserve

The Sierra de las Minas is in eastern Guatemala with an area of around 4,374 km²; the reserve covers 2,363 km². A management plan for the Biosphere Reserve was approved in 1992 and active management is being implemented, but facing heavy pressure from timber interests.The region has cloud-forest associations, rain forests, tropical and premontane dry forests, and thorn scrub. The flora is extremely diverse (over 2,000 species recorded) with high species endemism.

Useful plants

Major timber reserves, especially conifers, and some remnants of lowland hardwood forests in the north and southeast. There are 13 conifer species in the region, which is a major center for *Pinus*. The species most frequently exploited include *Pinus oocarpa*, *P. patula* ssp. *tecunumanii* and *P. caribea*, used especially for utility poles, railway sleepers and furniture. *Cedrela odorata*, *Dalbergia* (rosewood) and *Vochysia* spp. (San Juan) have been harvested in the past, but recent information on available resources is lacking.

Tree-fern species (*Dicksonia*, *Cyathea*, *Alsophila*) are harvested to produce either pots or the fiber used for growing ornamental plants. Bamboo is used in basket-making.

Medicinal plants abound. These include *Ocimum* spp., *Crescentia alata*, several Rubiaceae (e.g. *Borreria ocymoides*, *Randia armata*, *Hamelia patens*), *Dorstenia contrajerva*, *Neurolaena* spp., many Solanaceae. Several species of Cucurbitaceae and Solanaceae, including local varieties of tomato, represent potential germplasm reserves of food plants.

HONDURAS

16. Northeastern Honduras and Río Plátano Biosphere Reserve

Located in the Mosquitia region of northeastern Honduras, covering an area of about 5,250 km². Vegetation includes mangrove and freshwater swamps and marshes; sedge prairie; pine savanna; gallery forest; tropical moist, subtropical moist and subtropical wet forests; elfin forest. The biosphere reserve is a World Heritage site, Amerindian reserve, archaeological park.

Useful plants

The reserve harbors populations of some important timber trees, such as *Calophyllum brasiliense* var. *rekoi*, *Carapa guianensis*, *Cedrela odorata*, *Swietenia macrophylla*, *Tabebuia rosea*, *Virola koschnyi*. The abundance of seemingly wild *Theobroma* (cacao) near Las Crucitas del Río Aner suggests it was cultivated there in ancient times. Local people use native species for many purposes.

COSTA RICA

17. Braulio Carrillo-La Selva Region

On the Caribbean slope in Heredia, covering an area of about 480 km². The vegetation ranges from tropical wet forest through tropical premontane, lower montane and montane rain forests.
Conservation areas consist of a portion of Central Volcanic Cordillera Biosphere Reserve: Braulio Carrillo National Park and La Selva Biological Station.
There are 4,000-6,000 vascular plant species in Braulio Carrillo National Park; 1,900-2,200 at La Selva Biological Station.

Useful Plants

La Selva sector has species of known economic, including genetic, importance such as the rare *Monstera deliciosa*, as well as *Vanilla pauciflora* and two species of *Theobroma*. Some of the region's c. 56 reported palm species may be used for vegetable palm hearts, or are ornamental — e.g. *Geonoma epetiolata, Chamaedorea pumila, C. amabilis*. In the cool transition belt some valuable timber species are much more common than at the station — *Aspidosperma cruentum*, *Calophyllum brasiliense* var. *rekoi*, *Dalbergia tucurensis*, *Hyeronima oblonga*, *Lecythis ampla*, *Minquartia guianensis*. *Alnus acuminata* is an important upland timber species not found farther north in Costa Rica.

18. La Amistad Biosphere Reserve

In southeastern Costa Rica and northwestern Panama in the Talamanca range, including Pacific and Caribbean slopes and the highest mountain in each country. The area consists of 6,126 km² in Costa Rica in the biosphere reserve, over 4,000 km² in Panama planned for inclusion. The area is also a World Heritage site. In Costa Rica the land is protected in three national parks, one protected zone, two biological reserves, one forest reserve, seven Amerindian reserves, one botanical garden. In Panama the existing units planned for the biosphere-reserve core are three national parks, one forest reserve, one protection forest, one Amerindian reserve. Other areas are being evaluated for addition.
Vegetation comprises ten life zones in an altitudinal gradient from tropical humid forest to subalpine rain páramo, with over 90% of the Central American páramos. The flora shows very high diversity with about 10,000 vascular plant species and about 30% endemism.

Useful plants

Many commercially valuable timber species, including, in the lowlands *Carapa guianensis*, *Hyeronima alchorneoides*, *Aspidosperma megalocarpon*, *Terminalia amazonia*, *Virola* spp., *Vochysia* spp.; at middle elevations *Alnus acuminata* and *Cedrela tonduzii*; and in the high mountains the oak species, which also have excellent qualities for charcoal, plus *Magnolia*, *Podocarpus* and several Lauraceae species. In the Panamanian highlands *Magnolia sororum* is considered the most valuable tree species, producing an excellent timber.

Plants with medicinal value are used by indigenous and non-indigenous people. Medicine men ('awápas') use a large variety of plants such as *Dorstenia contrajerva*, *Petiveria alliacea*, *Psidium guajava*, *Quassia amara*, *Drimys granadensis*, *Senecio* spp., *Smilax* spp., *Dioscorea* spp. Other plants for example in Palmae, Araceae, Moraceae and Bignoniaceae are used in handicrafts to construct baskets, hammocks, crates, bags; in wood carving to manufacture drums, bows and arrows, water containers; and in house construction. Many food plants are also found in the RBA, among them *Euterpe* sp. for its palm heart.

19. Osa Peninsula and Corcovado National Park

In southern Costa Rica near southwestern Panama, the peninsula has an area of around 2,330 km²and the park 424 km². Vegetation is mostly tropical wet forest, also tropical premontane wet and rain forests; associations include marsh, mangrove and swamp forests, alluvial plains forest, cloud forest. There are 4,000-5,000 vascular plant species on peninsula, over 500 tree species in park. In addition to the National park, there are adjacent forest and Amerindian reserves; and integrated land-use planning for the peninsula's general development.

Useful plants

As a result of intensive local research, the park is increasingly prominent for more complex and long-term biological and ecological research. The park region has been chosen as one of the first areas for an intensive inventory by InBio.

Osa pulchra has notable ornamental potential. The genetic stocks of many tree species in the park are increasingly valuable for critical reforestation or afforestation efforts. Replanting has already begun on the peninsula. INBio has placed early emphasis on investigating plants with pharmacological properties.

PANAMA

20. Cerro Azul-Cerro Jefe Region

An area of central Panama northeast of Panama City, covering 34-53 km². Vegetation consists of various types of tropical rain forest. There are 934 recorded species of ferns

and flowering plants, with high endemism, disjunct taxa. Part of the area falls within Chagres National Park.

Useful plants

There are timber trees such as *Calophyllum longifolium* (María), *Manilkara* sp. (níspero), *Podocarpus cf. oleifolius* (pino de montaña). Occasionally, leaves and stalks of *Socratea exorrhiza* and *Colpothrinax cookii* (palma escoba) are used to make huts. Uses of endemic plants are not known. There are species e.g. in *Rauvolfia*, *Cephaelis* and *Hamelia* investigated for their chemical and pharmacological properties.

21. Darién Region and Darién National Park

A region of 16,671 km² in eastern Panama, with the Darién National Park covering 5,790 km². Vegetation consists of tropical lowland dry, moist and wet forests; perhaps 500-year-old secondary rainforest. Tropical premontane moist (warm transition), wet and pluvial forests and lower montane pluvial forest. Marshes and swamps, tall nonflooding forests, cloud and elfin forests. In Darién province, 2,440 plant species have been recorded.

Darién National Park is a World Heritage site and biosphere reserve, with buffer zone and Punta Patiño Nature Reserve to east and Colombia's Los Katíos NP to west. Other protected areas are: Canglón and Chepigana forest reserves; Comarca Emberá No. 1 (Cemaco District), Comarca Emberá No. 2 (Sambú District), Kuna de Walá, Mortí y Nurrá Amerindian reserve.

Useful plants

The Darién forests contain important reserves of timber, such as *Prioria copaifera* (cativo). This region has contributed 75% of the logs to the national market, with cativo comprising half of the total. Other timber species include *Anacardium excelsum*, *Bombacopsis quinata*, *Vatairea* sp., *Hyeronima oblonga*, *Capara guianensis*, *Cedrela odorata*, *Cordia alliodora*, *Dialium guianense*, *Myroxylon balsamum*, *Swietenia macrophylla*, *Tabebuia guayacan*, *T. rosea*, *Terminalia amazonia.*

The indigenous peoples use many species, for a variety of purposes. Cooking oil is extracted from the palm *Jessenia bataua* (trupa) and the palm *Phytelephas seemannii* is used to make vegetable-ivory carvings.

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BELIZE

National/international designations Name of area	IUCN management category	Area (ha)	Year notified
National Parks			
Chiquibul	II	107,607	1991
Nature Reserves			
Bladen Branch	I	39,256	1990
Rio Grande	IV	2,340	1968
Society Hall	I	2,729	1986
Wildlife Sanctuaries			
Cockscomb Basin	IV	102,400	1986
Crooked Tree	IV	1,470	1984
Marine Nature Reserve			
Hol Chan	II	411	1987
National Monument			
Half Moon Caye	II	3,925	1982
Forest Reserves			
Chiquibul	VIII	184,955	1991
Columbia River	VIII	44,789	1954
Commerce Bight	VIII	1,200	1989
Deep River	VIII	31,647	1991
Freshwater Creek	VIII	29,593	1960
Grants' Work A	VIII	3,439	1986
Machaca	VIII	2,300	1954
Manatee Lagoons	VIII	3,300	
Mango Creek	VIII	23,224	1987
Maya Mountains	VIII	52,124	1984
Mountain Pine Ridge	VIII	51,282	1920
Sibun	VIII	42,966	1987
Silk Grass	VIII	2,641	1920
Sittee River	VIII	37,938	1977
Swasey-Bladen	VIII	6,200	1958
Archaeological Reserve			
Caracol	IV	20,000	

COSTA RICA

National/international designations **Name of area**	**IUCN management category**	**Area (ha)**	**Year notified**
National Parks			
Arenal	II	2,000	1991
Ballena	IV	4,200	1990
Barra Honda	V	2,295	1974
Braulio Carrillo	II	44,099	1978
Cahuita	V	1,067	1970
Chirripó	II	50,150	1975
Corcovado	II	54,568	1975
Guanacaste	II	32,512	1991
Isla del Coco	II	2,400	1978
La Amistad (Talamanca)	II	193,929	1982
Palo Verde	II	13,228	1982
Rincón de la Vieja	II	14,083	1973
Santa Rosa	II	37,217	1971
Tortuguero	II	18,946	1975
Volcán Irazú	V	2,309	1955
Volcán Poás	I	I5,600	1971
Biological Reserves			
Cabo Blanco	I	1,172	1963
Carara	I	4,700	1978
Hitoy-Cerere	I	9,154	1978
Isla del Caño	IV	200	1978
Islas Guayabo y Negritos	I	143	1973
Lomas Barbudal	IV	2,279	1986
Faunal Refuges			
Barra del Colorado	IV	98,000	1985
Caño Negro	IV	9,969	1983
Gandoca y Manzanillo	IV	9,449	1985
Golfito	IV	1,350	1985
Isla Bolanos	IV	100	1981
Tapantí	IV	6,080	1982
Protection Zones			
Acuíferos de Guácimo y Pocosí	VIII	4,270	1987
Arenal	VIII	18,325	1991
Caraigres	VIII	4,000	1976
Cerros de Escazú	VIII	7,060	1976
Cerros de Turrubares	VIII	2,340	1983
Cerros de la Carpintera	VIII	2,000	1976
Cuencas del Río Tuis	VIII	4,095	1986
El Rodeo	VIII	2,222	1976

Juan Castro Blanco	VIII	14,258	1968
La Cangreja	VIII	1,937	1984
La Selva	VIII	2,815	1982
Las Tablas	VIII	19,602	1981
Miravelles	VIII	11,670	1991
Río Grande	VIII	1,500	1976
Río Pacuare	VIII	13,060	1991
Río Sombrero - Río Navarro	VIII	6,440	1984
Río Tivives	VIII	2,368	1986
San Ramón	VIII	7,800	1991
Tenorio	VIII	17,650	1991
Tortuguero	VIII	13,000	1990

National/international designations **Name of area**	**IUCN management category**	**Area (ha)**	**Year notified**
Forest Reserves			
Cordillera Volcánica Central	VIII	61,542	1975
Golfo Dulce	VIII	67,287	1978
Grecia	VIII	2,000	1973
Los Santos	VIII	62,000	1975
Manglares	VIII	35,000	1977
Río Macho	VIII	69,604	1964
Volcán Arenal	VIII	5,256	1969
Anthropological Reserves			
Abrojos	VII	1,480	1978
Alto Chirripó	VII	77,973	1976
Alto Pacuare	VII	1,336	
Awari	VII	1,332	
Bajo Chirripó	VII	18,783	1976
Barbilla	VII	2,077	1982
Boruca	VII	12,470	1956
Boruca-Terraba	VII	31,983	1957
Cabagra	VII	27,860	1956
China Kicha	VII	2,459	
Chirripó	VII	75,824	1976
Cocles	VII	3,538	
Conte Burica	VII	11,910	1977
Corina	VII	1,555	
Coto Brus	VII	7,500	1976
Guatuso	VII	2,743	1976
La Estrella	VII	13,616	
Matambú	VII	1,710	1976
Nimari Bukiri	VII	7,439	
Osa	VII	1,700	1985
Rey Curré	VII	10,620	1985

Salitre	VII	11,700	1956
Sibuju Norte	VII	2,195	
Talamanca - Bribri	VII	43,690	1976
Talamanca - Cabécar	VII	22,729	1976
Talamanca	VII	62,253	1976
Tayni	VII	13,616	1976
Telire	VII	16,260	1976
Térraba	VII	9,350	1956
Ujarras Salitre-Cabagra	VII	56,561	1957
Ujarráz	VII	19,040	1956
Zapatón	VII	2,855	1981
Biosphere Reserves			
Reserva de la Biósfera de la Amistad	IX	584,592	1982
Cordillera Volcánica Central	IX	144,363	1988
Ramsar Wetlands			
Caño Negro	R	19,800	1992
Palo Verde	R	9,969	1992
World Heritage Sites			
Cordillera de TalamancaLa Amistad	X	1977	

EL SALVADOR

National Parks			
Cerro Verde	IV	6,500	1981
El Imposible	II	5,600	1983
Montecristo	IV	3,893	1979
Wildlife Refuges			
Barra de Santiago	IV	2,200	1983
El Jocotal	IV	1,200	1978

GUATEMALA

National/international designations **Name of area**	**IUCN management category**	**Area (ha)**	**Year notified**
National Parks			
Atitlán	VIII	54,773	1955
Bahía de Santo Tomás	V	1,000	1956
El Rosario	VIII	1,031	1980
El Tigre	II	350,000	1990
Lacandón	II	200,000	1990
Laguna Lachua	II	10,000	1978
Mirador/Dos Lagunos/Río Azul	II	147,000	1990

Río Dulce	VIII	7,200	1955
Santa Rosalía	VIII	1,000	1956
Sipacate-Naranjo	IV	2,000	1969
Tikal	II	57,400	1957
Trifinio	II	4,000	1987
Volcán de Pacaya	III	2,000	1963
Biotopes			
Chocón-Machacas	IV	6,265	1981
Mario Dary Rivera (Quetzal)	IV	1,173	1976
Monterrico	VIII	2,800	1977
San Miguel - El Zotz	IV	42,000	1989
Biotopo Universitario para la Conservación del Quetzal	IV	1,153	1977
Forest Reserves			
Area de Uso Múltiple R.B.M.	VIII	650,000	1990
Area de Uso Múltiple R.S.M.	VIII	34,000	1990
Franja Transversal del Norte	VIII	1,200	1981
Río Chixoy	VIII	28,000	1980
Río Salama	VIII	63,124	1956
Cultural Monuments			
Aguateca	III	1,709	1987
Ceibal	III	2,100	1984
Dos Pilas	III	3,166	1987
Machaquilla	III	2,000	1974
Biosphere Reserve			
Sierra de las Minas (Zona Núcleo)	I	105,700	1990
Biosphere Reserve			
Maya	IX	1,000,000	1990
Ramsar Wetland			
Laguna del Tigre	R	48,372	1990
World Heritage Site			
Parque Nacional Tikal	X	57,400	1979

Summary of Protected Areas of Honduras

National/international designations Name of area	IUCN management category	Area (ha)	Year notified
National Parks			
Agalta	II	62,400	1987
Azul Meambar	II	20,000	1987

Celaque	II	27,000	1987
Cerro Azul	II	15,000	1987
Islas de la Bahía	II	29,416	
La Tigra	II	7,550	1980
Montaña de Comayagua	II	18,000	1987
Montaña de Cusuco	II	18,000	1987
Montaña de Yoro	II	15,000	1987
Pico Bonito	II	112,500	1987
Pico Pijol	II	11,400	1987
Santa Barbara	II	13,000	1987
Trifinio	II	5,400	1987
Biological Reserves			
El Chiflador	IV	1,000	1987
El Chile	IV	12,000	1987
El Pital	IV	3,800	1987
Guajiquiro	IV	7,000	1987
Guisayote	IV	7,000	1987
Lancetilla	IV	1,681	1987
Misaco	IV	4,600	
Montecillos	IV	12,500	1987
Opalaca	IV	14,500	1987
Volcán Pacayita	IV	9,700	1987
Yerba Buena	IV	3,600	1987
Yuscarán	IV	2,300	1987
Wildlife Refuges			
Corralitos	IV	5,500	1987
El Armado	IV	3,500	1987
Erapuca	IV	5,600	1987
La Muralla	IV	6,093	1987
Mixcure	IV	8,000	1987
Montaña Verde	IV	8,300	
Montaña de Puca	IV	4,900	1987
Ríos de Cuero y Salado	IV	8,500	1988
Texiguat	IV	10,000	1987
Protected Area			
Jardín Botánico de Lancetilla	IV	1,253	1978
Forest Reserves			
Agalteca	II	100,000	1966
El Cajón	VIII	33,696	
Guanaja	VIII	5,400	1969
Golfo de Fonseca	VIII	50,000	1958
Olancho	VIII	1,000,000	1966
Sierra de Omoa	VIII	8,315	

Multiple Use Reserves			
Cerro Guanacaure	VIII	1,000	
Lago de Yojoa	VIII	34,628	1971

National/international designations **Name of Area**	**IUCN management category**	**Area (ha)**	**Year notified**
Biosphere Reserve			
Reserva de la Biósfera Río Plátano	IX	500,000	1980
World Heritage Site			
Reserva de la Biósfera Río Plátano	X	500,000	1982

MEXICO

National/international designations **Name of area**	**IUCN management category**	**Area (ha)**	**Year notified**
National Parks			
Benito Juarez	II	2,737	1937
Bosencheve	II	15,000	1940
Cañón del Río Blanco	II	55,900	1938
Cañón del Sumidero	II	21,789	1980
Cascada de Bassaseachic	II	6,263	1981
Cerro de la Estrella	II	1,100	1938
Cofre de Perote	II	11,700	1937
Constitución de 1857	II	5,009	1962
Cumbres de Majalca	II	4,772	1939
Cumbres de Monterrey	II	246,500	1939
El Chico	II	2,739	1982
El Cimatario	II	2,447	1982
El Gogorrón	II	25,000	1936
El Potosí	II	2,000	1936
El Tepozteco	II	24,000	1937
El Veladero	II	3,159	1980
Grutas de Cacahuamilpa	III	1,600	1936
Insurgente Jose María Morelos y Pavón	II	4,324	1939
Insurgente Miguel Hidalgo y Costilla	II	1,760	1936
Isla Isabela	II	194	1980
Iztaccihuatl-Popocatépetl	II	25,679	1935
La Malinche	II	45,711	1938
Lagunas de Chacahua	II	14,187	1937
Lagunas de Montebello	II	6,022	1959
Lagunas de Zempoala	II	4,669	1936
Los Mármoles	II	23,150	1936
Nevado de Colima	II	22,200	1936

Nevado de Toluca	II	51,000	1936
Palenque	V	1,772	1981
Pico de Orizaba	II	19,750	1937
Pico de Tancitaro	II	29,316	1940
Sierra de San Pedro Mártir	II	63,000	1947
Zoquiapán y Anexas	II	19,418	1937
Biosphere Reserves (National)			
Calakmul	V	723,185	1989
El Pinacate	V	480,956	
El Triunfo	I	119,177	1972
El Vizcaíno	V	2,546,790	1988
Mapimí	V	103,000	1977
Michilía	V	42,000	1977
Montes Azules	II	331,200	1978
Sian Ka'an	II	528,147	1986
Sierra de Manantlán	V	139,577	1987
Marine Reserve			
La Blanquilla	IV	66,868	1975
Faunal Reserve			
Isla Cedros	I	1,000	1978
Cetacean Sanctuary			
Isla de Guerrero Negro	I	40,000	1979
Refuges			
La Mojonera	IV	9,201	1981
La Primavera	IV	30,500	1980
Sierra de Alvarez	IV	16,900	1981
Sierra del Pinacate	IV	28,660	1979
Valle de los Cirios	IV	3,500,000	1980
Natural Monument			
Cerro de la Silla	I	6,045	1991
Natural and Typical Biotope			
La Encrucijada	IV	30,000	1972
Special Biosphere Reserves			
Cascadas de Agua Azul	III	2,580	1980
El Ocote	IV	48,140	1982
Isla Contoy	I	176	1961
Isla Guadalupe	I	25,000	1922
Isla Tiburón	VII	120,800	1963
Islas del Golfo de California	I	150,000	1978
Mariposa Monarca	I	16,100	1980

Ría Celestún	IV	59,130	1979
Ría Lagartos	IV	47,840	1979
Sierra de Santa Martha	VII	20,000	1980
Volcán de San Martín	VII	1,500	1979
Park			
Omiltemi	II	3,600	
Forest Reserves			
Bavispe	VIII	198,164	1939
Campo Verde	VIII	78,792	1938
Centenario	VIII	3,000	1949
El Gavilán	VIII	9,682	1923
Mesa del Pitorreal	VIII	4,900	1923
Papigochic	VIII	172,480	1939
Porción Boscosa de San Luís Potosí	VIII	29,885	1923
San José de los Molinos	VIII	2,995	1942
Sierra de Juarez	VIII	140,000	1951
Sierra de Los Ajos, Buenos Aires y Purica	VIII	21,494	1936
Sierra de Pedro Mártir	VIII	74,000	1951
Sierras de Hansen y San Pedro Mártir, y Mesa Pinal	VIII	1,249,000	1923
Tequixquipan	VIII	32,000	1935
Terenos de Puebla y México	VIII	18,215	1926
Tutuaca	VIII	364,952	1937
Protection Area for Wild Flora and Fauna			
Corredor Biológico Chichinautzin	IV	37,302	1988
Biosphere Reserves			
El Cielo	IX	144,530	1986
Montes Azules	IX	331,200	1979
Reserva de Mapimí	IX	103,000	1977
Reserva de la Michilía	IX	42,000	1977
Sian Ka'an	IX	523,147	1986
Sierra de Manantlán	IX	139,577	1988

National/international designations **Name of area**	**IUCN management category**	**Area (ha)**	**Year notified**
Ramsar Wetlands			
Ría Lagartos, Yucatán	R	47,480	1986
World Heritage Site			
Sian Ka'an	X	528,000	1987

NICARAGUA

National/international designations Name of area	IUCN management category	Area (ha)	Year notified
National Parks			
Archipiélago Zapatera	II	10,000	1983
Saslaya	II	11,800	1971
Volcán Masaya	II	5,500	1978
Biological Reserves			
Cayos Miskitos	IV	502,654	1991
Río Indio Maíz	I	295,000	1990
Wildlife Refuges			
La Flor	VI	1,500	1983
Los Guatusos	IV	10,000	1990
Río Escalante-Chococente	IV	4,800	1983
Wildland Areas			
Macizos de Peñas Blancas	VI	7,000	1976
Pinares de Dipilto	VI	1,500	1983
National Natural Resource Reserve			
Bosawas	VIII	800,000	1991
National Natural Reserve			
Alamikamba	IV	2,100	1991
Archipiélago de Solentiname	IV	8,500	1990
Castillo de la Inmaculada	IV	1,500	1990
Cerro Bana Cruz	IV	19,700	1991
Cordillera Maribios	VI	34,460	1983
Estero Real	IV	38,725	1976
Isla Juan Venado	IV	4,500	
Isla de Ometepe	IV	3,700	
Laguna Mecatepe	III	1,050	
Laguna de Apoyo	IV	2,100	
Laguna de Tisma	IV	7,000	1983
Makantaka	IV	2,000	1991
Padre Ramos	IV	4,826	1990
Península Chiltepe	VI	1,800	1983
Volcán Concepción	VIII	2,200	
Volcán Cosiguina	IV	12,420	1976
Volcán Maderas	IV	4,000	1983
Volcán Mombacho	VI	2,847	1983
Volcán Momotombe y Momotombito	VI	8,500	1983
Yucul	VI	4,826	1990

PANAMA

National/international designations **Name of area**	**IUCN management category**	**Area (ha)**	**Year notified**
National Parks			
Altos de Campana	II	4,816	1977
Cerro Hoya	II	32,557	1984
Chagres	II	129,000	1984
Coiba	II	270,000	1991
Darién	II	579,000	1980
La Amistad	II	207,000	1988
Portobelo	II	34,846	1976
Sarigua	II	8,000	1984
Soberanía	II	22,104	1980
Volcán Barú	II	14,000	1976
National Marine Park			
Isla Bastimentos	II	13,226	1988
Scientific Reserve			
Isla Maje	I	1,433	1977
Wildlife Refuges			
Ciénega del Mangle	IV	776	1980
Islas Taboga y Uraba	IV	258	1984
Peñón de la Onda	IV	2,000	1984
Natural Monument			
Barro Colorado	II	I5,400	1977
Natural Park			
Metropolitano	V	265	1985
Forest Reserves			
Canglón	VIII	31,650	1984
Chepigana	VIII	146,000	1960
La Tronosa	VIII	22,000	1977
La Yeguada	VIII	3,000	1960
Montuoso	VIII	10,000	1978
Protection Forests			
Alto de Darién	VIII	211,000	1972
Palo Seco	VIII	244,000	1983
Indigenous Reserves			
Comarca Kuna Yala (San Blas)	VII	320,000	1938
Embere-Wounan (Ember-Orua)	VII	432,600	1983

Water Production Reserve			
La Fortuna	VIII	15,000	1976
Recreation Area			
Lago Gatún	V	348	1985
Golfo de Montijo		80,765	1990
Biosphere			
Parque Nacional Fronterizo Darién	IX	597,000	1983
Ramsar Wetland			
Golfo de Montijo	R	80,765	1990
World Heritage Sites			
Parque Nacional Darién	IX	579,000	1981
Parque Internacional La Amistad	X	207,000	1990

WORLD CONSERVATION MONITORING CENTRE

The Conservation and Sustainable use of the Plant Genetic Resources of Central America

Project summary

With funds from the UK Darwin Initiative and the Swedish International Development Agency (SIDA), WCMC is undertaking a study of the *in situ* conservation of useful plant genetic resources of Mexico and Central America, focusing particularly on the wild progenitors and landraces of crop plants. The project is being developed in partnership with international and regional organisations including the International Plant Genetic Resources Institute (IPGRI); Mesoamerican Plant Genetic Resources Network (REMERFI) and Smithsonian Institution.

Mexico and the countries of Central America have a significant level of indigenous crop genetic diversity and this is linked with scientific and applied research interests. There is currently, within the region, a conjunction of very positive elements in the study and conservation of plant genetic resources. The WCMC project provides an opportunity to strengthen *in situ* conservation through interdisciplinary activities. The intention is to involve a wide range of national organisations, both governmental and non-governmental, linking the plant genetic resource sector and other agencies of biodiversity conservation.

A regional strategy will be developed to reverse the trend of accelerating genetic erosion of plants of current or potential economic value. The need to conserve genetic resources for their use in food production, sustainable agriculture, forestry and new pharmaceuticals is widely recognised by governments and provides a powerful incentive for the conservation of biodiversity. This realisation is reinforced by the provisions of Agenda 21 and the Biodiversity Convention, both of which stress the need to identify and monitor the status, threats to, and utilisation of plant genetic resources.

In general, the emphasis in conservation of agricultural plant genetic resources around the world, has been almost entirely on *ex situ* conservation linked to plant breeding. Methodologies for *in situ* conservation have hardly been elaborated and information on which to plan *in situ* conservation strategies remains fragmented and incomplete. Expertise within Meso-America facilitated through this project, and with input from international agencies, will develop methodologies for *in situ* conservation, appropriate to the region, which can be used as a model worldwide.

The long term objectives of the project are:

i. to assess the status, distribution and threats to the most economically important plants and their wild relatives in Central America

ii. to determine current and potential uses and economic benefits of the plant genetic resources of the region

iii. to promote the conservation of genetic variation amongst the wild progenitors and landraces of agricultural crop plants in the region

iv. to reinforce the economic values of plant genetic resources as an incentive for countries in the region to conserve their biodiversity

v. to build the capabilities of the national institutions within the region to identify, evaluate and utilise their plant genetic resources as a key component of the biological wealth of the countries

vi. to develop, field-test and refine a methodology for in-country gathering of data and assessing national priorities, which will be presented to the FAO 1996 Conference on Plant Genetic Resources.

vii. to develop a methodology and operational practice for quantifying the status, use and economic values of plant genetic resources that can be applied in other regions of the world

It is proposed to hold an orientation meeting within the region in September 1994 to plan details of project implementation. This meeting will bring together national experts in plant genetic resources and ecosystem conservation. In preparation for the meeting, WCMC will prepare a series of reports as a basis for discussion and development of methodologies. The proposed contents of the reports result from discussions at a preliminary meeting between Comisión Nacional de Recursos Fitogenéticos de Costa Rica (CONAREFI); IPGRI Latin American Regional Office; Royal Botanic Gardens, Kew, UK; Royal Botanic Garden, Edinburgh, UK; CAB International and the Smithsonian Institution, USA. Wide consultation will be undertaken in preparation of the discussion documents for the meeting.

As a basis for discussion WCMC will prepare:

* the extent and coverage of information on plant genetic resources *in situ*
* a directory of experts on the taxa identified as of priority by REMERFI
* an assessment of the extent to which these species are held in *ex situ* collections
* an analysis of the protected area coverage, the extent to which botanical inventories exist for protected areas, and the level of available information on the diversity of genetic resources conserved *in situ*
* GIS data sets for selected taxa
* review of database applications and draft transfer formats for data exchange on *in situ* conservation of plant genetic resources.

For more information on the project please contact:

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WORLD CONSERVATION MONITORING CENTRE

La Conservación y el Uso Sustentable de los Recursos Fitogenéticos de Centro América

Resumen del proyecto

Con los fondos del " UK Darwin Initiative" y de la Agencia Internacional de Desarrollo de Suecia (SIDA), el Centro Mundial de Monitoreo de la Conservación (WCMC) está llevando a cabo un estudio sobre la conservación *in situ* de recursos fitogenéticos útiles de México y Centro América, con un énfasis especial en las plantas de origen silvestre y en "landraces". El proyecto se está desarrollando en conjunto con organizaciones internacionales y regionales entre las que se incluye al Instituto Internacional de Recursos Fitogenéticos (IPGRI), la Red Mesoamericana de Recursos Fitogenéticos (REMERFI), y el Instituto Smithsonian.

México y los países de Centro América tienen un nivel significativo de diversidad genética en cultivos autóctonos, lo cual es de gran relevancia para intereses científicos y para la investigación aplicada. En la actualidad existen en la región una serie de elementos muy positivos para el estudio y la conservación de recursos fitogenéticos. El proyecto del WCMC provee una oportunidad para fortalecer la conservación *in situ* a través de actividades interdisciplinarias. La intención es la de involucrar una amplia gama de organizaciones tanto gubernamentales como no gubernamentales, interrelacionando así al sector de recursos fitogenéticos con otras agencias de conservación de la biodiversidad.

Se desarrollará una estrategia regional para cambiar el ritmo acelerado con el cual se están destruyendo recursos genéticos en plantas que tienen un valor económico actual o potencial. La necesidad de conservar recursos genéticos para su uso en la producción de alimentos, en la agricultura sustentable, en actividades forestales y en el desarrollo de nuevos productos farmacéuticos es ampliamente reconocida por los gobiernos y constituye una herramienta de gran peso para la conservación de la biodiversidad. Esta necesidad es reforzada en las disposiciones de Agenda 21 y de la Convención de Biodiversidad, las cuales enfatizan la necesidad de identificar y monitorizar el status, la amenazas, y la utilización de los recursos fitogenéticos.

En términos generales, el énfasis en la conservación de recursos fitogenéticos agrícolas a nivel mundial ha estado enfocado casi exclusivamente hacia la conservación *ex situ* relacionada a la producción y reproducción de plantas. Muy pocas metodologías para conservación *in situ* han sido elaboradas y la información con la cual planificar estrategias de conservación *in situ* continúa fragmentada e incompleta. El conocimiento sobre Mesoamérica generado en este proyecto, con la colaboración de agencias internacionales, contribuirá al desarrollo de una metodología para conservación *in situ* adecuada a la región, la cual podrá ser utilizada como un modelo a nivel mundial.

Los objetivos a largo plazo de este proyecto son:

i asesorar sobre el status, la distribución y las amenazas hacia las plantas mas importantes en términos económicos (y sus especies silvestres relacionadas) de Centro América.
ii determinar los usos actuales y potenciales y los beneficios económicos de los recursos fitogenéticos de la región
iii promover la conservación de variedades genéticas entre los progenitores silvestres y los "landraces" de plantas de cultivo agrícola en la región
iv reforzar el valor económico de los recursos fitogenéticos como un incentivo para que los países de la región conserven su biodiversidad
v contribuir al desarrollo de la capacidad de las instituciones nacionales en la región para que identifiquen, evalúen y utilicen sus recursos fitogenéticos como un componente clave de la riqueza biológica de sus países.
vi desarrollar pruebas de campo y refinar una metodología para la recolección de datos a nivel nacional y para el asesoramiento de prioridades nacionales, lo cual será presentado a la Conferencia de 1996 de la FAO sobre Recursos Fitogenéticos.
vii desarrollar una metodología y experiencia práctica para cuantificar el status, el uso y los valores económicos de los recursos fitogenéticos, la cual pueda ser aplicada en otras regiones del mundo.

Se propone que se lleve a cabo una reunión de orientación en la región en septiembre de 1994 para planificar los detalles sobre la implementación del proyecto. Esta reunión agrupará a expertos nacionales en recursos fitogenéticos y en la conservación de ecosistemas. Para la reunión WCMC preparará una serie de reportes como base para la discusión y para el desarrollo de las metodologías. El contenido propuesto para los reportes es el resultado de discusiones de una reunión preliminar entre la Comisión Nacional de Recursos Fitogenéticos de Costa Rica (CONAREFI); la Oficina Latinoamericana Regional de IPGRI; el Jardín Botánico Real de Kew, Reino Unido; el Jardín Botánico Real de Edimburgo, Reino Unido; CAB Internacional y el Instituto Smithsonian, USA. Se llevará a cabo una amplia consulta durante la preparación de los documentos de discusión para la reunión.

Como bases para la discusión WCMC preparará:

* la extensión y cobertura de la información sobre recursos fitogenéticos *in situ*.
* un directorio de expertos en taxa, señalada como un prioridad por REMERFI
* un asesoramiento sobre la medida en la cual estas especies existen en colecciones *ex situ*
* un análisis de la cobertura de áreas protegidas, la medida en la cual existen inventarios botánicos para las áreas protegidas, y el nivel de información disponible de los recursos fitogenéticos conservados *in situ*
* Datos de Sistemas de Información Geográfica para grupos de taxa seleccionados
* una revisión de aplicaciones de bases de datos y formatos preliminares de transferencia para intercambio de datos sobre conservación *in situ* de recursos fitogenéticos

Para mayor información sobre el proyecto por favor contactar a:

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IUCN
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The World Conservation Monitoring Centre is a joint-venture between the three partners who developed the *World Conservation Strategy* and its successor *Caring for the Earth*: IUCN-The World Conservation Union, UNEP- United Nations Environment Programme, and WWF-World Wide Fund for Nature.