



TRINIDAD AND TOBAGO:

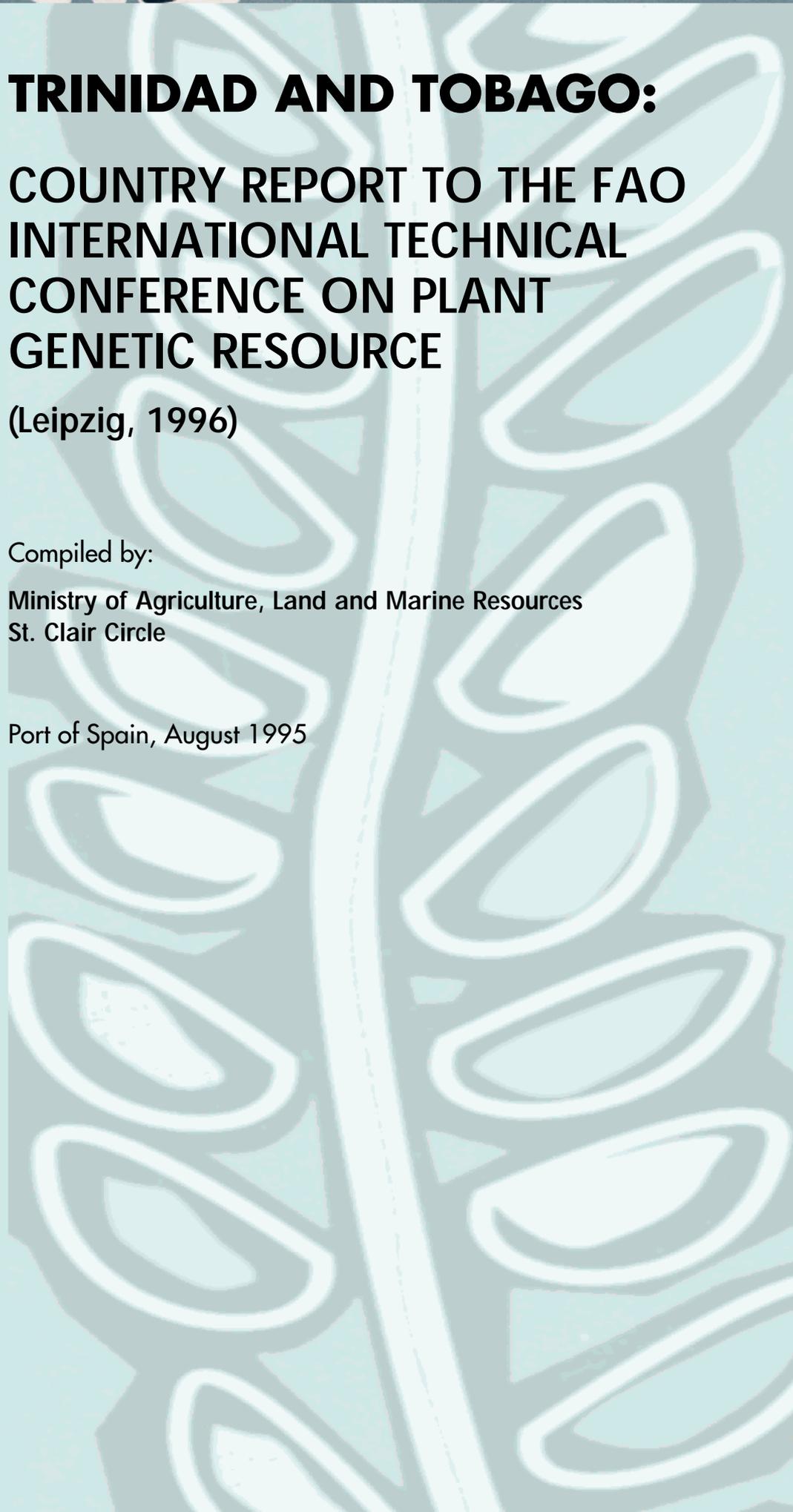
COUNTRY REPORT TO THE FAO INTERNATIONAL TECHNICAL CONFERENCE ON PLANT GENETIC RESOURCE

(Leipzig, 1996)

Compiled by:

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St. Clair Circle

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Note by FAO

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FOREWORD

At the invitation of the Food and Agriculture Organisation of the United Nations (FAO), the Government of the Republic of Trinidad and Tobago was requested to prepare a Country Report on the status of its national plant genetic Resources and capabilities to conserve and fully utilize these resources.

This responsibility was met with by the Ministry of Agriculture, Land and Marine Resources (MALMR) through a Core Committee under the Chairmanship of the Chief Technical Officer (Agriculture) and including a member of staff of the Department of Agriculture, Tobago House of Assembly. A sub-committee comprising of members of staff of the Agricultural Services Division, Forestry Division, Research Division and the senior Librarian provided technical and scientific information support. The sub-committee met continuously from March, 1995 and updated the Core Committee at bi-monthly meetings.

Valuable contributions were received from staff of the Cocoa Research Unit, the Faculty of Agriculture and, the Faculty of Natural Sciences, U.W.I., St. Augustine Campus. The MALMR also benefitted from discussions with Dr. Pinchinat of IPGRI whose visit was facilitated by IICA.

It is hoped that the report fulfills the request and in its own measure contribute to the identification of Plant Genetic Resources in developing countries, advise of our continuing efforts to sustainably utilize these resources and highlight shared concerns and priorities. We remain confident that as a consequence of national efforts, an international commitment for technical and financial assistance will be concretized so that we may enhance human welfare and return plant genetic resources to future generations.



FIGURE 1 TRINIDAD AND TOBAGO IN RELATION TO THE AMERICAS AND THE CARIBBEAN

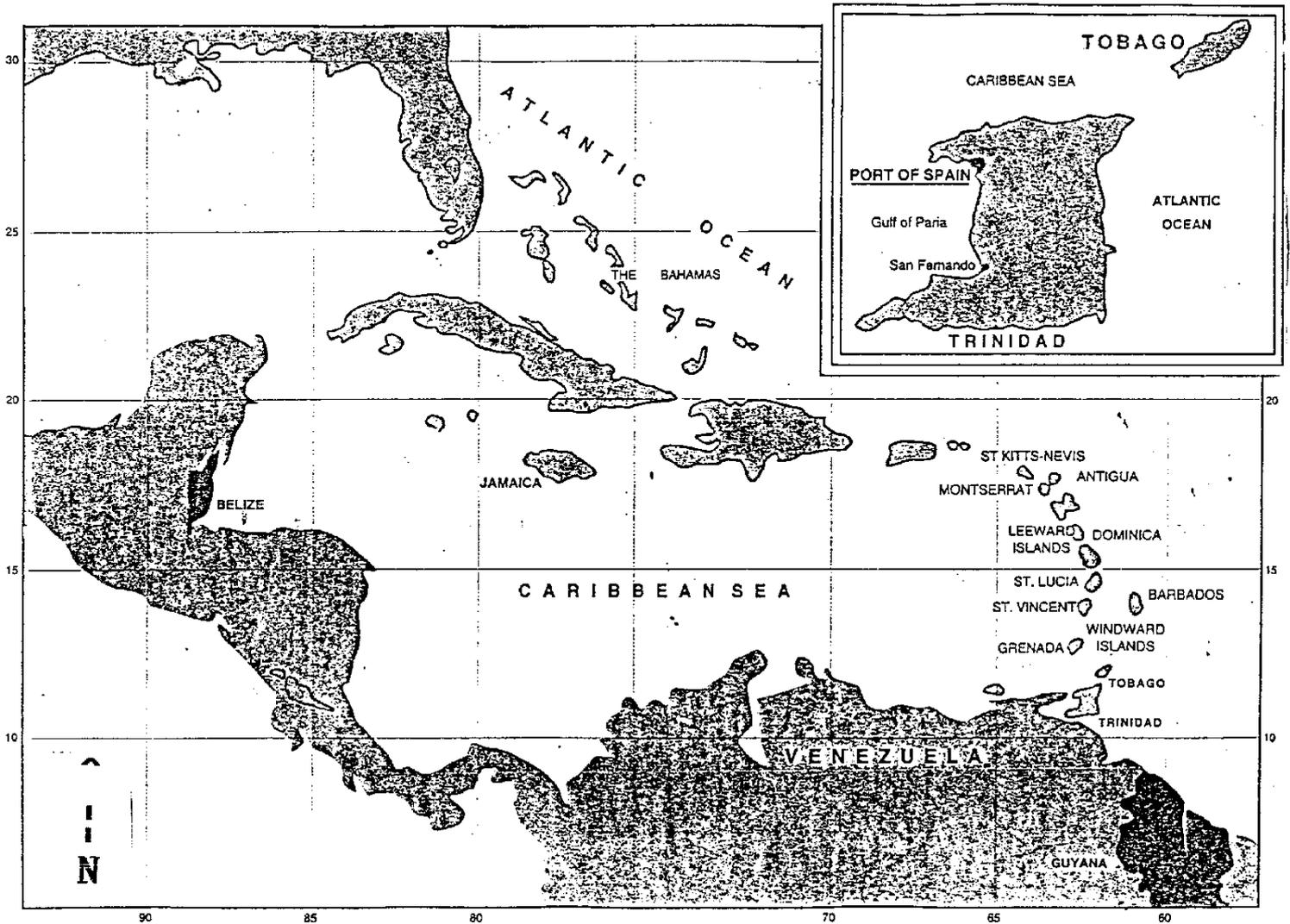




FIGURE 2 SOILS OF TRINIDAD AND TOBAGO SHOWING MAJOR SOIL TYPES

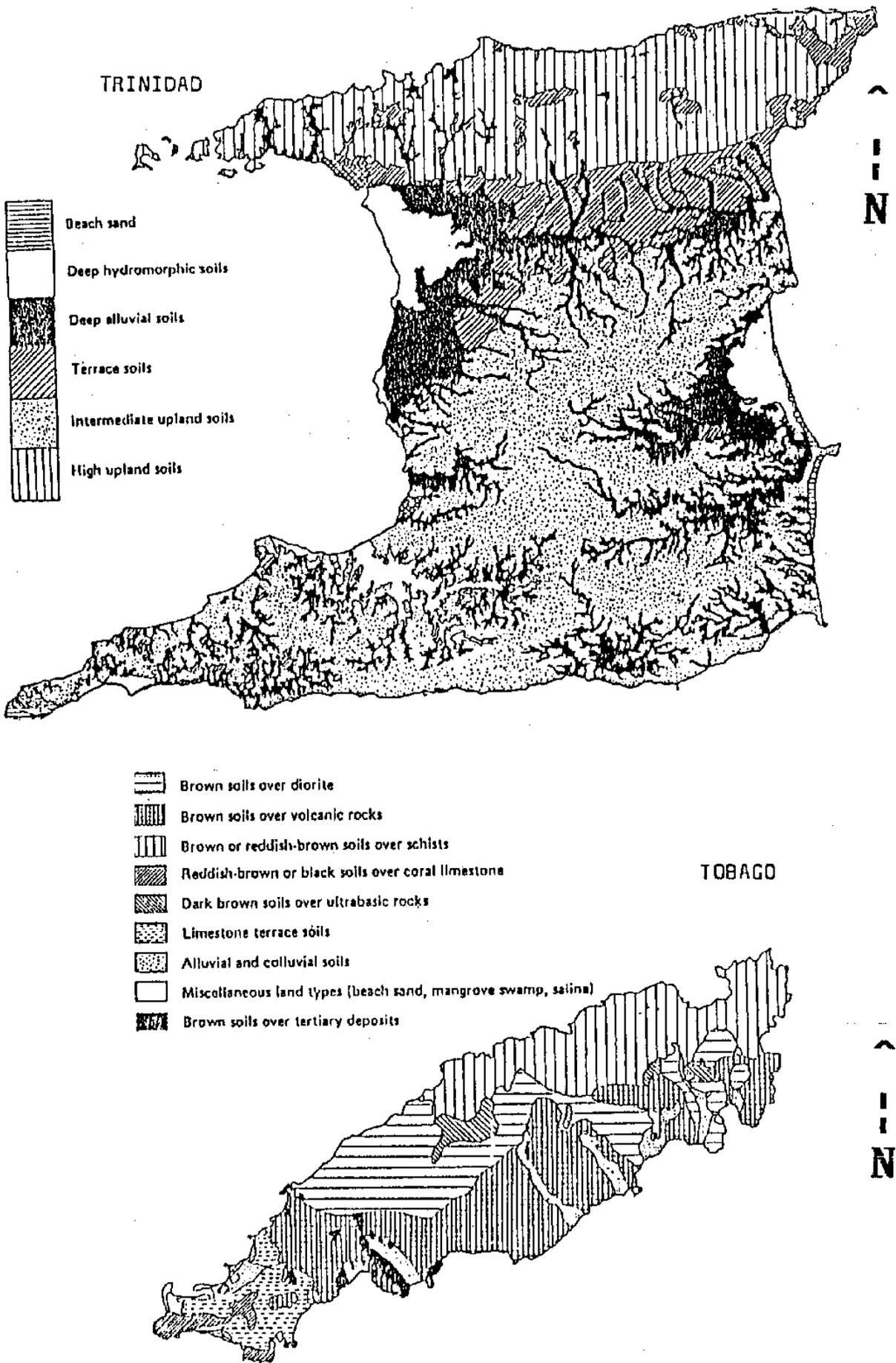
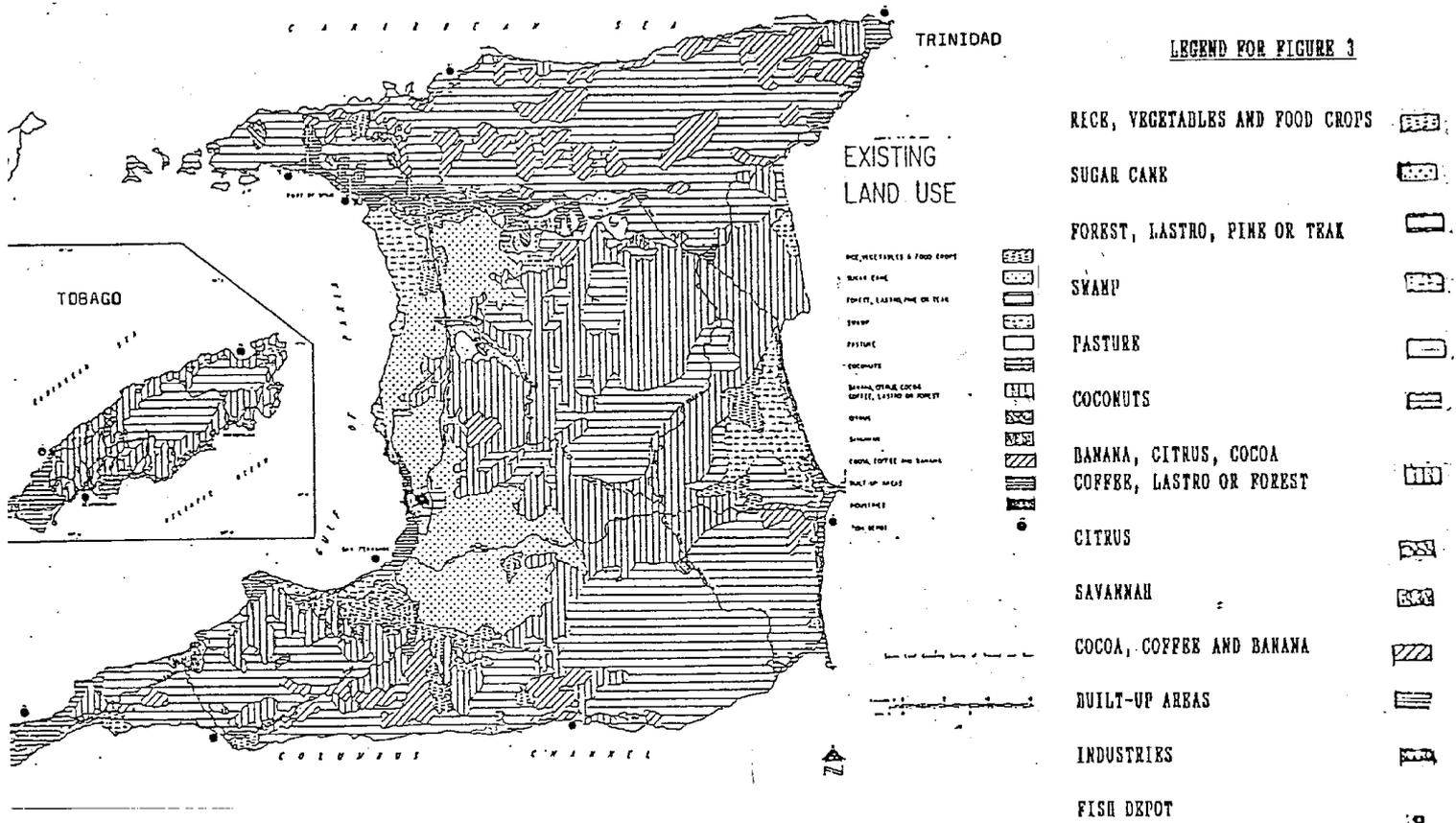




FIGURE 3 EXISTING LAND USE IN TRINIDAD AND TOBAGO





CHAPTER 1

Introduction To Country And Its Agricultural Sector

1.1 INTRODUCTION

The English speaking Republic of Trinidad and Tobago (T&T) lies at 10°N latitude and 60°W longitude (Figure 1) covering an area of 5,128 sq. km. with a cosmopolitan population of 1.3 million.

The tropical humid climate is characterized by a rainy season which extends from June to December and a dry season which extends from January to May. The annual average rainfall is 2150 mm and the annual minimum temperature is 22°C while the maximum is 32°C.

The main ecological types include rain forests, humid forests and savanna. The main ecological zones include coastal regions, river valleys, humid regions, hilly slopes and marine and fresh water ecosystems. There are six major soil types in Trinidad, nine in Tobago (Figure 2), and thirteen major land use patterns in T&T (Figure 3).

Trinidad may be classified as a “continental” island with regard to its South American genesis. A number of endemic plant species is known to exist arising out of the ecology produced by its continental past and recent insular status. Tobago is characterised by a generally rugged elevation with the only extensive lowland being a coral platform at the south western end.

The crystallines which form the northern range of Trinidad however underlies most of Tobago. The limited annual rainfall (< 130 cm) in Tobago and the extended dry season supports semi-evergreen forest wherein only two apparent tree stories exist. The associated palms, lianes and epiphytes therefore become very rare. Though secondary forest growth may also be found in damaged areas in Tobago, there is considerable natural regeneration of original species.

Williams (1949) documented the presence of wild plant species in T&T, some of economic value and others of aesthetic value. Annex I provides their classification.



Environmental degradation is threatening to destroy our species- rich and diverse ecosystems thereby resulting in irreversible damage and subsequent loss of plant genetic resources (PGR).

It should be noted though that spontaneous settlement, as a contributor to environmental degradation, is not as relevant in Tobago as it is in Trinidad.

1.2 THE AGRICULTURAL SECTOR

1.2.1 Land

The total arable area in T&T is estimated at 312,568 ha of which 44,239 ha are under permanent crops and 35,960 ha under annual crops. In addition to arable land, wetlands (comprising mainly mangrove forests) occupy 23,540 ha and natural forest cover, 230,000 ha.

1.2.2 Labour

The total labour force of the agricultural sector is approximately 54,000 and represents 13% of employment in all industries (CSO, 1994). Self employment in the agricultural sector accounts for 50% of the total agricultural labour force. The remaining 50% are employed equally between State-owned and private farms.

1.2.3 Infrastructure

The Republic is serviced by a network of highways, main roads and secondary roads totalling approximately 13,000 km. Agricultural access roads total in excess of 2000 km and are maintained by the Ministry of Agriculture, Land and Marine Resources (MALMR).

The main irrigation and drainage networks are concentrated in major agricultural production areas such as Plum Mitan, Caroni, Aranguez and Oropuche.

Wholesale markets are located in Port-of-Spain and Debe while retail markets are located in each of the eight counties in Trinidad and the two towns in Tobago.



1.2.4 Agricultural Production

The principal agricultural products are sugar, cocoa and coffee beans, citrus and copra. In 1993 exports of these commodities totalled TT\$ 185.0 M. In 1991, export value of vegetables, pulses, rootcrops and herbs and spices was TT\$ 7.0 M compared with imports of TT\$ 156.0 M.

In 1993 local rice production totalled 16.0M kg. however, 59.8 M kg. had to be imported.

1.2.5 Plant and Planting material

Farmers obtain seed material by retaining a portion of their crop as seed for replanting or by purchasing imported seed (mainly vegetable hybrid seeds) from private companies and/or the state. Vegetatively propagated planting material is maintained by both farmers and Government propagation stations. Planting materials for tree crops such as cocoa, citrus, mango and avocado are produced and distributed by the state. It is anticipated that the State would perform a more regulatory and facilitatory function in the production arena and that the private sector would assume a major responsibility for plant and planting material production. For comparison, 390,000 cocoa, citrus, mango and avocado plants were distributed by the state in 1992 whilst only 98,000 plants were distributed in 1994¹.

1.2.6 The Farming Community

The major categories of private farming based on socio-economic factors and technology utilisation are:

(i) subsistence level (35%)	-tree crops, root crops, vegetables, legumes and livestock.
(ii) commercial level (65%)	-vegetables, sugarcane, rice, rootcrops, cutflowers, and ornamentals, citrus, cocoa and bananas

Mixed farming systems constitute the majority of both subsistence and commercial farmers.

The agro-industrial subsector reflects a ratio of 1:2 of large to small multinational and local privately owned institutions.

¹ Annual Reports of MALMR, 1990-1994.



1.2.7 Major Pests and Diseases

The major pests and diseases which affect crops of economic importance are:

Black pod disease	Cocoa
Froghopper	Sugar cane
Citrus tristeza virus (CTV)	Citrus
Thrips, whitefly, bacterial wilt and anthracnose	Vegetables
Cassava bacterial blight and <i>Megastres grandalis</i>	Rootcrops
Tephritid fruit fly	Tropical fruits

Methodologies to address these problems emphasise integrated pest and disease management and include the use of tolerant or resistant rootstock, the selection/breeding of resistant varieties and the identification of resistant varieties.

1.2.8 The Public Sector in Agriculture

Enterprises which contribute to national agricultural development are:

Caroni (1975) Limited	Major producer and sole processor of sugar products. Now diversified to include citrus and rice. Strong agricultural research and extension.
National Flour Mills	The principal activities are the production and distribution of flour and related wheat by-products, soybean products and rice products. Some 10% of its output are exported.
National Agro-Chemicals Limited :	The Company operates a mixed blend fertilizer plant at Point Lisas and exports to regional markets. Joint venture (private foreign multinationals and government) options may soon develop into an enhanced fertilizer blending/bagging plant.
Agricultural Development Bank (ADB)	The objectives of the bank are to encourage the development of the sector by mobilizing and providing the necessary resources.
National Agricultural Marketing and Development Company (NAMDEVCO):	Manage the wholesale markets and provides marketing information to the farming and wider community.



1.2.9 Agricultural Incentives

Mainly in the form of subsidies, agricultural incentives include price support, e.g. guaranteed prices, subsidies for soil conservation, vehicles, wheel-tractors, equipment and machinery, and fiscal incentives encompassing duty-free concessions, purchase tax, stamp duty and Value Added Tax (VAT) exemptions and zero rated VAT on selected items.

Income tax exemption is also provided, for a maximum period of ten (10) years, for approved agricultural holdings less than or equal to 40.5 ha.

1.3 FOREST RESOURCES

Inclusive of plantations (21,400 ha), other nonforested areas within the natural forests (56,100 ha), and private forests (54,400 ha) this country reports a healthy forest cover of approximately 60%. However, over the past two (2) decades the natural forests have come under increasing developmental pressure.

For the period 1964 to 1984, forest reserves have been reduced from 28 to 24 percent of the total land area.

It is estimated that approximately 300 ha of forest cover are lost annually due to illicit activities. Table 1 details our natural forest types based on climatic diversity.

Table 1 Broad Natural Forest types and hectarage

Types	Hectarage
Evergreen seasonal forest	98,180
Semi-evergreen seasonal forest	13,928
Deciduous seasonal forest	3,617
Dry evergreen forest	495
Seasonal montane forest	926
Montane forest	21,619
Swamp forest	16,789
Secondary forest	22,650
Total	178,204



The major forest activities are logging, pole and picket production, hunting, mining and exploitation of minor forest produce. The single most important item continues to be round log production from natural forests and plantations of teak and pine for the saw-milling industry. New plantations of mixed hardwood, pine and teak are established annually.

The Flora of Trinidad and Tobago reports several plant species as either endemic to Tobago or as that which has been located there and not in Trinidad. These include *Alcmene tobagensis*, *Salacia granulata*, *Paullina exisa* (endemic), *Mimosa tobagensis* (endemic), *Myrcia tobagensis*, *Tococa broadwayi*, *Duggena incanescens*, *Alibertia tobagensis*, *Guettarda tobagensis*, *Psychotria tobagensis*, *Tobagoa maleolens*, *Alternanthera Ingramiana*, *Piper mormicola* and *Roupala tobagensis*.

Annex II lists the minor products from the forests of T&T, and their uses.



CHAPTER 2

Indigenous Plant Genetic Resources

2.1 INTRODUCTION

This chapter focuses on our country's wild relatives of crop germplasm of economic importance, indigenous forest species and, marine and coastal PGR.

By way of definition endemic/native means germplasm that is peculiar to a specific locality and rare refers to species occurring in limited numbers usually in a limited range or a restricted or specialised habitat.

2.2 FOREST GENETIC RESOURCES

This country has a long history of forest resource conservation. Systems for the management and rational exploitation of the Forestry resources are well developed but the intensive management of the resource has not reached its full potential.

The activities of the Forestry Division focus on conservation (including wildlife conservation, watershed management and the protection of biodiversity), sustainable exploitation of the forest resources, reforestation and recreational use.

Local trials of *S. macrophylla* are also conducted, utilizing nationally collected parent material, for assessment of resistance to the *Meliaceae* shoot borer and adaptability to T&T.

The total forest area (255,688ha) classified by the Canadian International Development Agency (CIDA) in 1980 - based on 1969 aerial photographs - is presented in Table 2.



Table 2 Forest types by species association and hectarage

Forest Type	Area(ha)
Crappo -Fineleaf-Carat	43,076
Mora	20,228
Serrette-Bois gris	21,486
Crappo-Debasse	19,560
Crappo-Fineleaf-Cocorite	8,829
Crappo-Blackheart-Cocorite	5,784
Purpleheart-Bois lissette	4,888
Acurel-Mousarra-Jiggerwood	4,594
Acurel-Gommier	4,139
Naked Indian-Incense-Poui	3,670
Bois Bande-Mountain Guatecare	1,030
Moussara-Figuier	254
Other	118,150

Protection forests occupy 32,200ha and production forests, 94,300ha. The protected forests are allowed to maintain its biological diversity and regenerate naturally without any silvicultural intervention given their role in conservation. The production forests excluding plantations (78,000ha) are sustainably managed under four silvicultural and management systems. These are the open range, the periodic block with and without marking and the shelterwood systems.

2.2.1 Open Range System

In this widely used system, individual licensed loggers are allowed to select and harvest a specified volume or number of trees anywhere in a defined range. The trees are inspected and approved for felling by forest officers based on minimum girth limits, replacement trees within a specified distance, stocking of trees, forest structure, wildlife, and soil considerations. Where forest degradation has occurred due to unsustainable or selective harvesting, replacement is pursued with teak (*Tectona grandis L. F*) and/or Caribbean Pine (*Pinus caribaea var hondurensis*). Plantations of indigenous and/or exotic species are also encouraged.

2.2.2 Open Range System within Blocks

This variant of the open range system was introduced to prevent overcutting, harvesting degradation and uneven harvesting. Harvesting is confined to a single block for a specified time after which period it may be closed.



2.2.3 Silvicultural Marking within Blocks

This system is the most intensive of the natural forest management systems. Trees are marked for removal within a block of predetermined size in order to maintain a satisfactory forest structure, species composition, and distribution of young and valuable species. The system is basically a crown thinning in which trees are favored for the next cutting cycle in 30 years. The block is opened for two years to permit sale of trees and closed for 28 years on a polycyclic regime.

This system was introduced in the Mora Forests of the Victoria Mayaro Forest Reserve in 1974. More recently compulsory felling of less valuable species has led to an improvement in stand composition and quality and yield potential of the original forest.

2.2.4 Arena Tropical Shelterwood System

The Arena Shelterwood system is the most widely known of the management systems in Trinidad resulting in improved species composition and maintenance of biological diversity.

In this system, commencing in 1932, timber fellings and fellings by charcoal burners were regulated so that at the end of exploitation within an area a shelterwood of dominants was left standing. In the following year there was abundant regeneration of species which either at Arena or from surrounding areas. The system developed over time with careful control of logging intensity, canopy opening, maintenance of regeneration and removal of undesirable trees for charcoal.

From 1950-1963 due to the reduced activities of charcoal burners, management continued by poisoning the unwanted weed trees. The areas regenerated by this system have excellent stands of managed natural forests with estimated yields of over $5 \text{ m}^3 \text{ ha}^{-1} \text{ yr}^{-1}$ of valuable species.

Approximately 2,600ha of natural forests has been managed using this system. In summary, the management systems utilized in the forests of Trinidad and Tobago have led to a change in species composition and stand structure. However, this change has not affected the forest types nor the main species within these types. At present species or groups of species within the natural forests which are threatened are not known.



The open range system is expected to be gradually phased out. Future management will however be based on the Arena Tropical Shelterwood system and silvicultural marking within blocks with compulsory felling of all marked trees. It is therefore envisaged that the forest genetic resources of the country will be maintained intact.

2.3 MARINE AND COASTAL PLANT GENETIC RESOURCES

There is great diversity of natural and man made aquatic environments in Trinidad and Tobago i.e. extensive river systems, artificial drainage channels, swamps and reservoirs.

Stagnant water in the areas of impeded drainage predisposes the growth of aquatic plants producing swamp conditions. Such conditions may be found at O'Meara, Fishing Pond and the Los Blanquizales Lagoon but a larger area exists at the Nariva Swamp. During the dry season however, "marsh" conditions seem to predominate at the Nariva Swamp. This area supports floating and partially submerged aquatic plants, rooted herbaceous vegetation and tree swamp, including some patches of palm forests, thereby producing a great variety of habitats for animal life.

At Nariva where fresh and sea water mix, mangrove swamp develops. The dominant species is the Red mangrove though the black and white mangrove grow in association. Our reservoirs also greatly increase the area of habitat available to aquatic plants.

A wide range of aquatic plants is sold by garden centres for ornamental ponds or by petshops for fish tanks and home aquaria, but the only cultivated aquatic food plant is the water cress (*Nasturtium officinale*).

2.4 ENDEMIC/NATURALISED PLANT SPECIES

Table 3 presents a list of endemic/naturalised species compiled from the Flora of T&T, unpublished sources and personal communication. This list however, needs verification. Many are of economic importance, others of known potential and yet others of unknown use. Exploratory and developmental initiatives are of crucial importance in exposing and sustainably exploiting the genetic resources therein.


Table 3 List of Endemic Plant Species (R = Trinidad O = Tobago)

<i>Alibertia acuminata</i>	- Rubiaceae	R
<i>Annona trinitensis</i>	- Anonaceae	R
<i>Anthurium aripoense</i>	- Araceae	R
<i>Arrabidaea oxycarpa</i>	- Bignoniaceae	R
<i>Axonopus equitans</i>	- Graminaceae	R
<i>Basanacantha phyllosepala</i>	- Rubiaceae	RO
<i>Beloperone flaviflora</i>	- Acanthaceae	R
<i>Bursera trinitensis</i>	- Burseraceae	R
<i>Capparis trinitensis</i>	- Capparidaceae	R
<i>Carica papaya sub spp.</i>	- Caricaceae	R
<i>Chimarrhis microcarpa</i>	- Rubiaceae	R
<i>Chrysophyllum beardii</i>	- Sapotaceae	R
<i>Citrus limetta</i>	- Rutaceae	R
<i>Clidemia cruegeriana</i>	- Melastomaceae	R
<i>Clidemia microthyrsa</i>	- Melastomaceae	R
<i>Clidemia trinitensis</i>	- Melastomaceae	R
<i>Clusia aripoensis</i>	- Guttiferae	R
<i>Clusia intertexa</i>	- Guttiferae	R
<i>Coccoloba nigrescens</i>	- Polygonaceae	R
<i>Croton aripoensis</i>	- Euphorbiaceae	R
<i>Ctenitis kallooi J&W BM</i>	- Tectarioideae	R
<i>Cybianthus cruegeri</i>	- Myrsinaceae	R
<i>Cynanchum freemani</i>	- Asclepiadaceae	R
<i>Dacryodes trinitensis</i>	- Burseraceae	R
<i>Dicliptera aripoensis</i>	- Acanthaceae	R
<i>Ecclinusa grisebachii</i>	- Sapotaceae	R
<i>Epidendrum bradfordii</i>	- Orchidaceae	RO
<i>Epidendrum hombersley</i>	- Orchidaceae	RO
<i>Eschweilera sandwithiana</i>	- Lecythidaceae	O
<i>Eschweilera trinitensis</i>	- Lecythidaceae	R
<i>Eugenia cruegeri</i>	- Myrtaceae	R
<i>Eugenia dussii</i>	- Myrtaceae	RO
<i>Eugenia megalocarpa</i>	- Myrtaceae	R
<i>Euterpe broadwayae</i>	- Palmae	R
<i>Galactia trinitensis</i>	- Leguminosae	R
<i>Hillia trinitensis</i>	- Leguminosae	R
<i>Ichnanthus ichnodes</i>	- Gramineae	R


Table 3 (cont'd) List of Endemic Plant Species (R = Trinidad O = Tobago)

<i>Isothecha alba</i>	- <i>Acanthaceae</i>	R
<i>Licania cruegerana</i>	- <i>Rosaceae</i>	RO
<i>Macrocarpaea arborea</i>	- <i>Gentianaceae</i>	R
<i>Macrobium trinitense</i>	- <i>Caesalpiniaceae</i>	R
<i>Mammea americana</i>	- <i>Guttiferae</i>	R
<i>Marcgravia elegans</i>	- <i>Mancgraviaceae</i>	R
<i>Marcgravia hartii</i>	- <i>Mancgraviaceae</i>	R
<i>Marthella trinitatis</i>	- <i>Buranniaceae</i>	R
<i>Maxillaria albiflora</i>	- <i>Orchidaceae</i>	R
<i>Maximiliana caribea</i>	- <i>Palmae</i>	R
<i>Maytenus monticola</i>	- <i>Celastraceae</i>	R
<i>Micropholis cruegeriana</i>	- <i>Sapotaceae</i>	R
<i>Mikania broadwayi</i>	- <i>Compositae</i>	R
<i>Mikania rotunda</i>	- <i>Compositae</i>	R
<i>Myrcia granulata</i>	- <i>Myrtaceae</i>	R
<i>Necramium gigantophyllum</i>	- <i>Melastomaceae</i>	R
<i>Notylia angustifolia</i>	- <i>Orchidaceae</i>	R
<i>Notylia punctata</i>	- <i>Orchidaceae</i>	R
<i>Omphalea megacarpa</i>	- <i>Euphorbiaceae</i>	RO
<i>Oncidium haematochilum</i>	- <i>Orchidaceae</i>	R
<i>Ornithocephalus cruegeri</i>	- <i>Orchidaceae</i>	R
<i>Ouratea purdieana</i>	- <i>Ochnaceae</i>	R
<i>Philodendron fendleri</i>	- <i>Araceae</i>	R
<i>Philodendron krugii</i>	- <i>Araceae</i>	RO
<i>Philodendron simsii</i>	- <i>Araceae</i>	R
<i>Phoradendron ayliffii</i>	- <i>Araceae</i>	R
<i>Phoradendron chaguaramasanum</i>	- <i>Loranthaceae</i>	R
<i>Picramnia antidesmoides</i>	- <i>Simarubaceae</i>	R
<i>Pleurothallis archidiaconi</i>	- <i>Orchidaceae</i>	R
<i>Pouteria caimito</i>	- <i>Sapotaceae</i>	R
<i>Pouteria hartii</i>	- <i>Sapotaceae</i>	R
<i>Prestonia brittoni</i>	- <i>Apocynaceae</i>	R
<i>Psychotria rufidula</i>	- <i>Rubiaceae</i>	R
<i>Rhynhospora aripoensis</i>	- <i>Cyperaceae</i>	R
<i>Rhynhospora triflora</i>	- <i>Cyperaceae</i>	R
<i>Rollinia multiflora</i>	- <i>Annonaceae</i>	R
<i>Rondeletia hispidula</i>	- <i>Rubiaceae</i>	R
<i>Securidaca lophosoma</i>	- <i>Polygonaceae</i>	R



Table 3 (cont'd) List of Endemic Plant Species (R = Trinidad O = Tobago)

<i>Senecio freemanii</i>	- Compositae	R
<i>Sicana trinitensis</i>	- Cueurbotaceae	R
<i>Sloanea trinitensis</i>	- Elacocoupaceae	R
<i>Solanum capillipes</i>	- Solanaceae	RO
<i>Solanum cataractae</i>	- Solanaceae	R
<i>Staurogyne trinitensis</i>	- Acanthaceae	R
<i>Styrax glaber</i> var. <i>micranthus</i>	- Styacaceae	RO
<i>Tetracera trinitensis</i>	- Dilleniaceae	RO
<i>Vanilla hartii</i>	- Orchidaceae	RO
<i>Vriesia broadwayi</i>	- Bromeliaceae	RO
<i>Vriesia glutinosa</i>	- Bromeliaceae	R
<i>Xyris grisebachii</i>	- Xyridaceae	R

2.4.1 Crop Genetic Resources

Some socially and economically underutilized agro-germplasm include *Averrhoa carambola*, *Passiflora edulis*, *Guilielma speciosa*, *Anacardium occidentale* and *Garcinia mangostena*.

Crops of economic importance of the following genera of *Xanthosoma*, *Colocasia*, *Manihot*, *Mordica*, *Cumus*, *Lycopersicum*, *Hibiscus*, *Carica*, *Solanum* and *Coffea* also have wild relatives of potential.

Within the farming community a small percentage of farmers continues to plant traditional cultivars of *Solanum spp.* and the above mentioned root crops due to their wide spatial stability, the lack of an awareness of improved planting material, the high cost of improved material and the farmers own social and traditional preferences. There is therefore limited conservation of land races and traditional cultivars or farmer varieties at either the state or farm level. In our proposed plant genetic resources management (PGRM) programme, provision has been made to conserve and characterize these cultivars. Already attempts are underway, by the Cocoa Research Unit (CRU), to identify traditional varieties of cocoa wherein seedling material from “old” cocoa estates, not clonal material, are being collected for characterization studies.

2.4.2 Environmental Horticulture and Ornamental species

Species of the *Araceae*, *Bromeliaceae*, *Orchidaceae* and *Palmae* families are of known potential in the floriculture and landscaping industries. The *Orchidaceae* in particular have been used extensively in commercial plant breeding and the *Araceae* and *Bromeliaceae* are of potential in both potted plant and floral



arrangement activities. The *Palmae* are of landscaping value (i.e. amenity) and are also known to contribute to ecological stability and maintenance of the integrity of wildlife habitats. Other examples of plant species which may be classified under this general subheading are *Aechmea spp.*, *Mauritia flexiosa*, *Jessenia oligocarpa*, *Philodendron fendleri*, *Cyathea spp.*, *Isertia parviflora* and *Coccoloba uvifera L.*

Factors which contribute to genetic erosion include the use of new varieties, poor agricultural practices e.g. slash and burn agriculture, environmental degradation and socio-economic factors (squatting).

Our PGR holdings are inadequate for projected use including commercial exploitation.

Additionally there is a pressing need to rationalise and augment the National Seed Programme with emphasis on Human Resource Development and, storage capabilities.

In this regard the Food and Agriculture Organisation of the United Nations (FAO) has been providing assistance by way of infrastructure development, provision of seed cleaning equipment and facilities for conditioned storage.



CHAPTER 3

In-Country Uses of Plant Genetic Resources

3.1 INTRODUCTION

The judicious utilization, development and distribution of national PGR is a critical factor for the success or failure of the agricultural sector in T&T. Stakeholders of our national PGR include farmers, researchers (Table 4), agro-processors, private companies, plant breeders and international research organisations. These stakeholders derive benefits such as the use of germplasm resistant to specific pests and diseases of economic importance, higher crop productivity which ultimately contributes to national food security.

Table 4 Staffing of the National Agricultural Research Institutions, 1992

Institution	Professional	Support Staff	Total
CARDI	14	2	16
CARIRI	17	19	36
CRS	9	80	89
CRU	7	9	16
U.W.I.	69	119	188
MALMR (RESEARCH DIVISION)	51	559	610
NAMDEVCO	5	6	11
SFC	6	56	62
ADB	5	4	9
IIBC	3	5	8
TOTAL	186	859	1 045

Source: Final Report of the Task Force to review the Research Management System in the MALMR.

The use of PGR collections in national crop improvement and plant and planting material distribution programmes in the MALMR, the University of the West Indies (U.W.I.) and Non-Governmental Organisations (NGOs) for ten species of economic importance are presented in Table 5.



Table 5 National Crop Improvement Programmes

Species	Orgorganization	Activities
1. COCOA	MALMR, CRU	Agronomy, Health, Breeding, Research, Planting material production and distribution
	MALMR CRU	Post harvest Management, Mechanization Breeding/Morphological characterization, Biochemical characterization, Physiology and Plant Pathology
2. CITRUS	MALMR	Agronomy, Health, Seeds, Post harvest, Crop Improvement, Planting material production and distribution.
	CRS	Health, Weed Control
3.COCONUT	MALMR CARDI	Agronomy, Health Research
4.SUGAR CANE	CRS	Agronomy, Health, Breeding, Soil Fertility, Weed Control, Crop Improvement.
	UWI	Processing (Economics), Health
5. RICE	MALMR	Agronomy, Health, Seeds, Germplasm screening, Weed Control, Post Harvest, Planting material production and distribution
	CRS	Agronomy, Breeding, Health, Weed Control, Soil fertility.
	UWI	Agronomy, Breeding.
6. PINEAPPLE	MALMR	Agronomy, Health, Post Harvest
7. PIGEON PEA	MALMR, CRS, UWI,	Agronomy, Plant Production and Distribution
	CARDI	Agronomy
	CRS, UWI	Breeding, Health
8. COWPEA	UWI	Agronomy, Breeding, Health, Soils
	MALMR	Health, Post Harvest, Planting material production and distribution
9. CASSAVA.	MALMR	Agronomy, Breeding, Health, Post Harvest and Morphological characterization, Planting material production and distribution.
10. HOT PEPPER	CRS	Agronomy, Breeding, Health
	UWI	Agronomy
	MALMR	Agronomy, Health, Post Harvest, Seed production and distribution. Agronomy, Health, Post Harvest, Seed production and distribution.



3.2 TROPICAL FRUITS

Several tropical fruits are consumed in the fresh state. They may also be candied, pickled, preserved or otherwise processed. Annex III lists the PGR, their common names and methods of consumption.

3.3 FOREST RESOURCES

The forest resources of the state directly contribute to maintaining the integrity of ecosystems and wildlife habitats, watershed management and to mitigation of the influences of climate. The lumber processed from the tree species are utilized in the construction and furniture industries whilst fibres and basket making materials are utilised in the handicraft industry. Specific mention must be made of *Ryania speciosa*, the stems of which are exported in limited quantities for use as an organic insecticide. Other forest resources have potential value for the commercial cutflower and potted plant industry, landscaping, industrial chemicals, cosmetic, medicinal and related industries.

3.4 MONGROVE

Amongst the many uses of the mangrove is its application as a source of dye or tannin in the manufacture of leather products. Table 6 lists a wider range of use of this species.

Table 6 Uses of the *Rhizophora mangle* (red mangrove)

Root system	nurseries and protection for fin and shell fish and shrimp and oysters
Extract of roots	preservation of fishing lines and nets
Bark	tanning of leather, production of glue, dyes and stains
Trunk	fuel and timber uses
Crown	wildlife habitat
Flowers	rich in nectar and a good source of white honey
Leaves	used in teas or for medicinal purposes



3.5 PHYTOCHEMICAL RESOURCES

More than one hundred plants are known to be used for medicinal purposes (Annex IV provides the common names). Annex V lists those with potential to contribute to the cosmetic industry. Annex VI however, lists some of the germplasm recommended for evaluation for their chemical constituents.

Table 3(cont'd) List of Endemic Plant Species

Some of the naturalized plants of this country of notable importance are the West Indian cherry as a source of vitamin C and tobacco as a source of nicotine (as an insecticide). The nicotine may be converted into the vitamin niacin. The chemical naringin which can be converted into a non-toxic sweetener, several times sweeter than saccharin, is found in the peeled skins of grapefruit. Bromelin, extracted from pineapples and papain from pawpaw are known to be used as meat tenderizers.

3.6 AQUATIC AND SUB-AQUATIC PLANT SPECIES

A variety of rooted aquatic plants, particularly sedges, are utilised in the handi-craft industry. A list of economically important aquatic plant species is presented in Table 7.

Table 7 Economically Important Aquatic Plant Resources

Scientific name	Common Name	Uses
MONOCOTYLEDONS		
<i>Sagittaria spp.</i>	Arrow head	Ornamental and Fish ponds
<i>Cryptocornye spp.</i>		Fish ponds
<i>Hydrocleys nymphoides</i>	Water poppy	Ornamental ponds
<i>Limnocariss flava</i>	Water poppy	Ornamental ponds
<i>Egeria densa</i>		Ornamental and Fish ponds
<i>Ottelia sp.</i>		Fish ponds
<i>Lemna perpusilla</i>		Ornamental ponds
<i>Najas sp.</i>		Ornamental ponds
<i>Eichhornia crassipes</i>	Water hyacinth	Ornamental ponds
<i>Pontederia cordata</i>		Ornamental ponds
DICOYLEDONS		
<i>Avicennia germinans</i>	Black mangrove	Timber and tannin
<i>Languncularia racemosa</i>	White mangrove	Minor use for timber
<i>Nymphaea amazonum</i>	Waterlily	Ornamental ponds
<i>N. rudgeana</i>	Waterlily	Ornamental ponds



Other aquatic species of potential economic importance but for which little investigative work has been done include seaweed for use in food e.g. salads or in agar production and which may also contribute to the food industry as a stabilizing, thickening and gelling agent. *Gracilaria debilis* (seamoss) is currently commercially exploited as a nutritive drink.

3.7 PLANT GENETIC RESOURCES DEVELOPMENT

Plant breeding programmes have suffered because of resource limitation and insufficient capacity. Early efforts resulted in the development of our world recognised cocoa germplasm collection (Trinidad Selection Hybrids (TSH) and Imperial College Selections (ICS)). More recently cowpea varieties resistant to Severe Cowpea Mosaic Virus have been developed. Pigeon pea varieties with improved characteristics, including suitability for mechanical harvesting, have also been developed. The erect habit of recently developed cowpea varieties also lends this crop to mechanical harvesting.

Efforts are underway to screen local commercial anthurium varieties for resistance to *Xanthomonas* wilt. Such resistance has been identified in locally bred Calypso and Trinidad cultivars. Subsequent efforts to breed such resistance into non-resistant varieties are to be pursued.

There is however a dire need to strengthen plant breeding programmes in the context of improved plant production activities.



CHAPTER 4

NATIONAL CONSERVATION ACTIVITIES

4.1 INTRODUCTION

Germplasm conservation activities in T&T have been conducted by a number of government agencies and NGO's. Co-ordination of these efforts has been limited; thereby signalling the need to have a national conservation effort. Conservation efforts comprise both in-situ and *ex situ* activities.

4.2 *IN SITU* CONSERVATION

In situ conservation treats mainly with forest and wetland eco-systems. Forest reserves number 36 in T&T and on state-owned land 7% of the land surface (36,900 ha) is designated as protected.

From its inception, the Forestry Division has always taken an acute interest in the conservation of biological diversity. Forest reserves cover a total land area of 130,982 ha. These consist of parks (16,069 ha), wildlife sanctuaries (17,636 ha), nature reserves (652 ha), dams (809 ha), windbelts (517 ha), and production forests (77,066 ha) (Tropical Forestry Action Plan (TFAP) 1992). Additionally, there are blocks of state-owned unprotected forest cover important in biodiversity conservation.

Wetlands of importance for biodiversity in Trinidad include 6 sites on the western side of the island and one of the east. Those in the west include the Laventille Swamp, the Caroni Swamp, Pt. Lisas, the Godineau and Rousillac Swamps and the Los Blanquizales Swamp. The Nariva Swamp, which occurs along the east coast, is the largest fresh water swamp in Trinidad. In addition to these wetlands, the Marsh Forest surrounding the Aripo Savannas is a unique palm-dominated forest-type that enhances biodiversity and acts as an important buffer as it protects the open savannas which are scattered within the forest.



In Tobago, the Bon Accord Lagoon has a mangrove swamp which is critical as a buffer zone controlling water quality in the Buccoo Reef. The Kilgwyn Swamp is also found in Tobago. Both of Tobago's important wetlands are privately owned and therefore may be more vulnerable to development threats but the Crusoe Reef Society is trying to get the Bon Accord Lagoon designated as a protected area.

Finally the islets around T&T are quite important sites for biodiversity conservation. Five of the islands have been designated as wildlife sanctuaries however this does not guarantee protection. Kronstadt Island, for example, has been heavily damaged.

4.3 EX SITU CONSERVATION

National *ex situ* PGR conservation is manifested mainly through field and seed collections and in vivo storage. These activities are conducted at the MALMR (including Forestry Division), the UWI, Caroni (1975) Ltd. and other sites including commercial and semi-commercial holdings, private farms and private holdings.

4.3.1 Field Genebanks

The main field genebanks are within the MALMR, UWI and Caroni (1975) Ltd.

Research Division (MALMR) Centeno

- (i) **Fruit/Tree crops:** *Achras spp.*, *Anacardium spp.*, *Annona spp.*, *Artocarpus spp.*, *Averrhoa spp.*, *Chrysophyllum spp.*, *Eugenia spp.*, *Garcinia spp.*, *Mangifera spp.*, *Melicococcus spp.*, *Musa spp.*, *Passiflora spp.*, *Psidium spp.*, *Tamarindus spp.*, *Theobroma spp.*
- (ii) **Root and Tuber crops:** *Colocasia spp.*, *Dioscorea spp.*, *Ipomoea spp.*, *Manihot spp.*, *Xanthosoma spp.*, *Zingiber spp.*
- (iii) **Herbs and Spices:** *Aloe spp.*, *Cinnenomum spp.*, *Colusrina spp.*, *Curcuma spp.*, *Elletaria spp.*, *Forniculum spp.*, *Murraya spp.*, *Myristica spp.*, *Ocimum americanum*, *Ocimum basilicum*, *Pimenta spp.*, *Piper spp.*, *Thymus spp.*, *Vanilla spp.*



- (iv) **Forages:** *Andropogon gayanensis*, *Bracharia arrecta*, *Bracharia decumbens*, *Bracharia humidicola*, *Bracharia ruziziensis*, *Centrosema pubescens*, *Cynodon dactylon*, *Digitaria eriantha*, *Hermathria altissima*, *Panicum spp.*, *Pennisetum purpureum*, *Pennisetum spp.*, *Stylosanthes guianensis*, *Tripsacum laxum*, *Zonia latifolia*, *Zoysia spp.*

Agricultural Services (MALMR)

- (i) **Fruit/Tree crops:** *Citrus spp.*, *Eugenia spp.*, *Mangifera spp.*, *Persea spp.*, *Theobroma spp.*
- (ii) **Roots and Tubers:** *Dioscorea spp.*, *Ipomoea spp.*, *Manihot spp.*
- (iii) **Ornamentals:** *Achmea spp.*, *Alchosmea spp.*, *Amba spp.*, *Anthurium spp.*, *Araceae spp.*, *Blechnum spp.*, *Bromelia spp.*, *Calathea spp.*, *Carapa spp.*, *Clathratropis spp.*, *Clethra spp.*, *Clusia spp.*, *Coccoloba spp.*, *Coleus spp.*, *Congea spp.*, *Conocarpus spp.*, *Costos spp.*, *Cydista spp.*, *Cyclanthaceae spp.*, *Euphorbiaceae spp.*, *Eugenia spp.*, *Evodianthus spp.*, *Excoecaria spp.*, *Filicales spp.*, *Ficus spp.*, *Flacourtiaceae spp.*, *Forcinia spp.*, *Gesneraceae spp.*, *Gloxinia spp.*, *Gravisa spp.*, *Geravea spp.*, *Gutterferae spp.*, *Guizmania spp.*, *Heliconia spp.*, *Isertia spp.*, *Jessenia spp.*, *Kohlesia spp.*, *Labiatae spp.*, *Lacthindaceae spp.*, *Lawsonia spp.*, *Leguminoseae spp.*, *Marantaceae spp.*, *Mancravia spp.*, *Maurita spp.*, *Mora spp.*, *Monstera spp.*, *Montagma spp.*, *Musa spp.*, *Nephelium spp.*, *Orchidaceae spp.*, *Palmae spp.*, *Philodendron spp.*, *Polybytrys spp.*, *Polydoiaceae spp.*, *Pitcairnia spp.*, *Renealmia spp.*, *Rubiaceae spp.*, *Ryania spp.*, *Sapindaceae spp.*, *Scrophulariaceae spp.*, *Selaginella spp.*, *Simarouba spp.*, *Swietenia spp.*, *Tabebuia spp.*, *Zerminalia spp.*, *Zillandsia spp.*, *Zsionilia spp.*, *Zingiberaceae spp.*

The Eastern Caribbean Institute of Agriculture and Forestry (ECIAF),(MALMR)

- (i) **Ornamentals:** *Brauassia spp.*, *Calophyllum spp.*, *Carapa spp.*, *Eucalyptus spp.*, *Hymenoea spp.*, *Manilkara spp.*, *Peltogyne spp.*, *Virola spp.*

Forestry Division, (MALMR)

- (i) **Tree species:** *Acacia spp.*, *Acauracaria spp.*, *Cedrela spp.*, *Cordia spp.*, *Gmelina spp.*, *Manilkara spp.*, *Simarouba spp.*, *Swietenia spp.*, *Tabebuia spp.*, *Mangifera spp.*

Cocoa Research Unit (CRU)

Theobroma cacao (approximately 2 500 accessions)



University of the West Indies

- (i) **Fruit/Tree crops:** *Achras spp.*, *Anacardium spp.*, *Annona spp.*, *Artocarpus spp.*, *Citrus spp.*, *Macadamia spp.*, *Mangifera spp.*, *Musa spp.*, *Persia spp.*, *Psidium spp.*
- (ii) **Root and Tuber crops:** *Dioscorea spp.*, *Ipomoea spp.*, *Manihot spp.*

Private Holdings

Three (3) major private field genebanks have been identified consisting of a wide range of exotic and tropical fruit trees as well as ornamentals.

4.3.2 Seed Storage

Seed storage of cereals, legumes and vegetable crops is practised at MALMR (Agricultural Services, Research Division and Forestry Division), UWI and Caroni (1975) Ltd. More specifically, conditioned storage is practiced at Chaguaramas Agricultural Development Project (CADP of the MALMR) and the Research Division of the MALMR, Caroni (1975) Ltd. and UWI.

At the CADP, of the Agricultural Services Division, storage (60,000kg capacity) conditions are maintained at 5°C-10°C and 45% - 55% R.H.). Legumes (pigeon pea (2 var.) and bodi), Cereals (Corn (2 var.) and Rice), Vegetables (Hot Pepper (2 var.), Ochroe (2 var.), Pumpkin (2 var.), Cucumber (2 var.), Sorrel and Tomato (2 var.)) and forest seeds are stored in either plastic bags (2 kg - 0.25 kg capacity) or crocus or jute bags under the conditions described. Rice seed produced at the Research Division for redistribution to farmers are also stored at CADP. Apart from germplasm conservation, seed for sale is also stored at CADP. Regeneration schedules are based on “in house” seed testing to determine viability and vigour.

At the Research Division (MALMR) there is limited vegetable seed germplasm conservation. Seeds of vegetable germplasm as described in Table 8 are kept in small glass bottles or plastic bags in a refrigerator.

Table 8 Seed Germplasm Conservation at the Research Division (MALMR),

Cowpea	5 var.
Sweet Pepper	3 var.
Hot Pepper	2 var.
Pumpkin	2 var.
Tomato	2 var.
Eggplant	1 var.
Cucumber	1 var.
Ochro	1 var.



Centeno

The UWI has a small storage facility for the conservation of legumes (pigeon pea, cowpea and bodi) and vegetable (tomato) seeds for their breeding and development studies.

Forest seeds are also stored at the Cumuto Station of the Forestry Division.

At Caroni (1975) Ltd., sugar cane is maintained for short periods in small scale cold storage facilities. Through intergovernmental arrangements the main seed storage bank is located in Barbados where breeding and regeneration also takes place.

4.3.3 *In vitro* Storage

In vivo collections of *Manihot spp.*, *Ipomoea spp.*, *Dioscorea spp.*, *Ananas spp.*, *Musa spp.*, and *Gracca spp.*, are maintained at tissue culture facilities in the MALMR and UWI. The MALMR facility has a national and regional responsibility and participates in regional research and exchange programmes. More recently, T&T has been identified as a regional centre for cassava conservation.

4.4 PLANT GENETIC RESOURCES COLLECTIONS POLICY

Collections are mainly sourced from farmers and international organizations e.g. Cassava from the Centro Internacional de Agricultura Tropical (CIAT), rice from the Caribbean Rice Information Network (CRIN). Such collections are used for agronomic evaluation studies, plant breeding programmes, regional and international exchange, propagation, production and commercial utilization.

4.5 PLANT GENETIC RESOURCES ACCESSIONS POLICY

The Government of the Republic of Trinidad and Tobago (GoRTT) is signatory to a number of International agreements on PGR conservation and maintains the right to expect reciprocal benefits for use of or access to endemic or naturalised PGR. Trinidad and Tobago wishes to remain the custodian of its PGR, retain access to and use of such PGR at the research, evaluation, semi-commercial and commercial levels and, access to technological or management informa-



tion advances which exist whatever the stage. It is anticipated that regulatory procedures will be instituted to ensure that the nation benefits from trade in seed, culture, cutting or live material.

Though no firm accession policy exists, technical considerations in respect of acquiring PGR include resistance/tolerance to pest and disease, changes in consumer tastes, increased yields, environmental adaptability, increased domestic consumption and export market potential.

4.6 CONSTRAINTS TO PLANT GENETIC RESOURCES MANAGEMENT

Constraints to PGR Management in respect of the major areas as outlined below are as follows:

(i) Field Genebanks

- a. The lack of proper evaluation, characterization and documentation in most of these field genebanks.
- b. Limited capabilities for collection, characterisation and evaluation of plant species of potential medicinal, cosmetic or industrial value.
- c. Insufficient training opportunities for local personnel in characterization, evaluation and the documentation of endemic PGR.
- d. Lack of secure and updated facilities.
- e. Insufficient funding for maintenance and replanting of field genebanks and for the purchase of appropriate field equipment.

(ii) *In vivo* Storage

- a. Lack of capacity for storage, transfer and hardening of plantlets.
- b. Insufficient training opportunities for local personnel in *in vivo* maintenance, regeneration and hardening of plantlets and genetic engineering.
- c. Insufficient funding for the continuous efficient operation of the laboratory.

(iii) Seed Storage

- a. Inadequate storage facilities at both CADP and the Research Division.
- b. Inadequate training opportunities in field techniques for the regeneration of genetically pure seed.



4.7 INFORMATION AND DOCUMENTATION

Nationally, information and documentation is processed at the MALMR, the National Herbarium, the Cocoa Research Unit, Caroni (1975) Ltd. and National Institute for Higher Education - Research, Science and Technology (NIHERST).

Within the MALMR, information on PGR is collected, organized, documented and disseminated at CADP and the Research Division. Information and documentation has been enhanced at CADP through the Caribbean Seed Improvement Germplasm Resource Information Network (CSEGRIN) program. CSEGRIN is a computerized database for the management of characterization data of a limited number of root crop and vegetable crops.

At Agricultural Services, an inventory of the national germplasm holdings is being developed.

The Research Division collects morphological characterization data on root crops, fruit crops, cereals and vegetable crops for dissemination through the Regional CSEGRIN programme and through global linkages including CRIN, the Centro Internacional de la Papa (CIP), CIAT, the International Institute of Tropical Agriculture (IITA), the International Information System for Agricultural Sciences and Technology (AGRIS) and the Inter-American Institute for Cooperation in Agriculture (IICA).

The present MALMR library facilities comprise specialized collections of agricultural economics, plant production, plant protection, forestry, fisheries, research and extension publications. The main co-ordinating unit is located at the Research Division and services the National Referral Centre as well as the National Agris (AGRIS Centre of T&T). This Library Unit represents the only agricultural information facility which works closely with the local agricultural societies, farmers, organizations and government collaborators including IICA, CABI, FAO, UWI and CARDI.

Such active participation in local, regional and global networks is critical to corporately satisfy PGR information needs both at the national and member country level. The organization of data is managed using the CDS/ISIS (Version 3.07) software package together with input formats compatible with UN/ECLAC and the FAO/AGRIN (Version 2.0) global information systems.

In respect of International Network to Support Regional and National Biosystematic Services, (BIONET), Trinidad and Tobago in cooperation with the Caribbean Agricultural Research and Development Institute (CARDI), UWI



and CABI is to progress the initiative aimed to establish a technical cooperation network for biosystematics in support of agricultural development, environmental protection and the conservation of genetic resources in the subregion.

The National Herbarium located at UWI provides a reliable and efficient plant identification and information service to farmers, agriculturists, researchers, students and the general public. This collection has approximately 45,000 specimens. Information of the vascular plant collection is being computerized.

The Cocoa Research Unit located at UWI, has partially documented information on the world renowned cocoa selections of the MALMR breeding programme. Characterization data using modified international leaf, flower, pod and bean descriptors are accessible through the International Cocoa Genebank Database (ICGD) based at Reading University in the U.K.

Caroni (1975) Ltd. maintains an information database on the varietal performance and characterization of sugar-cane germplasm. This system is linked with the sugar cane breeding unit in Barbados.

NIHERST mounts collaborative projects including an inventory of key plant and animal species, analytical studies to identify biologically active constituents of folk medicinal plants, plant tissue culture research and biological control of pests. The data, results and proceedings are kept in their library collection.

4.8 CHARACTERIZATION AND EVALUATION

Both the MALMR and the farming community, the latter though to a limited extent, are involved in evaluation and characterization studies. Currently modified international descriptor lists are applied to germplasm holdings at CADP with the characterization data maintained on the CSEGRIN database.

It is expected that evaluation studies will continue to be pursued at the farm level. Characterisation will however remain a specific focus of the MALMR.



CHAPTER V

National Policies and Goals, Programmes and Training and Legislation

5.1 NATIONAL POLICIES AND GOALS

The GORTT has identified in its Medium Term Policy Framework 1994 -1996 its commitment to the development of the Agricultural Sector as a primary source of economic activity. In this context the mission of the MALMR has been defined as facilitatory to sustainable development of Agriculture, Forestry and Fisheries while conserving and enhancing (safeguarding) the environment and strengthening the capabilities of our clients.

The MALMR Strategic Plan 1993-1995 has recognized the Agricultural Services Division, the Forestry Division and the Research Division as its primary operational arms with responsibility for PGR conservation and management. Other collaborators include the UWI, Caroni (1975) Ltd., the Cocoa Research Unit, private farmers and organisations.

However the need exists to establish a formalized mechanism for effective national PGRM. Such an action will also support our government's international commitments.

Ongoing major strategies intended to promote the development of the agricultural sector include enhanced market intelligence, the expansion of non-traditional export agriculture, accelerated joint-venture investments, effective land administration and use and rationalization of agricultural research, extension and education.

In respect of the lattermost, the UWI and ECIAF are expected to reorient their training programmes to incorporate resource management, environmental assessment, management and protection and other areas related to safeguarding our natural resource base.

In the context of national forestry activities, an appropriate balance is being sought between protection and production forestry and this approach is to facilitate extensive participation of the private sector.



Long term trade and pricing policies are to be pursued thereby encouraging domestic resource use and increasing the contribution of the agricultural sector to national income. However there will be an increase in import competition in a managed fashion.

Strategies intended to contribute to the achievement of the sustainable development of the agricultural sector and contained in the Food and Agriculture Policy are presented hereunder:

Economic

Establish a mechanism for directing support to vulnerable producer groups and sub-sectors.

Examine the feasibility of special rates for water and electricity for agriculture.

Major International Treaties/Agreements

Strengthen the institutional capacity of the MALMR and affiliated agencies to prepare technical briefs and to participate in negotiations.

Involve producers in preparation of negotiating positions.

Cease membership in organizations that provide few benefits in relation to costs.

Natural Resource/Environment

Update legislation to protect natural resources and environment.

Strengthen regulatory services and also encourage community participation in protection.

Use public funds to restore damaged areas and also encourage private sector participation.

Improve management of forest resources.

Social Issues

Promote the development of farmers, fishermen and foresters organizations.

Remove squatters from ecologically sensitive areas and prevent further squatting.

Recognize the importance of small scale farming and strengthen institutional support to small farmers,

Adopt gender sensitive approaches to agricultural development.



Encourage domestic farming for low income groups.

Institutional Support

Strengthen the institutional capability of the MALMR to undertake policy review and analysis.

Introduce a process for consultation within the sector in development of policy. Establish mechanisms for communication between research and extension and for client participation in planning of agriculture development.

State Owned Enterprises (SOE)

Reduce monopoly status of the SOE in the sector.

The following actions however have been identified to address the significant issues affecting the development of PGR:

- (i) provision of training for farmers in planting material selection,
- (ii) training in standards and quality,
- (iii) facilitation/implementation of a licensing process for input suppliers,
- (iv) promotion of research fostering exploitation of indigenous plant species,
- (v) giving effect to Environmental Protection Issues,
- (vi) exploring Caribbean Community (CARICOM) cooperation,
- (vii) granting scholarships/fellowships for study in amongst others:
 - a. Environmental Engineering,
 - b. Computerized Information Systems Management.

5.2 NATIONAL PROGRAMMES

The responsibilities associated with the programmes include the identification, selection, adaptation and development of appropriate technology to enhance crop production; the acquisition and conservation of germplasm to expand and preserve genetic potential; the conservation of indigenous plant material and the introduction of plant species and cultivars to promote the development of the floriculture industry.



Major activities relating to specific crops/commodities of economic importance and areas of responsibility are detailed in Table 9.

Table 9 Major Plant Biodiversity Conservation Programmes in the MALMR

Crop/ Commodity	Activities
Citrus	Propagation, production and establishment of Citrus Tristeza Virus (CTV) tolerant rootstock trees and disease free budwood to provide seed for future use
Tropical Fruits	Propagation available tropical fruits with market potential
Herbs and Spices	Development and maintenance of a germplasm bank of herbs and spices
Vegetables	Germplasm conservation of vegetable crops (pumpkin, ochro, hot pepper, eggplant, tomato and bodi)
Root Crops	Germplasm acquisition, maintenance and morphological description
Cut Flowers and Foliage	Maintenance of existing germplasm
Endemic/ naturalised plant species	<i>Ex-situ</i> conservation of plant species endemic, rare, threatened or endangered plant species; development and management of a plant biodiversity database. and biogeographic mapping
Landscape Management	Identification of unique/significant landscapes, providing for the <i>in situ</i> conservation/protection of endemic, rare, threatened or endangered plant species; restoration of degraded landscapes and watershed protection
Public Education	Promotion of a programme to inform the public of the value and significance of our plant biodiversity as an integral part of our natural environment

5.3 TRAINING

The training needs required to effect an enhanced national PGR programme include:

- (i) Increasing the number of trained personnel and posts in plant breeding, agronomic evaluation, taxonomy, statistical sampling, biotechnology, public awareness and education. Such trained personnel should be the primary motivators in a national PGR conservation and management programme. There are limited in-country training opportunities for either local and regional personnel. In this regard attachments and exchanges to relevant germplasm conservation institutions abroad are necessary.



- (ii) Expansion of opportunities at the UWI/Faculty of Agriculture and ECIAF to address basic training needs in PGR conservation and management. Provision of scholarships to nationals in identified primary areas will enhance the national PGRM effort.
- (iii) Provision of incentives to retain trained nationals in the national PGR program is noted as a corollary requisite.

As described earlier national PGRM efforts are led by activities of the MALMR. In this context, it is recommended that training opportunities be targetted to resident staff whose expertise could be enhanced and focussed to strengthen national PGRM. Additionally they will be better positioned to continue to apply this capability to ongoing national PGRM efforts. Simultaneously this incentive is expected to eliminate recurring staff turnover and maximize the utilization of available funding.

Our national *ex situ* PGR conservation effort, though limited, encompasses a wide range of crop germplasm and genetic resources and is capable of serving as a complementary tool for such training and education, including a capacity to accommodate international needs through personnel and germplasm exchange.

5.4 LEGISLATION

(i) National Legislation

The MALMR has taken the initiative through statutory requirements to ensure the conservation and exploitation of its plant biodiversity.

These are enunciated as follows:

- a. Plant protection - The Plant Protection Ordinance 1940 Chapter 23:17 and the Plant Protection Regulations, 1953.
- b. Archaeological Waters and Exclusive Economic Zone Act, 1986 (24).
- c. Regulation of forests and forest products - Forests Act Chapter 66:01.
- d. Regulation of sawmills - Sawmills Act Chapter 66:02.
- e. Regulation and Control of Purchase and sale of Cocoa and Coffee - Cocoa and Coffee Industry Act Chapter 64:20 as amended by Act No. 5 of 1988.
- f. Prevention of praedial larceny - Praedial Larceny Prevention Act Chapter 10:03.



- g. Provision of improved security of tenure for farmers - Agricultural Small Holdings Tenure Act Chapter 59:53 as amended by Act No. 16 of 1987.
- h. Exemption of income from approved agricultural holdings - Income Tax Act Chapter 75:01.
- i. Botanic Gardens Act Chapter 41:03.
- j. Queen's Park Savannah Act Chapter 42:06.
- k. Environmental Management Act No. 3 of 1995.
- l. National Trust of Trinidad and Tobago Act.

In the context of Intellectual Property Rights (IPR), enabling legislation to activate the terms and conditions of the 1978 International Convention for the Protection of New Varieties of Plants (UPOV), which this country has accepted, is to be completed by the end of 1995. This 1978 convention has been adopted given the benefits which would accrue to both farmers and breeders and the facilitation of trade which would arise therefrom.

(ii) International Agreements

Major international conventions and protocols in the context of environmental and biodiversity protection to which the GoRTT is signatory are the Convention for Nature Protection and Wildlife Preservation in the Western Hemisphere (1940), the Wetlands (Ramsar) Convention, the Convention on International Trade of Endangered Species of Wild Flora and Fauna (CITES, 1973), the Protocol concerning Specially Protected Areas and Wildlife in the Wider Caribbean (SPAW - 1990) and the Convention on the Conservation of Biological Diversity (1992).



CHAPTER 6

National Needs and Opportunities

6.1 POLICY ISSUES

The major need for PGRM in T&T is the development and implementation of a formalised and focussed national policy. Such a policy will be intended to address the following:

- (i) Promotion and support of internal and external linkages to effect national food security, ecological sustainability and trade enhancement.
- (ii) Adoption where appropriate, of standardized managerial approaches to strengthen biodiversity conservation in protected areas, as well as the *ex situ* conservation of species, populations of species and a wide range genetic diversity including the inventorising and screening of the lower plant *genera* with appropriate information management.
- (iii) Sensitization of the citizenry through public awareness and educational programmes.
- (iv) Development of a cadre of competent and dedicated professionals to implement sustainable PGRM.
- (v) The establishment of appropriate legislation to effect sustainable PGRM.

The policy formulation exercise will also address the regulation of PGR protection, trade, exchange, research and development and the rights of farmers to save, conserve and derive economic benefit from plant and planting material genetic resources.

6.2 BUDGETED PROJECT PROPOSAL

T&T has a conducive environment for study, research work and investment. The ease of economic and geographic accessibility and the availability of traditional and non traditional export oriented PGR readily availing itself to agroprocessing and expanded domestic consumption seems to position the sector to benefit from international interest for development.



This budgeted project proposal focusses on Institutional Strengthening, Human Resource Development, Information Management and PGR Development.

Appropriately coordinated, these will generate the necessary momentum to sustainably exploit the wide range of national opportunities - including a contribution to ecotourism - within the global environment.

Listed hereunder, in U.S. dollar currency, in the above context are our main needs:

i. Institutional Strengthening	- Generation and implementation of strategic policy and plans	\$ 400,000
	- Evolution and enforcement of legislation	\$ 400,000
	- Physical accommodation, in situ and ex-situ conservation infrastructural requirements and equipment.	\$ 1,600,000
	- Establishment of a National Biotechnology Unit	\$ 1,000,000
ii. Human Resource Development	- Creation of new posts, redesignation and reclassification of existing posts. Training in technology(including biotechnology) use PGRM, policy and planning and legislative drafting.	\$ 600,000
iii. Information Management	- Strengthening and expanding traditional and computerized information access, acquisition, storage, retrieval, presentation and exchange relating to a wide range of PGR and landscapes.	\$ 1,000,000
	- Public awareness and education	
iv. Plant Genetic Resources	- <i>In situ</i> resources Development inventoring and biogeographic mapping, taxonomic and botanical studies	\$ 1,000,000
	- <i>ex-situ</i> and <i>in-situ</i> conservation efforts including collection, multiplication, characterisation and field evaluation.	\$ 1,000,000
	- research and development, agro-processing and ethnobotanical studies.	\$ 1,000,000
	- technology (including biotechnology) assessment, and adoption or adaptation.	\$ 1,000,000
	- monitoring and surveillance	\$ 1,000,000
Grand Total		\$10,000,000



6.3 NATIONAL OPPORTUNITIES

A wide range of opportunity exists for contributing to the sustainable exploitation of our PGR. Such is enhanced by the acknowledged uniqueness of our PGR, the opportunity for *in situ* and *ex situ* conservation, research and development - including agroprocessing, plant and planting material production and capitalization through PGR protection, patenting, ownership and appropriate valuation. These may only be realized though with cooperative international efforts to upgrade the capacity and capability of existing human and physical resources.

Our available training and educational facilities, amongst which number the ECIAF and the UWI, possess qualified scientific expertise and contemporary research and development equipment poised to contribute to national and international initiatives.

In contributing to the sustainable development of agriculture our land administration system is intended to facilitate wider and more efficient use of land zoned for agricultural production. This will therefore support the expansion of the wide range of commercial crops grown for both domestic consumption or export in the fresh state or processed. For example our world renowned cocoa varieties continue to be used in international chocolate product manufacture and a field genebank of seventy two citrus varieties is to be established in 1995. The processing of citrus into a diversified range of concentrate of single strength juice, pulp or preserved sections is expected.

Specific mention must be made of the opportunities in the agro-processing industry which include vinegar, amino acids and yeast from the fermentation of molasses from sugar cane, culinary herbs, spices and seasonings, desiccated coconut, tomato paste and ketchup production, canned or dehydrated beans and peas (e.g. Tobago peas), wet or dry preserved tropical fruits (mango - forty six varieties conserved - guava, cherries, pommerac, pawpaw, saponilla and five fingers) and concentrate or single strength juices (e.g. sorrel).

In the context of our natural plant genetic resource landscape our conservation and development effort can contribute to enhancing the stability of the global environment e.g. use of *Ryania speciosa* as an environment friendly insecticide or mangroves to buffer sea level rise or ameliorate soil erosion, provide opportunity for expansion of the handicraft industry thereby enhancing human welfare, provide low cost natural product medicinals and pharmaceuticals for global use and promote the commercial potential of *Aroids*, *Orchids* and *Bromeliads*. Our *in situ* conservation efforts are also of considerable potential in contributing to ecotourism.



The Ornamental horticulture subsector has great potential for expansion but the development of expertise in production and postharvest handling, diagnostic services, export oriented handling facilities, enhanced air transportation and associated market intelligence needs urgent attention.

There is increasing opportunity to incorporate the utilization of PGR accessions, held for international partners, into the national socio-economic fabric. Governmental support in the form of direct tax incentives or indirect tax reliefs can be introduced such as to encourage participation. This could effect poverty alleviation through the promotion of private sector investment for product/commodity development as well as much needed national financial savings with respect to import substitution e.g., herbs, spices, medicinals.

It is envisaged that the MALMR will continue to function as a leader in PGRM, maintaining a facilitatory role, through support and promotion, and a regulatory role in respect of quality and standards. The MALMR will ensure the appropriate mechanisms for the coordination of activities of national PGRM, wherein significant inputs of programme planning and development will be provided to support NGO or other efforts. Financial accountability and monitoring and evaluation will also be a primary responsibility of the MALMR.

6.4 PRIORITY NEEDS

In complementing the FAO efforts, as part of an overall UN attempt to manage international plant genetic resources, three core areas of our national PGRM action plan need urgent and immediate attention. They are a complete and comprehensive plant genetic resource inventory and biogeographic mapping (including landscapes of a unique or significant nature), training of personnel and the establishment of an up to date system for efficient information management - to facilitate access and exchange and, dissemination -to support public education and awareness, and, human resource training and technology supply or adaptation for *in situ* and *ex situ* PGR conservation.



CHAPTER 7

Regional and Global Collaboration

7.1 INTRODUCTION

At the global level, the FAO has been the prime facilitator of national crop germplasm conservation and improvement activities through the provision of training opportunities, the hosting of conferences and workshops, information and documentation support, commodity research and development, and to a limited extent, *ex situ* conservation.

The executing agencies of such programmes include the International Plant Genetic Resources Institute (IPGRI), the Asian Vegetable Research and Development Centre (AVDRC), CIAT, IITA, IICA, CIP, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) and the Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT). Major linkages are described below.

7.2 GLOBAL

The FAO has a regional office in Santiago, a sub-regional office in Barbados and local representation here in T&T. Through these offices FAO has facilitated a regionally networked root crop research and development program, a vegetable and fruit crop seed program and the exchange of relevant scientific expertise.

The IPGRI has hosted regional courses in respect of plant biodiversity, information and documentation support in respect of cowpea, coconut and mango and sponsored slow growth experiments at the MALMR's Tissue Culture Laboratory.

The AVDRC has been responsible for supplying tomato germplasm material for national research and development.



CIAT has provided cassava, rice and bean germplasm from which agronomic studies have resulted in cultivars being released to farmers. Cassava storage has been developed to international standards and the formulation of a cassava/ molasses livestock feed has been shown to be of potential.

IITA's supply of cowpea has facilitated cowpea breeding studies at the UWI.

Cultivars of white potato from CIP have been evaluated whilst ICRISAT has been instrumental in assisting with national pigeon pea breeding efforts.

CIMMYT's contribution to corn breeding efforts for increased yields have resulted in the selection of improved lines, developed at CIMMYT, for commercial production in T&T.

7.3 REGIONAL

At the Regional level significant networking occurs through Ministries of Agriculture (MsoA), the UWI and CARDI. Major benefits which have resulted from these interactions include cost effective multiple site research and development, ease of access to regional and international germplasm and information access and exchange and the strengthening of inter and intra sectoral linkages.



CHAPTER 8

Proposals for a Global Plan of Action

8.1 TOWARDS A GLOBAL PLAN OF ACTION

In facing the challenge for food security, enhanced human welfare and ecological sustainability, T&T will continue to support global efforts to sustainably manage the earth's natural resources. However, given individual disparities in plant germplasm and genetic resources and the wherewithal to sustainably exploit same for the common good, the following prioritised cooperative global actions are proposed so as to permit optimum threshold levels of interaction between man and the environment.

- i. Prioritised and comprehensive PGR inventories, management, storage and *in situ* and *ex situ* conservation.
- ii. Prioritised, cooperative and integrated research and development into plant diversity with specific reference to optimizing the use of the genetic resource (through a strengthened biotechnology approach), identifying and promoting new sources of nutritive food, medicinals and industrial chemicals, fuel and shelter, the provision of socio-economic opportunities for entrepreneurship and investment, realizing agro-processing potential and maintaining or restoring the integrity of natural ecosystems.
- iii. Institutional (human, physical and financial) strengthening, integrated policy and legislation evolution and enforcement, monitoring and evaluation support and the encouragement of equality of trade and private sector and governmental investment in natural products to countries whose natural PGR wealth position them as centres of the origin of diversity or for which they exercise a comparative advantage in respect of PGR.
- iv. International plant germplasm and genetic resource exchange, equality and mutual respect for IPR and the plant patent environment.
- v. Equality of appreciation on national needs, objectives and priorities, information management, biodiversity value and environment friendly, low cost indigenous conservation mechanisms as they relate to developing countries.



- vi. International support for the efforts of developing countries in the financial valuation of PGR and the channeling of benefits to her national community rather than developing countries remaining as mere custodians of her PGR and not being financially compensated for it.
- vii. Direct involvement of the FAO in the management of international PGR.
- viii. Strengthened information management thereby permitting ease of access, mutual exchange and, enhancement of the global development process through the establishment and maintenance of inter and intrasectoral linkages. Such is to include support for the development and provision of appropriate technology and opportunities for personnel training.



ANNEX 1

Major Classification of Plant Genetic Resources

USEFUL PLANTS, MAJOR PLANTATION CROPS, MINOR PLANTATION CROPS

FOREST CROPS

- Timbers
- Thatching leaves
- Fibers and basket-making materials
- Laths for Tapia framework
- Fruit
- Oil Seeds
- Miscellaneous

MAJOR FIELD FOOD CROPS

- Cereals
- Pulses
- Tubers
- Fruit

MINOR FOOD CROPS

GARDEN FOOD CROPS

- Green Vegetables
- Salads
- Tubers
- Beans and Peas
- Cucurbits
- Roots
- Other Vegetables



CULINARY HERBS AND FLAVORINGS, FODDER CROPS AND GRASSES, COVER AND GREEN MANURE CROPS

FRUIT

OTHER USEFUL PLANTS

Spices and Condiments
Medicinal Drugs and Narcotics
Dyes and Tans
Gums and Resins
Rubbers
Oil seeds
Perfumes
Beverages

ORNAMENTAL PLANTS

TREES

A. WITH BEAUTIFUL FLOWERS

- (1) White flowers
- (2) Yellow flowers
- (3) Orange flowers
- (4) Flame-colored flowers
- (5) Red Flowers
- (6) Pink Flowers
- (7) Blue, Mauve and Purple flowers
- (8) Mixed-colored flowers

B. WITH BEAUTIFUL HABIT OR FOLIAGE

C. CURIOUS TREES

D. CONIFERS



SHRUBS

A. WITH BEAUTIFUL FLOWERS

- (1) White flowers
- (2) Yellow flowers
- (3) Orange flowers
- (4) Salmon-colored flowers
- (5) Red flowers
- (6) Pink flowers
- (7) Blue, Mauve and Purple flowers
- (8) Mixed-colored flowers
- (9) Shrubs with several-colored varieties of flowers

B. WITH BEAUTIFUL HABIT OR FOLIAGE

C. CURIOUS SHRUBS

HERBACEOUS ANNUALS AND PERENNIALS

A. WITH BEAUTIFUL FLOWERS

- (1) White flowers
- (2) Yellow flowers
- (3) Orange flowers
- (4) Red flowers
- (5) Pink flowers
- (6) Blue, Mauve and Purple flowers
- (7) Greenish flowers
- (8) Several-colored flower



B. WITH BEAUTIFUL HABIT OR FOLIAGE

C. CURIOUS PERENNIALS

- (1) White flowers
- (2) Yellow flowers
- (3) Orange flowers
- (4) Red flowers
- (5) Pink flowers (1)
- (6) Blue, Mauve, Purple and Violet-colored flowers
- (7) Mixed-colored flowers
- (8) Flowers changing color with age
- (9) Several-colored flowers

B. WITH BEAUTIFUL FOLIAGE

C. CURIOUS CLIMBERS

ORNAMENTAL BERRIES

- White berries
- Yellow berries
- Red berries
- Blue berries
- Black berries
- Various-colored berries

ORNAMENTAL SEEDS

LILIES OR LILY-LIKE PLANTS

IRIS-LIKE PLANTS

CANNA, GINGER OR BANANA-LIKE PLANTS

SUCCULENT PLANTS EXCEPT CACTI



POPULAR PLANTS FOR BEDDING

POPULAR PLANTS FOR EDGING

POPULAR PLANTS FOR POTS

PLANTS SUITABLE FOR HANGING-BASKETS

FERNS AND FERN ALLIES

ORNAMENTAL HEDGES

Flowering hedges

Foliage hedges

Prickly hedges

WATER PLANTS

ORNAMENTAL BAMBOOS AND GRASSES

GRASSES FOR LAWNS

CYCADS (Sago Palms)

PALMS

HARMFUL PLANTS

Plants with stinging hairs

Plants reputed to be poisonous

Plant Parasites and Epiphytes

Ornamental Plants which may become weeds

BEE FLOWERS



ANNEX 2

List of Minor Products from the Forests

Common Name	Botanical Name	Parts used	Purpose
A. Trees			
Balata	<i>Manilkara bidentata</i>	fruit; latex	edible;gum
Balsa	<i>Ochroma pyramidale</i>	seed floss	stuffing pillows
Bay rum	<i>Amomis caryophyllata</i>	leaves	bay rum of commerce
Black mangrove	<i>Avicennia nitida</i>	heartwood	contains lapachol
Black sage	<i>Cordia cylindrostachya</i>	leaves	medicinal
	<i>Parinari campestris</i>	bark	aphrodisiac properties
	<i>Roupala montana</i>		
Calabash	<i>Crescentia cujete</i>	fruit	ornaments
Chenet	<i>Melicocca bijuga</i>	fruit	edible
Cherry Guava	<i>Eugenia floribunda</i>	fruit	preserves
Crappo	<i>Carapa guianensis</i>	seeds	medicinal oil
Fat Pork	<i>Chrysobolanus icaco</i>	fruit	edible
Fustic	<i>Chlorophora tinctoria</i>	wood	khaki dye
Hog Plum	<i>Spondias monbin</i>	fruit	jellies; preserves
Incense	<i>Protium guianense</i>	bark exudate	incense smell on burning
Jumbie bead	<i>Erythrina spp.</i>	dried seeds	necklaces
Mahoe	<i>Sterculia caribaea</i>	bark	cordage
Obi	<i>Trichilia trinitensis</i>	wood	cutlass handles
Penny Piece	<i>Lucuma multiflora</i>	fruit	edible
Pois Doux	<i>Inga spp.</i>	Fruit	edible
Quassia, Bitter Ash	<i>Quassia amara</i>	wood, leaves	medicine,insecticide
Red mangrove	<i>Rhizophora spp.</i>	Bark	tanning material
Rokoo jab	<i>Ryania speciosa</i>	stem, branch	insecticidal properties
Sandbox	<i>Hura crepitans</i>	fruit	ornament
Seaside grape	<i>Coccoloba uvifera</i>	fruit	edible/astringent
Silk Cotton	<i>Ceiba pentandra</i>	seed floss	stuffing pillows
Tirite	<i>Ischnosiphon arouma</i>	leaves, ste	handicrafts
Tree fern	<i>Cyathea spp.</i>	Stem	horticulture



Common Name	Botanical Name	Parts used	Purpose
B. Palms			
Anare	<i>Geonoma vaga</i>	stem	walking, sticks
Cabbage plam	<i>Roystonea oleracea</i>	leaf bud	edible
Camwell	<i>Desmonus major</i>	stem	basket making
Carat	<i>Sabal mauritiiformis</i>	leaves	thatching
Cocorite	<i>Maximilliana caribaea</i>	leaves, kernel	thatching/edible palm oil
Gri- Gr	<i>Bactris cuesa</i>	fruit	edible
Gru- Gru	<i>Acrocomia aculsata</i>	fruit & kernel	edible
		leaf bud	edible
		trunk	walking sticks
Mamoo	<i>Calamus rotang</i>	leaves	handicraft
Manac	<i>Euterpre oleracea</i>	leaf bud	edible
Rouseau	<i>Bactris major</i>	stem	thatching
Timite	<i>Manicaria saccifera</i>	leaves	thatching
C. Vines, shrubs and herbs			
Bamboo	<i>Bambusa vulgaris</i> <i>Gramineae</i>		vases, baskets, waiters tables, blinds, trinket boxes
Bow-string hemp	<i>Sansevieria thyrsiflora</i> <i>Liliaceae</i>		Fibre plaited or woven for ropes, hats, bags, slippers
Cachibou	<i>Calathea discolor</i> <i>Marantaceae</i>		Water-proof baskets
Khus Khus	<i>Vetiveria zizanoides</i> <i>Gramineae</i>		Floor & table mats, hats, bags, coasters, blinds, waiters
Screw Pine	<i>Pandanus spp.</i> <i>Pandaceae</i>		Woven & plaited for hats, bags, mats, waiters, coasters, baskets, slippers
Sisal	<i>Agave sisalana</i> <i>Amaryllidaceae</i>		Fibre for ropes, twine, bags, mats and hats
Supple Jack	<i>Paullinia pinnata</i> <i>Sapindaceae</i>		Fish poison, baskets chairs, walking sticks



ANNEX 3

Selected Tropical Fruits (common names) and methods of consumption

Fruits eaten in fresh state

Akee	Avocado Pear	Bael Fruit	Balata
Banana	Barbados Gooseberry	Butternut	Cacao plum
Carambola	Cashew apple	Cherimoya	Chinese tamarind
Common plum	Custard apple	Date	
Chenet	Golden apple	Governor's Plum	Grape
Grapefruit	Granadilla	Gri- gri	Gru-gru
Guava	Hog Plum	Jamaica Plum	Jambalam
Jujube	Litchi	Loquat	Mamey Sapote
Mamey Apple	Mandarin	Mango	Orange
Papaw	Passion Fruit	Persimmon	Pewa
Pineapple	Pitanga cherry	Poix doux	Pomegranate
Pomerac	Sapodilla	Shaddock	Star Apple
Tamarind	Tangelo		

Fruits used in ice-creams and sherbets

Bael Fruit	Banana	Custard Apple	Granadilla
Grape	Grapefruit	Mamey Sapote	Mango
Lemon	Passion	Persimmon	Pineapple
Pitanga Cherry	Sapodilla	Soursop	Papaw
Sugar Apple	Orange		

Fruits used for stewing or making sauces

Cape Gooseberry	Roselle	Granadilla	Guava
Jujube	Mamey Apple	Rose Apple	Mango



Fruits used in pies

Cashew Apple	Governor plum	Loquat	Mango
Otaheite Gooseberry	Papaw		

Fruits furnishing beverages

Bael	Bilimbi	Carambola	Cashew Apple
Custard Apple	Golden Apple	Granadilla	Grapefruit
Jamaica Plum	(Carob or St. John's Bread - Ceratonia siligue)	Pitanga Cherry	Pomegranate
Lemon	Lime	Orange, Sour	Orange, Sweet Roselle
Papaw	Passion Fruit	Soursop	Sugar Apple
Sapodilla	Tamarind		

Fruits furnishing jams, marmalades and preserves

Bael Fruit	Banana	Barbados Gooseberry	Cacao plum
Cape Gooseberry	Carambola	Cashew apple	Gooseberry
Grapefruit	Guava	Golden Apple	Jujube
Loquat	Mamey Apple	Mamey Sapote	Orange, Sour
Othacite	Pitanga cherry	Papaw	Roselle

Fruits furnishing jellies

Barbados cherry	Bilimbi	Cacao plum	Cape Gooseberry
Carambola	Golden apple (ripe)	Governor's plum (ripe)	Grape
Guava (green)	Jamaica Plum	Jambalam	Hog Plum (green)
Loquat	Mamey Apple & Pineapple	Mango (green)	Orange, Sour
Pitanga Cherry	Rose-apple	Roselle	Sea grape (ripe)
Tamarind			

Fruits candied

Citron	Grapefruit	Shaddock	Lime
Papaw	Pineapple	Rose apple	Sour orange

Fruits pickled

Fig	Grape	Grapefruit	Guava
Lime	Loquat	Mango	Orange
Pineapple	Pitanga	Tamarind & Tangarine	Cherry



ANNEX 4

Common Names for Medicinal Plants

Agouma	datwan
Aguma	Ditay payee
Alantukai	dite betelmi
Allatukai	Diten bethelmy
Aloes	Dragon blood
Anongdevac	Dutch grass
Aroubaba	
Avocado	
Baby bush	Female candle bush
Bachelor button	Fever grass
Ball bush	Fiddle bush
Ballhead bush	Fit weed
Bamboo	Fowlfoot grass
Barbadine	Fregosa
Basil	French guava
Bay leaf	Friosa
Bay rum tree	
Bed grass	Garden balsam
Bene bush	Garlic
Bird pepper	Garlic wine
Blacksage	Geritout
Bois bande	Gimauve
Bois cano	Graine amba feuille
Breadfruit	Granny coffee
Breadnut	Grater wood
Bruka	Greasy bush
Bwa banday	Grenambafeu
Bwa cano	Guava
	Guinea grass
Cafe boucat	Gully root
Calabash	Gumbo mis
Cancanapiray	Gumbo mus
Candle bush	



Common Names for Medicinal Plants

Caraili	Hibiscus
Carpenter grass	Hog plum
Cartwright bump	
Cashew	Japana
Cassava	Jigger bush
Castor oil	Jumbie bead
Chataigne	
Christmas bush	Kayakeet
Clean teeth	Kayakit
Cocoa mint	Kojo root
Cocoa onion	Kooze mahoe
Cocolicka	Kuze maho
Coconut	
Coffee	lash root
Congolala	leaf-of-life
Coraili	Lemon grass
Cord violan	Lickrish
Corde violin	Lime
Cotton	Liquorice
Crab eye	Lizard grass
Croton	Lololap
	Love vine
Lozei bwa	
Lozeille	Rachette
	Railway daisy
	Ramongsi
Maiomal coffee	Roukou
Male candle bush	Round calabash
Malomay	Rough bush
Malomen	Rokshan
Mamey sapote	Ruction
Mammey apple	Ruckshan
Mammey apple	Running picka
Man-better-man	
Mang bush	Santa marie
Mango	Sapodilla
Mapiurite	Scientific plant
Marigold	Seed-under-leaf



Common Names for Medicinal Plants

Mat root	Seme contra
Mauby	sensitive plant
Mayoc chapelle	Shado beni
Mazay marie	Shame bush
Milkweed	Shandilay
M inny root	Shine bush
Mint	Shining bush
Moka	Shiny bush
Money bush	Silk fig
Mowan	Simen contra
Mowor	Sirrio
Myrtle	Siriyo
	Sorrow seed
Needle grass	Soursop
Never dead	Spearmint
Nickararacka	Spider lily
Nutmeg	stinging nettle
	Stinking suzy
Ochro	St. John bush
Old maid	Sugar apple
Olive bush	susi
Onion	Sweet broom
Orange	Syrio
Pain bush	Tamarind
Papai	Tansy
Parvu	tarantan
Pawpaw	Ti marie
Payapul	Titi payee
Periwinkle	Tomato
Physic nut	Toolsie
Pied poule	Tref
Pie pul	Trumpet tree
Pigeon pea	Twef
Planten	
Plum bush	Urine bush
Pop bush	
Popilolo	Vervine
Popolola	vorivine



Common Names for Medicinal Plants

Popololo

Portugal

Pumpkin

Pursley

Pusley

Wild mint

Wild ochro

Wild onion

Wild pinder

Wild senna

Wonder-of-the-world

Worm grass

Waritote

Water grass

Whitehead broom

Wild coffee

Zaboca

Zebafam

Zebapip

Zepapique

Zeb chat

Zooti



ANNEX 5

LIST OF PLANT GENETIC RESOURCES WHICH MAY CONTRIBUTE TO THE COSMETIC INDUSTRY

<i>Ocimum basilicus</i>	oil extracted by distillation
<i>Pteridophytes (Ferns)</i>	oils, solvent extracted from foliage and rhizomes
<i>Zingiber officinale</i>	oil traces used in oriental perfumes
<i>Hyacinthus orientalis</i>	oils solvent, extracted from its flowers but may be synthetically compounded
<i>Jasminum grandiflorus</i>	perfume oil extracted from flowers, and a similar fragrance may be synthesized
<i>Lavandula officinales</i>	oil obtained by distillation of flowers but used in blending
<i>Citrus lemon</i>	oil found in peel and blends well with other essences to give a perfume used in soaps
<i>Origanum majorana</i>	source of perfume oil
<i>Citrus aurantium</i>	oil expressed from the rind of the sour orange and used in colonges or used as a flavoring
<i>Salvia officinales</i>	oil used as an adulterant for rosemary and spike
<i>Poliantes tuberosa</i>	oil obtained by solvent extraction
<i>Veteveria zinganioides</i>	a grass oil obtained from the distillation of roots and used as a fixer of "violet" odors
<i>Canagium odoratum</i>	oil obtained from distillation of flowers and used in expensive perfumes. It is blended particularly in oriental odors.
<i>Pogostemon patchouli</i>	oil used as a fixative for heavy perfumes



ANNEX 6

Germplasm Recommended for evaluation of their Chemical Constituents

Family & Botanical Name	Common Name	Reputed Usage	Remarks
ACANTHACEAE			
<i>Ruellia tuberosa</i>	Minnie root	A tonic and abortifacient	Contains gallic acids and resins
AMARANTHACEAE			
<i>Achyranthes indica</i>	Man-better-man	For the 'flu	Expectorant action
AMARYLLIDACEAE			
<i>Hymenocallis tubiflora</i>	Loyon dil	Tea for asthma; bulb in poultice on boils	Antibacterial extracts
ANNONACEAE			
<i>Annona muricata</i>	Soursop	Teas for fever, insomnia etc.	Extract is respiratory stimulant; also alkaloidal
APOCYACEAE			
<i>Catharanthus roseus</i>	Periwinkle	For dropsy and diabetes	Contains anti-cancer alkaloids
<i>Rauwolfia ligustrina</i> <i>Reideparel</i>	For snake-bites and scorpion stings	Contains reserpine-like tranquilizer alkaloids	
ARACEAE			
<i>Colocasia esculenta</i>	Dasheen	Petiole juice for athlete's foot	Extracts of oxalate and of saponin
ASCLEPIADACEAE			
<i>Asclepias curassavica</i>	Pwentan	For diarrhoea and venereal diseases	Contains toxic glycosides
BIGNONIACEAE			
<i>Crescentia cujete</i> <i>Calabash</i>	Round	Leaf tea for pneumonia	Contains cyanide
CACTACEAE			
<i>Nopalea cochenillifera</i>	Rachette	Juice for fever and lung diseases	Contains oxalate, mucilage, tannin
CAESALPINIACEAE			
<i>Cassia alata</i>	Wild senna	Purgative. Also in curing ringworm	Sennosides; also antibacterial extracts
<i>Cassia occidentalis</i>	Wild coffee	Purgative; abortifacient	Sennosides; also alkaloids



Family & Botanical Name	Common Name	Reputed Usage	Remarks
CHENOPODIACEAE			
<i>Chenopodium ambrosioides</i>	Semen contra	Tea for indigestion; also removes intestinal worms	Oil contains Ascaridole
COMMELINACEAE			
<i>Commelina elegans</i>	Water grass	Tea for pneumonia	Cyanide present (?)
COMPOSITAE			
<i>Ageratum conyzoides</i>	Zeb-a-fam	Tea for 'flu and abortifacient	Cyanide present (?)
<i>Ambrosia cumanensis</i>	Altamis	For fever and colds	Antiviral and antibacterial extracts (?)
<i>Eclipta alba</i>	Congo lana	For colds and diarrhoea	Contains alkaloids
<i>Neurolaena lobata</i>	Zeb-a-pik	For diabetes and malaria	Bitter alkaloid in extract
CUCURBITACEAE			
<i>Momordica charantia</i>	Karilla	For malaria and diabetes	Anti-diabetic extract (?)
EUPHORBIACEAE			
<i>Acalypha wilkesiana</i>	Carpet	For fever and headaches	Anti-diabetic extract (?)
<i>Hura crepitans</i>	Sandbox	Emetic	Toxic-protein in extract
<i>Jatropha gossypifolia</i>	Bellyache bush	Emetic	Emetic oil
<i>Manihot esculenta</i>	Bitter cassava	Tuber as antidote for snake bites and for boils	Contains cyanide
<i>Ricinus communis</i>	Castor oil bush	Emetic, for stomach and inflammation of the womb	Expressed from seed- cake containing toxalbumin
FILICALIACEAE			
<i>Adiantum tenerum</i>	Maidenhair fern		
<i>Pityrogramma calomelanos</i>	Whiteback fern	For 'flu and fever	Antibacterial juice (?)
GENTIANACEAE			
<i>Ericostema verticillatum</i>	Quinine bush	Tea for malaria	Bitter glycoside in extract
GRAMINEAE			
<i>Cymbopogon schoenanthus</i>	Lemon grass	Tea for fever	Antiseptic oil (?)
<i>Eleusine indica</i>	Fowl foot	For diarrhoea and pneumonia	Contains alkaloids and cyanide



Family & Botanical Name	Common Name	Reputed Usage	Remarks
<i>Vitiveria zizanioides</i>	Vetivier	For 'flu and fever	Root oil is expectorant
LABIATAE			
<i>Hyptis atrorubens</i>	Wild mint	Juice for diarrhoea and indigestion	Extracts of tannins and antiseptic (?)
<i>Leonotis nepetaefolia</i>	Shandelely	For fever, and as diuretic and abortifacient	Extract shows anti-cancer activity
<i>Ocimum gratissimum</i>	Diten jaraba	For fever and pneumonia	Bactericidal oil
MORACEAE			
<i>Cecropia peltata</i>	Bois canon	For hypertension and diarrhoea. Shoots chewed as antidote for snake bite	Contains sterols and alkaloids (?)
MYRTACEAE			
<i>Pimenta racemosa</i>	Bay leaf	For 'flu and pneumonia	Oil is as expectorant
PAPILIONACEAE			
<i>Abrus precatorius</i>	Lickrish	For coughs and colds	Toxoalbumin present
<i>Cajanus cajan</i>	Pigeon pea	Leaf juice as an antidote	Tannins present
<i>Desmodium canum</i>	Sweetheart	Tea as tonic	Contains resin
<i>Crotalaria incana</i>	Shak shak	For fever and rashes	Extract astringent but hepatotoxic alkaloids
PHYTOLACCACEAE			
<i>Petiveria alliacea</i>	Gully root	Tonic	Contains diuretic and counter irritant
PIPERACEAE			
<i>Peperomia pellucida</i>	Shiny bush	For hypertension	Oil is anti-spasmodic
RUBIACEAE			
<i>Morinda citrifolia</i>	Yam seed	For arthritis	-
SCROPHULARIACEAE			
<i>Capraria biflora</i>	Dite pays	For 'flu and fever and eye-wash	Extract anti-microbial
<i>Scoparia dulcis</i>	Sweet broom	Vermifuge	Antidiabetic extract
SIMAROUBAEAE			
<i>Quassia amara</i>	Quashi bitter	Tonic, febrifuge	Contains Quassin



Family & Botanical Name	Common Name	Reputed Usage	Remarks
SOLANACEAE			
<i>Datura stramonium</i>	Night shade	Tea taken for epilepsy	Contains toxic alkaloids
<i>Nicotiana tabacum</i>	Tobacco	Leaf used in poultice for toothache	Contains toxic alkaloids
UMBELLIFERAE			
<i>Eryngium foetidum</i>	Chardon beni	For colds and convulsions	Oil is antispasmodic Extract antimalarial (?)
VERBENACEAE			
<i>Lantane camara</i>	Cariaquite	For colds and fever	Contains photosensitizing substances
<i>Lippia micromera</i>	Piti ditén	For 'flu and fever	Extract expectorant
<i>Stachytarpheta jamaicensis</i>	Vervine	For colds, diabetes and hypertension	Contains noradrenaline
ZINGIBERACEAE			
<i>Costus cylindricus</i>	Kan rivye	For coughs, and venereal disease	Boiled rhizome is astringent



Abbreviations

ADB	Agricultural Development Bank.
AGRIS	International Information System for Agricultural Sciences and Technology.
AGRIN	International Information Network for Agricultural Sciences and Technology.
AVDRC	Asian Vegetable Research and Development Centre.
BIONET	International Network to Support Regional and National Biosystematic Services.
CABI	Commonwealth Agricultural Bureau International.
CADP	Chaguaramas Agricultural Development Project.
CAGRIS	Caribbean Agricultural Information System.
CARDI	Caribbean Agricultural Research and Development Institute.
CARIRI	Caribbean Industrial Research Institute.
CARICOM	Caribbean Community.
CATIE	Centro Agronomico de Investigacion y Ensenanza.
CDS/ISIS	Computerized Documentation System/Integrated Set of Information Systems.
CES	Central Experiment Station.
CGIAR	Consultative Group on International Agricultural Research.
CIAT	Centro Internacional de Agricultura Tropical.
CIDA	Canadian International Development Agency.
CIMMYT	Centro Internacional de Mejoramiento de Maiz y Trigo.
CIP	Centro Internacional de la Papa.
CITES	Convention for International Trade in Endangered Species.
CRIN	Caribbean Rice Information Network.



CRS	Caroni Research Station.
CRU	Cocoa Research Unit.
CSEGRIN	Caribbean Seed Improvement Germplasm Resource Information Network.
CSO	Central Statistical Office (Trinidad and Tobago).
CTV	Citrus Tristeza Virus.
ECIAF	Eastern Caribbean Institute for Agriculture and Forestry.
FAO	Food and Agriculture Organization of the United Nations.
GORTT	Government of the Republic of Trinidad and Tobago.
GRIN	Germplasm Resources Information Network.
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics.
ICTA	Imperial College of Tropical Agriculture.
ICS	Imperial College Selections.
IIBC	International Institute for Biological Control.
IICA	Inter-American Institute for Cooperation in Agriculture.
IITA	International Institute of Tropical Agriculture.
IPGRI	International Plant Genetic Resources Institute.
IPM	Integrated Pest Management.
IPR	Intellectual Property Rights.
ISNAR	International Service for National Agricultural Research.
MALMR	Ministry of Agriculture Land and Marine Resources.
MsoA	Ministries of Agriculture.
NAMDEVCO	National Agricultural Marketing Development Company.
NGOs	Non-Governmental Organisations.



NIHERST	National Institute for Higher Education (Research, Science and Technology).
PGR	Plant Genetic Resources.
PGRM	Plant Genetic Resources Management.
SFC	Sugarcane Feed Centre.
SOE	State Owned Enterprises.
TFAP	Tropical Forestry Action Plan.
TSH	Trinidad Selection Hybrids.
T&T	Trinidad and Tobago.
UN/ECLAC	United Nations/Economic Commission for Latin America and the Caribbean.
UPOV	International Convention for the Protection of New Varieties of Plants.
UWI	The University of the West Indies.
VAT	Value Added Tax.



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