ANTIGUA AND BARBUDA:

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

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Note by FAO

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CHAPTER 1
Introduction to Country and its Agricultural Sector

1.1 GENERAL INFORMATION

The nation of Antigua/Barbuda is situated at the northern end of the Lesser Antilles arc of islands and is approximately 250 miles (400 km) east-south-east of Puerto Rico.

Antigua/Barbuda was discovered by Christopher Columbus in 1493 and was colonized by the British in 1632. The island nation was granted self-government in Association with Britain in 1967 and gained political independence in 1981.

Antigua/Barbuda has been described touristically as the "Heart of The Caribbean", for it's central location between the Greater and Lesser Antilles. The island nation's geographical position in the region has made it important historically, and now serves as the hub for regional airline connections.

1.1.1 Location

The approximate coordinates of Antigua/Barbuda on the Caribbean map are as follows:

i) Antigua: 17^0 - 17^0 10' North latitude;

61^0 40' - 61^0 55' West longitude

ii) Barbuda 17^0 35' North latitude;

61^0 48' West longitude

Barbuda is situated approximately 28 miles due north of Antigua.

1.1.2 Area

The nation of Antigua/Barbuda is approximately 440 square kilometres with Antigua 280 sq. km and Barbuda 160 sq. km. Antigua is roughly elliptical in shape and is characteristic of many mangroves, swamps (lagoons) which fringe

the western and southern coastal areas. Barbuda's dimension is approximately 29 km by 24 km (18 by 15 m).

1.1.3 Population

According to the 1991 population census, the number of persons residing in Antigua/Barbuda is 65,000. Prior the 1991 population census the estimated population of Antigua/Barbuda was 80,000 which was based on an average growth rate 1.5%. While the latter maybe so, there has been a significant migration of national to the US Virgin Islands, Canada, USA and the United Kingdom within the past (2) decades. The estimated population of 65,000 inhabitants have shown an increased per capita of some 7,000 US dollars which places Antigua/Barbuda in the context of developing countries. This in fact, has had negative effects in terms of qualification for international aid etc.

1.2 PHYSIOGRAPHICAL FEATURES

1.2.1 Antigua

Antigua is divided in three distinct topographical regions. (See figure 1 for details). These regions are as follows:

i) Volcanic region in the south west

ii) Central Plain

iii) Limestone in the north and east

The volcanic region: The south-west consists of hilly terrain which averages approximately 1,000 feet (308 m) above sea level. The highest peak in this range is Boggy Peak, which is approximately 1,319 feet (406 m). The orientation of this range is south-west to south-east which does not readily intercept the north-east trade winds. This region is bounded on the south by a narrow coastal plain which contains several alluvial valleys where most of the agricultural activities are carried out.

The central plain: This lies on a diagonal belt separated from the volcanic region by the flood plains of Bendals, Belvedere/Brecknock river valley and from the limestone region by a one (1) mile wide, low lying trough. The central plain is flat to undulating with some hills averaging 500 feet (154 m) above sea level.

The limestone region: This region represents approximately 1/3 of Antigua and is located in the northern and eastern portions of the island. The topographical features of this region is characteristic of many small islands, islet and cays that are located on the northern fringes of Antigua. Within the limestone region, the flat, low elevation landscape is characteristic of the many conical hills averaging 400 feet (123 m) in height. Much of the limestone region is separated from the central plain by an abrupt, but discontinuous, escarpment rising in places to over 350 feet (108 m).

1.2.2 Barbuda

In comparison with Antigua, Barbuda's topography is relatively uniform and lower in elevation (see figure 2 for details). The major differences are the absence in Barbuda of volcanic mountains that define the western third of Antigua and the presence of sand dunes in Barbuda which constitute large tracks of sandy fields absent from Antigua (Morello, 1983).

The Highlands represents the highest elevation in Barbuda reaching some 100 feet (30.8 m) above sea-level. The Highland region is characteristic of an abrupt escarpment on the north and west, a gentle slope on the south and sea cliffs on the east. Generally, Barbuda is relatively flat with many depressions.

A lagoon, averaging 1½ miles (2.4 km) runs almost entirely along the western coast of the island. This lagoon is separated from the sea by a narrow sand bar only a few meters wide with a winding entry in the north (Martin-Kaye 1959; Hill 1966).

1.2.3 Soils

Soils of Antigua/Barbuda have been studied in details by Martin-Kaye (1959) and Hill (1966). In Antigua, soil types can be grouped within three (3) main topographic areas. The volcanic regions consist of igneous rocks with the derivative clay looms. These soils are mainly neutral to slightly acidic and well drained. Slopes within the volcanic region varies between 11-20 degrees. The central plains consist of heavy clay in some areas, but most of the areas have well-drained soils over tuffs (stratified volcanic detritus) and agglomerates. Slopes on the central plains vary between 2 - 5 degrees. On the other hand, the limestone region consists of light soils over calcareous sandstone's, heavier soils over calcareous grits and deeper well-drained clays over calcareous marls. Some areas contain large amounts of almost pure calcium carbonate, and alkaline soils dominate throughout this region. Slopes are generally less than 10 degrees (Loveless 1960; Atkins, 1983).

Barbuda soils are more homogenous and are most similar to those of the limestone regions of Antigua Martin-Kaye, 1959).

1.2.4 Rainfall

Rainfall in Antigua/Barbuda averages 45" (1,143 mm) and 30" (762 mm) per annum respectively. This low rainfall precipitation is considered low in terms of tropical standards. Hence, Antigua/Barbuda is characteristic of semi-arid conditions extending from January to July whereas the wet season normally commences in August/September and taper off in December. Rainfall precipitation is influenced by the presence of tropical waves, storms and depressions in the region and have also contributed to the erratic rainfall pattern.

The south-west volcanic region receives an average rainfall precipitation of 55" (1,397 mm), and this is the area where the tropical forest species are found. On the other hand the North Eastern limestone region as well as the coastal fringes receive an average of 35" (889 mm) per annum. (See figure 3 for detail).

1.2.5 Temperature

The average temperature of Antigua/Barbuda is 29^0 C (84.2^0 F) during the summer month while the temperature for the winter months average 24^0 C (75.2^0F).

The relatively high ambient temperature is tempered by the cooling effects of the north-east trade winds which blow constantly throughout the year. However, there is a marked increase in wind velocity during the period June to November.

1.2.6 Main Forest Types

There are five (5) major forest types in Antigua/Barbuda. These include the following:

i) Humid Valley Forest

ii) Slope forest

iii) Mangrove

iv) Scleromorphic forest of white cedar (*Tabeluia pallida*)

v) Mangrove edge

Humid valley forest are the most complex of the insular ecosystem of Antigua, however, only small areas of this exists. The main species which dominate this forest type are 'ciba trees ceiba pentandir with several species of *Ficus sp. Delonix regia* and a number of fruit trees. The structure still consists of four layers or more of vegetation, although it is poor in vines, epiphytes and palm trees. This type of forest is found in the south-western volcanic regions of Antigua.

The Slope forest contains much of the deciduous forest trees and are found within the south-west volcanic region as well as the highlands of Barbuda. In a report described by (Morello 1983) indicated that the original vegetation has been greatly altered due to the production of charcoal.

The three types of mangrove forest species exist on both islands. These include red Rhizophora mangle, while *Laguncularia spp.* and black *Avicennia spp.*

Scleromorphic forest of white cedar *Tabeluia pallida* exist on the island of Barbuda only.

Mangrove edge forest consist of a leguminous forest dominated by H*aematoxglon* (logwood) and *Pithecellobium* ("bread and cheese"). This type of forest is very extensive on Barbuda and to a lesser extent on Antigua.

With the increasing dry weather, forest fires and the demand for fuel wood (Charcoal) as well as forage for livestock, both the humid valley and slope forest are constantly under threat.

Within the context of the humid and slope forests, regular forest fires particularly during the dry season have resulted in a secondary vegetation of *Citronella spp.* (lemon grass) which dominates at least 10% of mountain slopes within the south-west volcanic region. The commercial value for *the citronella grass sp* is not realized, since the grass is not processed into oils etc. In Antigua/Barbuda the rate of decrease of forest species within the south-west volcanic region is approximately 1-2% per annum.

The third forest type mangrove is the most threatened in view of the increasing demand to construct hotel and marine infrastructure on beaches within the high water mark. This has lead to significant loss of the three (3) species of red, white and black mangrove forest species. This dilemma is most severe on Antigua and to a lesser extent on Barbuda. The rate of decrease of this mangrove forest is at least 3-5% per annum.

The Scleromorphic forest of white cedar Tabebuia pallida is decreasing at a rate of 3% in view of the increasing demand to use local cedar to construct boats used in the fishing industry. The problem is common both in Antigua as well as Barbuda.

1.3 AGRICULTURAL SECTOR

1.3.1 General Introduction to Farming Systems

Antigua/Barbuda was once a monoculture crop economy that is, sugar cane production. However, within the past two (2) decades, there has been a significant shift from an agrarian society to a tourist oriental society. Agriculture's contribution to the GDP in the 1960 and early 1970 was 60%, whereas tourism was averaging 10-15%. With the abandonment of sugar cane production, there has been significant rise of small farming activities, particularly in the area of vegetable and food crop production as well as the rearing of ruminants, sheep, cattle, goats on the vast tracts of under-utilized agricultural lands which were former sugar estates. In addition, Antigua/Barbuda still produces the famous sea-island cotton and the Antigua black pineapple which is now on the increase in terms of acreage since these crops are on the priority list of the Ministry of Agriculture.

Sea-island cotton produce locally are exported mainly to Japan whereas all vegetables, fruits and food crops with the exception of minor exports of yam and sweet potato to UK are consumed locally.

In fact, tourism has become the main foreign exchange earner contributing some 70% out towards the GDP (Gross Domestic Product). Tourism in fact is the engine of the Antigua/Barbuda's economy.

Nationally, the main concern in Agriculture, is the increasing demand for water in view of the highly intensive nature of vegetable production activities. This situation is further compounded by the outdated law in respect of water use and water legislation, hence, for the high prices of agricultural commodities on the local.

Agricultural activities in Antigua/Barbuda consist of the following:

i) Vegetable and Food Crop Production

ii) Sea Island Cotton Production

iii) Fruit Crop Production

iv) Livestock Production

With the abandonment of the sugar industry, large tracts of land became available for farmers who are currently engaged in the production of vegetables and food crops. Currently there are some 3,000 farmers in Antigua/Barbuda, however the majority of these farmers do not have title for the land. The current land tenure system is based on an annual rental of $10.00 per acre, per annum/24.71/ha.

Major crops grown by farmers are vegetables per se, solanaceous, cole crops, cucurbits, carrot, onions etc. More than 60% of crop is produced under irrigated of partially irrigated conditions. The size of farms are categorized as small, medium, large. The categories are as follows:

i) small 0-5 ac (0-2 ha)

ii) medium 6-10 ac (2.4-4 ha)

iii) large over 11 ac (4.50 ha)

There is a Central Marketing Corporation which purchases farmers produce, however, in view of the differences in prices, farmers prefer to sell directly to householders, hotel, restaurants and supermarkets. Crops production activities is considered a lucrative business in Antigua/Barbuda. All vegetable and food crops grown is consumed locally with a minor export of yam and sweet potato to the U.K.

1.3.2 Cotton

Sea Island cotton production is becoming an increasing activity in view of the demand for this commodity particularly in Japan, where it fetches 5.25 US dollars per pound (45 kg) of lint. Because of the semi-arid nature of Antigua/Barbuda sea-island cotton has an ecological advantage compared to other regions of production. In addition, there are some 350 acres (141 ha) are currently under production and is expected to be doubled. Major limitation in sea-island cotton production is manual harvesting.

1.3.3 Fruits

Fruit Crop activities is centred around the production of pineapple variety - Antigua Black which has a great demand on the local market. The major limiting factor is the production of planting material. The Ministry of Agriculture is currently undertaking a project to address the situation.

In addition, mango is the other major fruit crop production activities where a 500 acre of mango project is currently undertaken by the Ministry of Agriculture, with a view to tap niche markets in UK, USA and Canada.

1.3.4 Livestock

Livestock production activities represent the largest area under agricultural activities. Unfortunately, most of the livestock farmers are landless farmers and are invariably engaged in other activities, e.g. taxi, clerk, fishermen etc.

More than 75% livestock farms are without title or lease agreement to the land. Livestock farms are group as small, medium and large. A category of livestock farms are as follows:

Small 0 - 5 acres (0-2 ha)

Medium 6 - 20" (2.4-8 ha)

Large over 21 acres (8.5 ha)

The population of livestock in Antigua/Barbuda represents the highest in the OECS Islands. The population of livestock in Antigua/Barbuda is shown below:

i) Cattle 6,000

ii) Goat 7,000

iii) Sheep 5,000

iv) Pig 3,000

v) Broilers 500

Layers (white) 20,000

" (brown) 15,000

Currently, a livestock population census is carried out by the Livestock Division of the Ministry of Agriculture.

More than 80% of farms, both livestock and crop farms operate at commercial level whereas the remaining 20% operate at subsistence level particularly with a view to provide food for home use as the main objective.

1.3.5 Seed Supply System

In Antigua/Barbuda, there are three (3) main ways that seeds are supplied within the farming system. These are as follows:

i) National

- **(a)** Ministry of Agriculture
- **(b)** CARDI
- **(c)** Farmer Seed Seeds

ii) Statutory Bodies - CMC (Central Marketing Corporation)

iii) Private Sector

More than 95% of all vegetable seeds are imported mainly by "CMC and private seed suppliers. Invariably the CMC occupies the largest market share of some 65%.

CARDI, Ministry of Agriculture and selected farmers produce seeds, mainly of the landrace type, that is sweet potato, yams, cucurbits (pumpkin, cucumber, squash etc), corn, eggplant etc. On the other hand, the Ministry of Agriculture, Cotton Division is sole producer and supplier of sea-island cotton seeds locally as well as overseas markets.

The production of seeds remain foreign companies activities, however, I see the need for national and regional entrepreneurs to invest into seed companies, in order to minimize the loss of valuable foreign exchange.

1.4 CROP PRODUCTION

As mentioned earlier, the major crops grown in Antigua/Barbuda are as follows:

i) Sea-Island cotton - 350 ac (142 ha)

ii) Pineapple - 150 ac (60 ha)

iii) Mango - 500 ac (202 ha) proposed*

iv) Vegetable & Food Crops - 3,000 ac (1,214 ha)

Current area under sea-island cotton is 350 ac (142 ha), this area is expected to be doubled within the next cropping season. The main reasons include the increasing demand for this product on the Japanese market as well as relatively lucrative crop for farmers - particularly in terms of an market.

Pineapple production represents one of the main potential areas for development mainly because of the demand for this commodity within the hotel industry. In addition, because of 'its uniqueness as a tropical fruit has the potential to penetrate niche markets in the UK and Canada. Present area is 150 acres, (60 ha) however, within the increase demand for this product, current area can be doubled within the next 18 months.

Projects to develop the pineapple and mango is currently executed by the Ministry of Agriculture. The proposed development of 500 acres (202 ha) mango is expected to provide an increased income to farmers as well as gaining valuable foreign exchange earnings through exports.

Antigua/Barbuda remains a net importer of fruits and vegetables, however, the Ministry's objective is to concentrate on import substituted crops particularly the solanaceous crops i.e. tomato and the cole crop i.e cabbage broccoli, cauliflower etc. Invariably, the white fly Bemicia tabaci remains the major pest affecting vegetables *per se*.

CHAPTER 2
Indigenous Plant Genetic Resources

2.1 HISTORICAL

The indigenous plant genetic resource is constantly being altered in terms of the introduction of new varieties, but mainly by man's quest to exercise his complete dominion over all earthly resources.

This phenomenon bears testimony during the colonial era from the mid 1600 - 1970's when Antigua/Barbuda was engaged in extensive cultivation of sugar cane.

During that era, the Humis Valley forest or well as the slope forest were virtually destroyed particularly for the cultivation of sugar cane as well as the provision of fuel wood, construction, boat building, fish pot construction, etc.

With the destruction of those indigenous plant genetic resource had lead to the development of secondary type forests. Extensive forest clearing on the lower slopes had lead to the development of grassland savannahs which eventually were cultivated for sugar cane production. To bear testimony to this fact Beard 1955 and Loveless 1960 had written extensively in respect of forest vegetation that existed on Antigua/Barbuda. Forest species that were in great demand are shown in Table 3.

By the turn of the 1970's when the sugar industry became a relic of the past, the socio-economic pressures were even greater on all (5) forest types. With the abolishment of sugar estates lead to the proliferation of different *Acacia sp.* which engulfed the arable lands which became one of the main fuel wood in the charcoal industry.

In addition, with those changes showed an increase in small farming activities and the introduction of new cultivars of vegetables and food crops as well as the development of landrace type varieties of crops as shown in Table 2. Table 1 also include varieties of crops that were introduced and became adopted to Antigua's semi-arid conditions.

The era of the 1970's also showed an increase in livestock population particularly the ruminants which browsed the secondary forest and no doubt altered the genetic biodiversity of the environment.
This era also showed the introduction of legumes and forages for research trial by the U.W.I. (University of the West Indies). Some of the varieties of local grasses are legumes are shown below in Table 1.

Table 1: Local legumes and grasses of Antigua/Barbuda

Legumes	Grasses
Hamata sp.	*Panicum maximum*
Terramnus sp.	*(Seymour grass)*
Leucaena leucocephala	*Disconthuim sp (local Hay grass)*
Clitoria sp.	*Cynodon dactylon*
Desmanthus sp.	*Citronella sp.*
Rhyncosiia sp.	*Elusine indica*
Desmodium sp.	
Centrosema sp.	
Centrosenma pubescens	
Acacia sp.	

Source: Veterinary Livestock Division Antigua/Barbuda.

2.2 GENETIC RESOURCES OF AGRICULTURAL CROPS

Despite Antigua's small size it has several distinct agro-ecozones and because it is an island state, it has had the opportunity to develop a number of locally adapted cultivars and land races of crops that may have value to other countries and that are not part of any conservation programme. These cultivars are therefore in danger of being lost or corrupted as new introductions are made for various purposes and as farmers switch from planting their traditional cultivars to other introduced cultivars that are often required for export programmes etc. Some examples of crops that have local cultivars in use in Antigua are given in Table 2.

Most of the above cultivars are "informal selections" that are not commercially produced and are only maintained by the farming population. They have, in general, not been properly described or characterised. They are therefore in danger of being lost as new commercial cultivars are introduced and farmers change growing practices. This has already happened to some extent with the local eggplant and pigeon peas. It is important that this resource of genetic material be conserved and characterized so that farmers

can be assured of supplies of seed (planting material) when they need to return to these cultivars. The material also needs to be conserved as it may be a source of special characteristics such as pest and disease resistance or drought tolerance.

Table 2: List of crops with land races in Antigua

Crop	Scientific name	Examples of local cultivars
Cotton (Sea Island)	*Gossypium barbadense*	MSI, V135
Cowpea	*Vigna sinensis*	African red
Cucumber	*Cucurbita sativa*	Un-named local type
Eggplant	*Solanum melongena*	"Local"
Hot pepper	*Capsicum chinense*	Peggy mouth
Pawpaw	*Carica papaya*	Several local types
Pigeon pea	*Cajanus cajan*	Several local types
Pineapple	*Ananas commosus*	Antigua Black
Seasoning pepper	*Capsicum spp.*	"Seasoning pepper"
Squash	*Cucurbita pepo*	"Table squash"
Sorrel	*Hibiscus sabdiffra*	Several local types
Sweetpotato	*Ipomoea batata*	Black Rock, Backra Mary, White Drill, Ketch Me, etc.
Yam	*Dioscorea spp*	Early Anthem, Antigua yam

Source: CARDI (Antigua).

2.3 ECOLOGICAL LIFE ZONES OF ANTIGUA/BARBUDA

2.3.1 Description

A summary description of the natural forest of Antigua/Barbuda is given in terms of ecological life zones based on the Holdridge System of classification. According to the Holdridge System of Classification two Life Zones are represented in Antigua/Barbuda. These are the Subtropical Dry Forest Zone and the Subtropical Moist Forest Zone.

The Subtropical Dry Forest Zone covers most of the country. The mean annual rainfall is approximately 1,100 mm. Most of the rainfall occurs during the latter four or five months of the year with a marked dry season during February, March and April. The vegetation in this Life Zone tends to form a complete ground cover. The leaves are often small and succulent or coriaceous and species with thorns and spines are very common. Tree heights usually do

not exceed 10 m and the crowns are typically board, spreading and flattened with sparse foliage.

Extensive areas of the Subtropical Dry Forest Zone overlie limestone, and the vegetation on these soils is more xerophyllous than that which would be expected on a zonal soil. The soil surface in these associations often lacks any grass or herb cover, and many of the trees and shrubs are evergreen.

Species which are easily recognized sand which, when taken as a group, are useful indicators of this Life Zone in Antigua/Barbuda *include Bursera simaruba* (L.sarg (turpentine tree). *Prosopis juliflora* (cassie*). Cephalocedreus royeni* (L.) Byles & G Rowley, *Pictetia aculeata* (Vahl) Urban. *Budida buceras L* (White wood), *Leucaena Glauca* (L) Benth (wild tamarind), *Adacia sp* (cassie) *Haematolylon campethianum L.* (Loogwood), *Capparis sp.* Croton flavens and *Lanata involucrata* (sage). The Subtropical Moist Forest Zone covers a comparatively small area of the country (approximately 20%). The mean annual rainfall is about 1,270 mm. The vegetation is characterized by trees up to 15 - 20 m tall with rounded crowns. Many of the wood species are deciduous during the dry season and ephphytes are common. It must be noted that no vestige of the original forest remains. The entire area was at one time under cultivation or the forest was cleared to provide material for fuel, shelter, etc.

Species found within this life zone generally *include Tabeuia heterophylla* (DC.) *Britt.* (white cedar, Nectandra membranacea, *Ocotea sp., Inga Laurina* (SW) Wild (Spanish Oak), *Cedrala odorata L.* (red cedar) *Hymenaea coubaril L* (West Indian locust), *Zanthoxylum sp.* (prickle) and *Cordia sp.*

A more detailed draft ecosystem classification, including a partial testing of plant species used in the classification is shown in Appendix 1.

2.3.2 Major Species Harvested from Natural Forest and Some of Their Uses

A small open market, forestry and related activities can only play a supplementary role in the Antigua and Barbuda economy, which is primarily driven by the tourism industry. The major species harvested from the forest and some of their uses are shown in Table 3.

2.3.3 Conservation Efforts

The Forestry Division of the Ministry of Agriculture is currently working in collaboration with a local non-governmental organization - the Environmental Awareness Group (EAG) in a biodiversity monitoring programme.

The major components of this programme are as follows:

- Development of a detailed ecosystem classification
- Identification of plant and animal species
- Development of a herbarium
- Identification and listing of rare and endangered species
- Generation of baseline data with respect of selected a biological component
- Recommendations on areas to be included in a protected area (?) system.

Other conservation efforts include several tree planting projects, attempts at drafting and adopting new forest policy and legislation, and the proposed new National Physical Development Plan which has one of its aims, the conservation of critical ecosystem and of the country' s natural resources.

Table 3: Uses of forest species

Plant species	Usage
Acacia sp	Charcoal, leaves used for forage
Tamarindus indica	charcoal; fruits eaten raw; also use to make jam and several other products
Avicennia germinans	charcoal
Bambusa spp.	craft, construction
Annona spp	fruits
Caesalpinia pulcherrima	seeds used in game
Cocoloba uvifera	fruits
Cocoloba diversifolia	brace for fish traps
Cocos nucifera	fruits
Cresentia cujute	utensils
Eugenia spp.	brace for fish traps
Guettarda spp.	brace for fish traps
Haaemotoxylon campechianum	charcoal
Lagunucularia racemosa	charcoal
Leucaena leucocephala	charcoal, fence post, forage, live fence
Malphigia emaginarta	fruits
Mangiafera indica	fruits
Hymanea coubaril	fruits
Phoenix dactylifera	fruits
Psidium guajava	fruits
Tabebuia heterophylla	boatbuilding, minor construction, fence post
Swietenia mahogani	boat building, interior construction, craft

Source: Forestry Unit, Antigua/Barbuda.

2.3.4 Major Threats

The major causes of ecosystem and species loss are as follows:

- Indiscriminate clearing of land for human settlement (housing, industry, roads, agriculture, etc.)
- Annual bush fires
- Overgrazing

2.4 PLANT USED TRADITIONALLY IN ANTIGUA/BARBUDA FOR MEDICINAL PURPOSES

As a means to exploit plant genetic resources to its fullest, man have used local herb, leaves, barks of trees, etc. to cure certain ailments. While most of the plants shown in Appendix 2 are in fact domesticated plants, man over the centuries have established through trial and error, types of plants in relation to curing certain ailments or diseases that have affected his existence.

The major limitation with these herbal medication is centred around rates (dosages) of application for a specific ailment. However, this is a rather potential area in terms of further development of herbal medicines or extracts which may solve some of mankind's deadliest diseases and ailments. Plant genetic resources found in the wild is becoming threatened each day in view of man's quest to expand industries and urbanise his activities as much as possible. This is of particular importance in an island nation like Antigua/Barbuda where tourism development is severely affected plant bio-diversity and consequent a reduction of the total plant genetic resources.

Currently there are no specific programmes in respect of conservation of plant genetic resource material that have shown to possess medicinal properties. Conservation in this regard is a relatively new area in these parts and would require the necessary legislation to govern and protect plant species shown in Appendix 2. Conservation *per se*, that is, *in situ* and as well as ex-situ in addition to further research and development work are vital components to develop plant genetic resources for medicinal purposes.

CHAPTER 3
Conservation Activities

3.1 NATIONAL CONSERVATION ACTIVITIES

3.1.1 *In Situ* Conservation Activities

In situ conservation activities are conducted at CARDI Field Station and the Ministry of Agriculture Experiment Station at Dunbars. These activities are currently managed by field technicians and supervised by Senior Research Scientists in the Ministry of Agriculture and CARDI.

Crops that are currently conserved *in situ* are as follows:

Cotton/Dunbars experiment station

i.	Sea Island Cotton 14 cvr.	*Grossypium barbadense*
ii.	Sweet potato (6) cultivars	*Ipomea batata*
iii.	Local eggplant (2) cultivars	*Solanum melongena*
iv.	Field corn (3) cvr.	*Zea mays*
v.	Barbuda lima beans	*Phaseolus sp.*

CARDI Field Station
Crops

i.	Hot pepper	*Capsicum sp.*
ii.	Field corn	*Zea mays*
iii.	Curcurbits (pumpkin)	*Curcurbitae sp.*
iv.	Pigeon pea	*Cajanus cajan*

Forage/legumes

i.	Guinea grass	*Panicum maximum*
ii.	Local legume	*Terramnus sp.*
iii.	Local legume	*Leucena sp.*

iv. Local legume *Centrosema sp.*

v. Local legume *Hemeta sp.*

3.1.2 Donor Funded Activities

With the advent of the Seed Improvement Project for CARICOM and Suriname which was initiated approximately 2 1/2 years ago there have been concentrated efforts from both the Ministry of Agriculture and CARDI in strengthening their plant genetic conservation efforts both for forage/legumes as well as field crops.

The main objective of these conservation activities is to initiate a programme of characterization and evaluation using the appropriate descriptors with a view to input the data into the CSEGRIN (Network).

3.2 *EX-SITU* COLLECTIONS

3.2.1 The Ministry of Agriculture of Antigua/Barbuda does not have a genebank as an *ex situ* collection

This can be an effective activity from a National perspective in terms of the fact that Antigua/Barbuda experience extreme climate in respect of very wet and very dry. With these extreme climate important plant genetic resources can be lost. (See Table 1, 2 and 3 for plant genetic material found in Antigua/Barbuda).

Some attempts have been made in the past to store varieties of sea island cotton as ex-situ collections in the U.K. but was never pursued.

3.3 STORAGE

National storage facilities for plant genetic resource material in terms of short, medium and long term is a major limitation within the agricultural sector.

However, there is a small storage facility at CARDI Field Station at Betty's Hope which is used mainly to store forages, legumes, hot pepper and corn seeds on a short to medium term basis.

As part of the counterpart contribution to the Seed Improvement Project for CARICOM and Suriname, the Ministry of Agriculture is currently constructing storage facilities to augment its plant genetic resource conservation activities. Plant genetic material that will be conserved will include sea-island cotton, field corn, and landrace type material, that is, Solanum melongena, and the cucurbits. At the same time, the storage facilities will allow for the provision of short to medium storage of seed material.

In addition, there is need to duplicate plant genetic resource material in other gene banks in order to reduce the risk of loosing valuable genetic resource.

Plant genetic material that could be duplicated include the following: sea island cotton cultivars, field corn, leguminous, curcurbitae varieties along with plants that have shown medicinal properties (See Appendix 2 for detail).

3.4 EVALUATION AND CHARACTERIZATION

3.4.1 Crop Genetic Resources

From the advent of a computerized, evaluation/characterization course on plant material sponsored by FAO and held in Trinidad from 29th September to the 7th October, 1994, the Ministry of Agriculture did not possess the capabilities to evaluate and characterize germplasm. Currently, the Ministry of Agriculture is evaluating varieties of pineapple, sweet potato and sea island cotton. Expanded activities of the characterization and evaluation is expected to commence in forestry, ornamentals and other field crops. The characterization and evaluation activities are part of the CSEGRIN (network) where data base can be down/up loaded in respect of plant genetic resource.

3.4.2 Forest Genetic Resources

There are no specific conservation measure in respect of forest genetic plant resource. Invariably, the legislative measure used within the forestry programme is one of regulatory and rather general. Forest genetic resource material is shown in Table 3 and Appendix 1.

Most of the laws regulating activities in the forest or in respect of forest genetic resource material are basically obsolete and need to be urgently amended.

Major threats to the forest genetic resource are as follows:

i. Overgrazing

ii. Forest fire

iii. Urbanization encroachment

iv. Construction of hotels and marinas particularly in the mangrove forest areas. In addition, construction of hotels below the high water mark.

The salvation of our forest genetic resource needs an urgent attempt to amend and reinforce conservation laws in order to protect the environment for future generations.

CHAPTER 4
In-Country Use of Plant Genetic Resources

4.1 CURRENT TRENDS

Supported by the activities of the Ministry of Agriculture, the agricultural sector of Antigua and Barbuda is engaged in a process of agricultural diversification. The sector was traditionally involved in the production of sugar cane and cotton. Sugar cane was abandoned in the early 1970's and was replaced by small scale vegetable production. Many farmers are still quite small and use minimal levels of technology in part time operations. However, a number of farmers have developed a commercial approach and have embraced many elements of modern technology, including improved varieties, many of which are expensive hybrids available from the international seed companies. Other aspects of technology in use are drip irrigation, pre-emergent herbicides, and a full array of plant protection methods.

In this environment there is considerable interest in new germplasm, especially vegetable cultivars that are tolerant to the particular constraints of the local climate. High night temperatures, especially during the "summer" months of May to September cause problems for several vegetable crops by affecting such factors as fertilization/pollination (especially in tomatoes) and head formation in cole crops such as cabbage and cauliflower. Minimal change in day length also affects production of a number of crops such as pigeon pea and onion.

In the past, much of the "commercial" vegetable germplasm was introduced from North America and Europe and many cultivars no longer in production in these countries are still in use in Antigua and other parts of the Caribbean. For the traditional crops that depend on farmer saved seed and vegetative planting material, there has been little change in cultivars, except, perhaps, in the area of root crops where disease problems and market constraints have shifted production to newer cultivars. Together with the several agro-ecological niches that occur in Antigua and Barbuda, these conditions have led to the development of many farmer varieties or land races and to locally adapted versions of traditional commercial cultivars.

More recently, there has been some development of cultivars better adapted to tropical conditions in such countries as Israel, Japan and Taiwan as well as the United States and this has promoted a shift to the adoption of vegetable varieties from these countries. Also, the promotion of some development

programmes, particularly those directed towards export markets, has resulted in a shift away from traditional cultivars, some of which are now at risk of dying out, since farmers are no longer growing them.

4.2 GENETIC IMPROVEMENT

It should be pointed out that there is no active breeding programme in Antigua/Barbuda. However, new germplasm is obtained in several other ways. A few of the major seed companies have representatives in Antigua who provide new cultivars of commercial vegetable crops, some of which are suitable for tropical conditions such as ours. Farmers also bring in new varieties from other countries to try out. Research and development organizations, such as the University of the West Indies, the Caribbean Agricultural Research and Development Institute (CARDI) and the Inter American Institute for Co-operation in Agriculture (IICA) access new material through their own breeding programmes or, more frequently, through contact with other R&D institutions in the CGIAR etc. The Ministry of Agriculture has a small programme to screen and recommend varieties of some crops to farmers. As there is no breeding programme, there is little opportunity for the local genetic material to be improved or combined in any organized way with the improved material in commercial varieties. This situation leads to the further neglect of the local material.

4.3 COLLECTION AND EVALUATION

Attempts to collect, describe and evaluate some local germplasm have been made in recent times, but were frustrated by inconsistent support. The longest term activity, which has had the continuous support of the Ministry of Agriculture has been with the cotton germplasm. At present about ? lines are maintained and some selections continue to be made but no active breeding is being carried out. Other working germplasm collections of pigeon pea, peanut, sweet potato, yam, papaya and hot pepper have existed at one time but as the projects that supported them came to an end, there were no resources to continue holding them and despite some attempts to retain these collections, they have all been lost for one reason or another. Unfortunately, there is presently no programme specifically directed to germplasm evaluation and conservation in Antigua/Barbuda.

Fortunately, some material has been collected and lodged in the germplasm collections of other international institutions (local pigeon pea lines were collected some years ago by ICRISAT, cassava material has also been collected by CIAT). Often, however, the extent and location of these collections are not well known in the 'donor' country.

4.4 CONSERVATION AND CHARACTERIZATION

Facilities for the long term storage of germplasm as seed could be provided with only minimal inputs at the CARDI field station where a functioning seed laboratory is already in existence. Additional equipment to store frozen seed would enable long term storage of small germplasm samples of crops and wild plants if necessary. Crop characterization and evaluation would require additional resources over a several year period to gather the required data from observation plots. These could be located at the CARDI Field Station and /or carried out by the Ministry of Agriculture at their several research and demonstration stations.

4.5 DATABASE DEVELOPMENT

Development of a database of germplasm information will be greatly facilitated by the use of the CSEGRIN (Caribbean Seed and Germplasm Resource Information Network) already set up through the FAO Improved Seed Project in CARICOM Countries and Surinam. The software and some hardware necessary for operation of this network have already been set up throughout the Caribbean and training in its operation has been provided to all participating countries. The system provides for the full description of a range of crops common to the region according to descriptors based on the IPGRI descriptors but adapted to local needs and includes detailed passport data, evaluation and characterization inputs. Also included is a graphics capability for the illustration of attributes such as leaf and fruit shapes or the appearance of disease symptoms etc. The central database, accessible on-line to all participating stations, is located in Trinidad at the Economic Commission for Latin America and the Caribbean (ECLAC). An additional advantage of this system is that it accommodates information on stocks of seed or other planting material that are available at the country or institutional nodes. At the present time only limited information is available on the system but it is anticipated that this will increase considerably in the near future. Information

can be accessed on line or via hard copy of the information. Both the Ministry of Agriculture, Research Division, and CARDI are Antigua nodes in the network.

4.6 FUTURE NEEDS

As described above, the situation regarding germplasm utilization in Antigua/Barbuda is not satisfactory. Considerably more effort needs to be put into the collection, evaluation and conservation of local germplasm along with a more systematic programme of germplasm introductions from the region and outside as parts of a comprehensive programme of germplasm improvement. It is unlikely that Antigua/Barbuda can sustain a breeding programme by itself but in collaboration with other CARICOM countries, through CARDI, IICA or some other institution, it could participate in a regional breeding programme focused on key target crops where maximum potential and need exists. Small scale seed production programmes exist in CARDI (forage legumes, pepper, corn, pumpkin, pigeon pea) and the Ministry of Agriculture (cotton) that could be expanded to accommodate new material coming out of a breeding programme. There have been some relatively successful experiences with farmer production of vegetative material for expansion of introduced varieties of yam in the past few years which could be built upon if necessary.

CHAPTER 5
National Goals, Policies, Programmes and Legislation

5.1 NATIONAL GOALS

In a tourist oriented economy, there is the usual conflict between developers and the environment. This scenario becomes more evident within fragile ecosystems, since one tries to balance activities of economic development vis-à-vis sustainable development. The national goal in terms of the conservation and management of plant genetic resources are as follows:

> "To attain economic sustainability (growth) with minimal impact on the plant genetic resource using the most appropriate scientific technology."

5.1.1 Participating Institutions

In Antigua/Barbuda There are (4) four major institution that are concerned with the conservation and management of plant genetic resources. There are as follows:

i) Ministry of Agriculture

ii) CARDI

iii) EAG Environmental Awareness Group

iv) Environmental Commission

5.1.2 Ministry of Agriculture

The Ministry of Agriculture's plant genetic resource programmes are in the divisions of Crop Research and Forestry. Tables shows the major agricultural crops and forestry species where the genetic resource programme is concentrated. The major limitations of the plant genetic resource programme was highlighted in chapter 7, however, invariably funding is one of the major limitation to increase conservation and proper management functions.

In my view the plant genetic resource activities is not focused on in fact on the priority Ministerial list of activities. As mentioned previously, the area of focus in terms of plant genetic resources included: sea-island cotton, pineapple, sweet potato.

5.1.3 CARDI

CARDI is another institution that is concerned with the conservation of plant genetic resource. Apart from their activities in forage/legumes, hot pepper etc., there is a concerned effort to conserve plant genetic resource material in terms of local field corn, local eggplant solanum sp, and the cucurbitae family in general. (see Tables 1 and 2 for detail).

While storage plant genetic resource oat CARDI field Station may not be an immediate problem I envisage storage at medium to long term period could be problematic if sufficient investment capital is not injected into the institution's programme in respect of the conservation and management of plant genetic resources.

5.1.4 The Environmental Awareness Group (EAG)

The EAG consists of a group of environmentally conscious individuals of different disciplines who have form an organization to enlighten major activities issues. That is happening within the environments. In fact, one of the overall goals of this organization is for mankind to live or co-exist with flora and fauna and to make earth a sustainable environment. The conservation of plant genetic resource is of paramount importance within the objectives of the EAG operates independent of governmental or Ministerial functions.

5.1.5 The Environmental Commission

The Environmental Commission is a recently formed organization that is concerned primarily with the preservation of historical buildings, institutions etc. with a view to have an impact on the tourism sector. However a secondary objective is the preservation of plant genetic resource material with a view to make Antigua/Barbuda and the earth generally a more sustainable environment for mankind.

5.1.6 General Observations

As shown above, the major organizations that are concerned with the preservation of plant genetic resource material tend to operate rather independently of each other and hence, this could be one of the major limitation's in terms of the effectiveness of the plant genetic resource conservation programme.

Secondly, it is clear that plant genetic resource conservation programmes are not on the priority list of governmental activities.

This is particularly evident in terms of the indiscriminate destruction of mangrove forest to construct hotels and marinas as well as the random clearing of slopes in excess of 15% to construct the most luxurious housing project etc. The conservation of these valuable plant genetic resources could some day be the salvation for the country.

Thirdly, as mentioned previously, funding is the major limitation in respect of the conservation activities of plant genetic resource.

5.2 TRAINING

While most of the persons engaged in activities of the conservation and management of plant genetic resource are trained in related disciplines that is Agriculture, Forestry, Horticulture, Soil Science etc., There is need to have a more hands on or practical oriental approach in order for one to fully comprehend or appreciate the whole exercise. In addition, the training that is required need to filtered through these organizations rather than a few possess the relevant skills.

In my view as mentioned in Chapter 8, the conservation of plant genetic resource is relatively new in these parts and no doubt individuals could benefit from training course per se in respect of the subject in question.

5.3 NATIONAL LEGISLATION

There are quarantine laws in respect of the importation of seeds and vegetative planting material in Antigua/Barbuda. However, I am of the firm view that there is need to amend current laws in respect of the following:

i) Importation and Export of in vitro material

ii) Movement of plant genetic resource within country as well as across borders (export) and import

iii) Legislation in respect of intellectual and property right in terms of plant genetic resource

iv) Legislation in terms of the payment of royalties to parties involved in the sale and transfer of plant genetic resource material.

CHAPTER 6
International Collaboration

6.1 INTERNATIONAL CONVENTIONS

Antigua and Barbuda was a signatory to Chapters 14 and 15 of Agenda 21, and as such is officially in support of such activities. However, there has so far been only marginal effort to implement these undertakings. The part that Antigua/Barbuda would play in any Global System that is established is still not very clear. It is important that Antigua/Barbuda contribute to as well as receive inputs from any such system.

6.2 INTERNATIONAL TECHNICAL ASSISTANCE

As mentioned in a previous chapter, Antigua/Barbuda has been involved with several FAO projects that deal with germplasm and because of its seed production capability Antigua and Barbuda can play a useful role in the Caribbean region.

The CGIAR commodity centres have made a number of contributions to Antigua/Barbuda, both by way of training and also by the provision of germplasm and technical assistance. Most important have been CIAT (forages and seed technology training); AVRDC (hot pepper technology); ICRISAT (peanut and pigeon pea germplasm and technology inputs); CIP (sweet potato pest management).

National institutes such as NRI (UK), Rothamsted (UK), USDA and University of Georgia (USA) have also played a role in providing germplasm, training and technology to assist in variety evaluation, improve seed production and germplasm storage and handling techniques. There have been some difficulties in accessing germplasm with specific characteristics suitable for individual ecozones.

One way in which these centres can assist our efforts is by providing backup germplasm collection facilities, so that should a collection here be lost through natural disasters such as hurricanes or through institutional changes, the material could still be recovered. Some centres do include material from the region in their collections of mandate crop germplasm, but the process has not been systematic and has not been properly documented.

IPGRI descriptors have helped provide a common base line for descriptions of our important crops, but if maximum benefit is to be derived, training in the use of the descriptors is very necessary. This became evident when training was being provided for the CSEGRIN database programme. It would be useful if IPGRI could provide more training in this area and strive to provide descriptors that reduce the amount of subjectivity to an absolute minimum.

6.3 REGIONAL TECHNICAL ASSISTANCE

Regional Research Organizations have a vital role to play in the development of regional germplasm for the benefit of CARICOM countries. The small size of the countries of the OECS makes it very difficult for them to provide the resources necessary to do individually all that needs to be done. In any case, much of the effort would be duplicated. A regional approach is therefore much more cost effective and capable of being sustained. Regional organizations such as CARDI and UWI with their expertise and facilities and their regional presence are well placed to develop germplasm activities on a regional basis. The West Indies Sugar Cane Breeding Station, one of the few institutions with a full time plant breeder, also has considerable experience in germplasm production, distribution and management. What is needed is a well thought out regional programme that can draw on the strengths of all these institutions.

6.4 NON-GOVERNMENTAL ORGANIZATIONS (NGOS)

There is a small but growing contribution from non-governmental organizations (NGO's) in the area of germplasm characterization and conservation. In Antigua, the Historical and Archaeological Society (HAS) began the work of educating the population about its natural and cultural heritage. However, the need for an organization more directly concerned with environment matters led to the establishment of the Environmental Awareness

Group (EAG) in 1989. This NGO has undertaken a number of projects aimed at characterizing and conserving the biological diversity of the country. Currently, a Biodiversity project, partially funded by the Nature Conservancy and in collaboration with the Island Resources Foundation (IRF) is in progress and is aimed at recording the species composition of several selected habitats. NGO's have considerable potential to provide impetus in the drive to conserve natural habitats such as forests, wetlands, and coastal reefs and in so doing to provide broad based conservation of the country's genetic resources, but they need technical and financial assistance from international and regional institutions as well as the local government agencies. Regional NGO's such as the Caribbean Conservation Association and the IRF mentioned above have made technical and financial contributions to national efforts. Other programmes and information networks such as the CARINET which has only recently been set up offer some scope for increased collaboration in this area.

6.5 NEEDS

The major needs in developing collaboration would appear to be:

- Increased awareness of the need for a specific focus on germplasm management and biodiversity matters.
- Adequate knowledge of the resources available to assist in biodiversity management.
- Sufficient funding to maintain and support the personnel and work required to obtain the needed information at the local level (Governmental agencies and NGO's)
- Ways to access the specialized technical knowledge for species recognition, identification and exploitation that is needed to assess biodiversity potential and the areas at risk.

CHAPTER 7
National Needs

7.1 GENERAL

This country report has revealed many national needs and opportunities in terms of conserving and managing plant genetic resource material within a nation where the main sector which contribute to the economy is tourism.

In this report I have shown that tourism contribution to the GDP (Gross Domestic Product) is some 70% whereas agricultural contribution to the GDP is only 4%.

This first statement has clearly shown very little importance is placed on the national genetic resource material, since tourism within the national bounds of Antigua/Barbuda means the destruction of the mangrove forest along the coast in order to construct multi-million dollar hotel and marina projects. As you may be aware, this does not only have a direct impact on the immediate plant genetic resource but on the flora and fauna or the environment per se.

On the other hand, there are many opportunities which may have been over-sighted or it could be that the emphasis is not placed on the conservation as well as planned development of plant genetic resource to satisfy a particular need which can mean valuable returns for the country. Both national needs as well as opportunities will be enumerated in respect of plant genetic resource material.

Below a number of national needs are enumerated that have been highlighted within the context of the country report, particularly on plant genetic resources.

7.2 AGRICULTURAL POLICY

After the abandonment of the sugar industry toward the mid 1970's, agricultural policies in respect of land use, land tenure, agricultural marketing, agricultural credit, and input supply particularly sourcing of seeds was never

done in a comprehensive manner which no doubt have directly impacted on both the conservation and management of plant genetic resources.

Some schools of thought have postulated that return on investment on tourist oriented projects is higher than agricultural projects, hence the slant toward tourism project. While this may be so an agricultural based economy tend to be more stable than a tourism economy. Thee is need to develop a comprehensive agricultural programme.

7.3 LEGISLATION

Laws governing activities within the (5) forest types as mentioned in Chapter 1 were basically regulatory in nature. In fact, these laws came into effect during the 1930s or during the colonial era.

Firstly the current forestry laws need to be amended as well as the creation of new laws particularly in the area of :

(a) Conservation of plant genetic resources material

(b) Movement of plant genetic material within border as well as strict quarantine laws governing the export and entry of exotic species of plant genetic resource material

(c) The need to develop comprehensive laws in respect of genetic (germplasm) material as well as the whole question of payment of royalties.

(d) The need to conduct environmental impact assessment studies particularly along and within the mangrove forests prior to the construction of hotels and marinas. The EIA should be equipped with the necessary legislature to stop construction.

7.4 PLANT GENETIC RESOURCE CONSERVATION PROGRAMME

Currently plant genetic resource conservation programmes are weak or in some cases non existent. However, there is need to recognize the importance of plant genetic resources and the value of these assets within the economy of any country.

As shown, the plant genetic conservation programme operate as single entities, some are funded by the Ministry of Agriculture and international agencies. However, it is of paramount importance that organizations with interest in plant genetic resources be integrated in order to maximize their national effort.

There is an urgent need for guidance in respect of developing plant genetic resource and conservation programmes.

For example, it is clearly shown in Tables 1, 2 and 3 and Appendix 1 and 2 that Antigua/Barbuda is abound with a wide plant genetic resource as well as their uses that have been evaluated to some extent. However, there is need to further develop scientifically the properties of these genetic resource.

7.5 CONSERVATION OF GENETIC RESOURCE BOTH *IN-SITU* AND *EX-SITU*

As shown in Chapter 3, the conservation of plant genetic resource *in situ* was a normal function both at CARDI and Dunbars Field Stations. With the advent of the Seed Improvement Project for CARICOM and Suriname, there has been increased concentration activities of agronomic crops at both stations, however, there is need to strengthen plant genetic resource and conservation activities particularly in the area of germplasm characterization and evaluation.

Another important area is the need for physical storage facilities in respect of plant genetic resource. These facilities are lacking except on one of the field stations.

7.6 NATIONAL OPPORTUNITIES

7.6.1 Ecological Advantage

While the semi-arid climate of Antigua/Barbuda appears to have a negative effect on certain aspects of tropical agricultural products, these dry climate is in fact positive attribute in production of certain crops. In other words, Antigua/Barbuda possess specific ecological advantage in certain crops.

These crops are as follows:

(i) Sea-island cotton

(ii) Mauby production - *Colubrina sp.*

(iii) Pineapple production

(iv) Aloe

(v) Vegetable production

In terms of forest products, these include:

(i) Citronells *sp.*

(ii) Mahogany - furniture

(iii) White Cedar - boat building

(See Table 3 and Appendix 1 for detail.)

Some of the genetic resource mentioned, that is, mauby sp. and Aloe sp. have not been developed to their fullest potential. Mauby sp. remains one of the most potential agro-industrial crop once given the necessary policy signals to initiate production.

As you are aware, Antigua/Barbuda produces the longest staple (lint) sea island cotton variety MSI which fetches premium price on the Japanese market of US$5.25/lb. or US$11.66/kg.

In spite of Antigua/Barbuda's semi-arid climate, Antigua is the largest producer of vegetables per hectare in the OECS. This has been achieved using dry farming technologies such as drip irrigation technology as well as mulching. While the citronella grass sp. resource is untapped, this product can be a lucrative concern particularly in the area of oil production used in the formulation of cosmetics, etc.

7.6.2 Genetic Resources of Medicinal Plants

Plant genetic resource that have shown medicinal properties or the ability to cure a particular ailment is shown in Appendix 2.

The investigation of these genetic resource was done at the Chemistry Division of the Ministry of Agriculture as part of an OAS project. The use of these materials was noted locally by persons who have used these material for a specific ailment.

This area of herbal medicine opens a new dimension of the untapped resource found in Antigua/Barbuda.

With further scientific investigation, these genetic resource can be the answer for some to the world's deadliest diseases/ailments.

7.6.3 Insular Conditions *vis à vis* Genetic Purity

Because of the insular nature of these islands plant genetic resources can remain pure genetically within a given population dynamics. Hence, there is less genetic variability within a specific plant genetic resource.

7.6.4 Creation of Conservation Programme

In view of the fact that the conservation of plant genetic resource is a relatively new area in these parts it would be relatively easier to impose or super-impose the correct principles in terms of the conservation and management of plant genetic resource material.

CHAPTER 8
Proposals for a Global Plan of Action

While the proposal mentioned are by no means panacea to solve global mismanagement of the environment if we as countries unite our efforts, I am of the firm view that we will attain a world that is able to sustain life for a very long time.

Below are a number of proposals which we believe can have a positive impact throughout life on earth. These proposals are therefore as follows:

- To heighten the awareness of the conservation of plant genetic resource material at the global level.
- To strengthen national plans and programmes in respect of plant genetic resource conservation and management at the international level.
- To strengthen legislation in relation to the movement of plant genetic resource within countries and across borders.
- To create and amend legislation within the context of property and intellectual rights in terms of genetic resource material.
- To create mechanism whether legally or otherwise to ensure the full implementation by signatories to Agenda 21, the Convention on Bio-diversity and any other convention that have been enacted to conserve plant genetic resource.
- To demonstrate clearly the correlation between destruction of tropical forest and the effects on the ozone layer as well as the increase levels of oceans globally that will affect low-lying island nations in the Caribbean and the Pacific.
- To heighten the awareness of sustainable development in relation to economic development within small island nation globally, particularly in a tourist oriented economy.
- To show positively the effects of bio-diversity and the value of plant genetic resource within an island nation.

8.1 CONCLUSIONS

While aspects in relation to the nuclear testing, movement of radioactive material globally may not be part of the terms of reference of this exercise, we see the potential hazards radioactive material can have on fragile ecosystems within insular nations of the Caribbean and the Pacific. We endorse the global stance of the deleterious effects that nuclear/radioactive material can have on life *per se* on earth.

In spite of our small size in terms of global perspective, we are of the firm view that life on earth can be at sustainable levels once we the countries that make up this beautiful planet earth adhere to the various international conventions in respect of plant genetic resources and the environment.

To create a sustainable earth all nations whether small or large must respect the rights and the sovereignty of each other.

As perceived, there are wide gaps in terms of the level of plant genetic conservation and management programmes, however I have highlighted our weakness or needs as well as our potentials. The major success of these activities lies in the awareness of the need to conserve plant genetic resource globally as well as the implementation of the various conventions, agreements, etc. Sustainability can also be achieved globally when larger nations erase the philosophy of exploitation and greed for national resources world-wide.

APPENDIX 1

A. Descriptive

Criteria used in our ecosystem classification

Vegetation structure

Maximum height (three major levels)

Pressure or absence of a canopy or other storeys

Percentage ground covering of woody vs. non-woody species

Physical characteristics

Type of substrate

Seasonality and extend of water

Fresh vs. saline

Plant species (dominants and/or indicator species)

Next steps

Some work still remains for the classification itself. In particular, additional information is needed on the location of these ecosystems in Barbuda.

For each of the agricultural areas listed and for the urban areas, we plan to provide an estimate of the acreage based on the latest government statistics and the recent data gathering effort of the Development Control Authority.

We plan to map all of the ecosystem information, and record it as part of a GIS, when the opportunity allows.

B. Key

I. Trees to 20 meters or more - Distinct strata - Moist

A1. Moist Forest Formation - Upland Forest

A2. Moist Forest Formation - Gulley Forest

A3. Moist Forest Formation - Wet Limestone Forest

II. Trees and shrubs more than 5 meters and less than 20 meters

A4. Moist Forest Formation - Street and Ghaut

B1. Dry Evergreen Formation - Mixed Woodland

B2. Dry Evergreen Formation - Acacia Thicket

B3. Dry Evergreen Formation - Logwood Thicket

B4. Dry Evergreen Formation - Leucaena Thicket

B5. Dry Evergreen Formation - Palm Forest

C1. Coastal Formation - Mangrove Forest

C2. Coastal Formation - Sale Flat and Lagoon Forest

C3. Coastal Formation - Dune Forest

D1. Aquatic Plant Formation - Riparian Forest

D2. Aquatic Plant Formation - Freshwater Swamp

III. Vegetation less than 5 meters

B6. Dry Evergreen Formation - Cactus and Thorn Scrub

C4. Coastal Formation - Hedge Community

C5 Coastal Formation - Rock Pavement

C6. Coastal Formation - Dune Scrub Vegetation

C7. Coastal Formation - Beach Vegetation

C8. Coastal Formation - Estuarine and Mud Flat

C9. Coastal Formation - Saline/Brackish Marsh

D3. Aquatic Plant Formation - Dune Marsh

D4. Aquatic Plant Formation - Freshwater Marsh

D5. Aquatic Plant Formation - Ponds and Lakes

E1. Terrestrial Herbaceous Formation - Tall Grass Flood Savanna

E2. Terrestrial Herbaceous Formation - Mixed Savanna

E3. Terrestrial Herbaceous Formation - Pasture

E4. Terrestrial Herbaceous Formation - Upland Sananna

E5. Terrestrial Herbaceous Formation - Citronella Savanna

F1. Agricultural Area - Herbaceous Crop

F2. Agricultural Area - Tree Crop

F3. Agricultural Area - Livestock

F4. Agricultural Area - Forest Plantation

G1 Urban Area

I. Trees to 20 meters or more - Distinct strata - Moist

A1. Moist Forest Formation - Upland Forest

Approaches rainforest conditions; i.e. abundant lianas (*including Philodentron spp*) often climbing to canopy; abundant epiphytes, bromiliads and ferns. In addition to a canopy and ground covering a mid-level understorey from 2 - 5 meters is sidcernible (unlike in the "Gulley Forest").

Dominant species: Canopy: *Sideroxylon foetidissimum* (Boggy Peak) *Clusia major* (Mountain cherry), *Lanchocarpus violaceus, Cordia spp.,* many species in the Lauraceae.

Mid-level understorey: *Eugenia spp., Inga laurina* (Spanish Oak), *Tabernaemontana citrifolia* (Milk weed), and several species in the *Melastomataceae*.

Location: Not found in Barbuda. An Antigua, only at Boggy Peak, top of Christian Valley and parts of Wallings.

A2. Moist Forest Formation - Gulley Forest

Steep wet ghauts; often with freshwater springs. Understoret is sparse because of floods, consisting mainly of seedings of the canopy species plus ferns and others adapted to flooding.

Dominant species: *Roystonea oleracea* (Royal palm), *Hura crepitans* (Sandbox) *Cocos nucifera* (coconut), *Bucida buceras* (Whitewood), *Andira inermis* (Angelin), *Ceiba pentendra* (silk cotton), *Terminalia catappa* (Indian Almond), *Mangifera indica* (Mango), *Cresentia cujete* (Calabash), *Chrysophyllum argenteum* (Star Apple) *Bambusa spp* (Bamboo), a number of species of Polypodium ferns.

Location: Not found in Barbuda. In Antigua, main examples are Wallings, Christian Valley, Sugar Loaf, Hamilton's, and Brecknocks.

A3. Moist Forest Formation. - Wet Limestone Forest

Associated with solution holes. Well defined canopy and mid-level understorey.

Dominant species: Canopy: *Cocothrinax barbadensis, Sideroxylon obovatum* (Boxwood; common at Bryand Cave) *Sideroxylon sp* (Mastic; common at Darby Cave.). Mid-level understorey: Seedlings of the canopy species plus Capparis indica (Black willow), *Capparis cynophallophora* (Black willow).

Location: Restricted to Highlands of Barbuda.

II. Trees and shrubs more than 5 mmeters and less than 20 meters

A4. Moist Forest Formation - Stream and Ghaut

Separable from other "Moist Forest Formations" by the lower height of the vegetation and lack of a distinctive canopy. Under natural conditions the vegetation differs from that on adjoining lands because of greater water availablilty; with current land pressures, an equally strong constraint is that adjoining lands tend to be under cultivation.

Dominant species: *Codia obliqua* (Clammy Cherry), *Psidium guajava* (Guava), *Phoenix dactylifera* (Date palm), *Elaeis guineensis* (Oil Palm); especially at Body Ponds, *Cocos Nucifera* (Coconut), *Tabebuia heterophylla* (White Cedar), *Coccoloba diversifolia* (Chilli grape), *Coccoloba uvifera* (Sea grape), *Ficus Citrifolia* (Strangler fig), *Bucida buceras* (Whitewood), *Annona Glabra* (Ghaut or Pond apple), *Ipomoea spp., Bambusa spp* (Bamboo), *Stigmaphyllon spp.*

Location: Throughout Antigua, with good examples in All Saints, Boddy Ponds and Swetes.

B1. Dry Evergreen Formation - Mixed Woodland

This, and the next three communities, are dense, fairly impenetrable thickets with at least 75% ground covering of wood species. Occurs in dry areas and/or with shallow soils. In the mixed Woodland" - in contrast to the following three communities - no species dominate; i.e. no single speices covers more than 50% of the area. The species comprising the "Mixed Woodland" differ somewhat from site to site and between islands. Two sites - in particular Sleeping Indians and the northeast face of sugarloaf - are distinct enough from the other "Mixed Woodland" sites that they receive special attention below).

Dominant species: Antigua: *Chamaecrista glandulosa var. swartzii, Taebuia heterophylla* (White cedar), *Pithecellobium unguis-cati* (Bread and cheese), *Tamarindus indica* (Tamarind), *Plumeria alba* (Wild frangipani*), Amyris elemifera* (Torchwood), *Celtis iguanaea* (Cockspur), *isonia subcordata* (Loblolly), *Capparis indica* and *C. cynophalalophora* (Black willow*), Malphigia emarginata* (West Indian cherry), *Malphigia linearis* (Ram goat cherry), *Canella winterana* (Wild cinnamon), *Comocladia dodonaea* (Hogwood), *Jacquinia armillaris, Guettarda parviflora* (white wattle) *Agave raratto* (Dagger plant), *Leucaena leucocephala* (Wild tamarind), and several myrtle species. In moister pockets only, *Ficus citrifolia* (Strangler fig) occurs and an *occasional Ceiba pentendra* (Silk cotton) rises above the other vegetation. In open patches or forest edge, *Colubrina arborescens* (Mauby tree) occurs.

Sleeping Indians and northeast face of Sugarloaf: Both of these "Mixed Woodland" communities are identifiable by the abundance of Tillandsia uneoides (Old man's beard). In addition to the species listed above, these rocky, cliff-face sites host *Morisonia americana* (Rat apple), *Pilocorereus royeni* (Dildo cacuts), *Rhipalis baccifera*, *Hylocereus trigonus* (Night-blooming cactus), *Tragia volubilis* (Stinging nettle) *Pitcairnia angustifolia*, *Tillandsia utriculata* (Wild pine).

Barbuda: *Coccoloba krugii* (Wild grape), *Tabebuia heterophylla* (White cedar), *Bursera simaruba* (Turpentine), *Plumeria alba* (Wild frangipani), *Canella winterana* (Wild cinnamon), *Pithecellobium unguis-cati* (Bread & cheese), *Comocladia dodonaea* (Hogwood), *Pisonia subcordata* (Loblolly). *Ficus citrifolia* (Strangler fig), *Malphigia linearis* (Ram goat cherry), *Bourreria succulenta*, *lantana involucrata* (Sage), *Solanum racemosum* (Canker berry).

Location: In Antigua, fairly restricted to Paynters, New Winthropes, and Barnes Hill. In Barbuda, this is the most common type of "Dry Evergreen" community, found throughout the Highlands and in Bull Hole.

B2. Dry Evergreen Formation - Acacia Thicket

More than 50% of the area covered by Acacia species. Believed to be secondary in nature; whether an Acacia species, *Haematoxylon campechianum*, or *Leucaena leucocephala* dominates, may depnd on the type and timing of human disturbance. Acacia thickets are believed to result from wholesale clearing, especially for sugar cane.

Dominant species: *Acacia farnesiana, A. macracantha, A. tortuosa, A. nilotica* (Cassie), *Pithecellobium unguis-cati* (Bread and cheese), *Prosopis juliflora* (Prosopis), *Haematoxylon campechianum* (Logwood).

Location: Common in Antigua, examples in Piggots, Fitches Creek, Pares, All Saints, Jonas, Bethesda, New Field/St. Phillip area. Occurs in isolated patches in Barbuda, where the plants typically are more stunted (often less than 5 meters).

B3. Dry Evergreen Formation - Logwood Thicket

More than 50% of the area covered by Haematoxylon campechinum.

Dominant species: *Haematoxylon campechianum* (Logwood).

Location: In Antigua, occurs in All Saints, Sandersons, Burkes. In Barbuda, occurs east of Codrigton and in the fields along the road to Coco Point.

B4. Dry Evergreen Formation - Leucaena Thicket

More than 50% of the area covered by *Leucaena leucocephala*.

Dominant species: *Leucaena leucocephala* (Wild tamarind).

Location: In Antigua, occurs in similar areas as for logwood Thicket. Not known to occur in Barbuda.

B5. Dry Evergreen Formation - Palm Forest

Antigua and Barbuda each has a different type of Palm Forest characterized by the dominant palm species.

Antigua:
Dominant species: *Phoenix dactylifera* (Date palm).

Location: All Saints, Freemans, buckleys.

Barbuda:

Dominant species: *Cocothrinax barbadensis* (individuals do not reach the height attained in the Wet Limestone Forest), *Canella winterana* (Wild cinnamon) and *Ficus citrifolia* (Strangler fig).

Location: Fairly continuous belt running east-west in the sourth-east section of the Highlands.

C1. Coastal Formation - Mangrove Forest

Mangrove forests in the Lesser Antilles are characterized by the dominance of one or more of the seven salt-tolerant species in the following genera -- Rhizophora, Avicennia, Leguncularia or Conocarpus.

Dominant species: *Rhizophora mangle* (Red mangrove), *Avicennia germinans* (Black mangrove), *Laguncularia racemosa* (White mangrove), *Conocarpus erectus* (Buttonwood).

Location: In a 1991 study by Bacon, he noted 36 sites in Antigua comprising 559 hectares and 9 sites in Barbuuda comprising 617.

C2. Coastal Formation - Salt Flat and Lagoon Forest

This can be considered a component of the broader mangrove-sea grass system, but interaction with the sea only occurs through flooding (freshwater flows to sea) or sea surges (salt water flows inland). It is characterized by (i) the flats which are dry or seasonally flooded areas lacking vegetation and (ii) lagoon forests of mixed composition (i.e., includes many non-mangrove species) that form very narrow fringes outside the flats.

Dominant species: The "Lagoon Forest" contain the mangrove species listed above, but mixed with other speices such as *Thespesia populnea* (Seaside manho), *Hippomane mancinella* (Manchieel). The species of the "Salt Flat" are unknown.

Location: Restricted in Antigua to the flashes, Parham, Urlings, Old Road, Bethesda, Ayre's Creek, Fithces' Creek, Claremont, Indian Creek, Falmouth. In Barbuda, adjoins many of the Mangrove Forest sites.

C3. Coastal Formation - Dune Forest

Distinguishable by the height of the vegetation (5-20 meters) and the dune substrate.

Dominant species: *Coccoloba uvifera* (Sea grape), Canella winterana (Wild cinnamon), *Tabebuia heterophylia* (White cedar).

Location: Not found in Antigua. In Barbuda, it is most extensive at Palmetto Point, especially on the older more weathered dunes closest to Codrington Lagoon. Also occurs at Cedar Tree Point, Palm Beach and the south-east coast.

D1. Aquatic Plant Formation - Riparian Forest

Like the other "Aquatic" formation, it is characterized by presence of standing fresh water or soil that is saturated much of the year. The water actually could be considered part of the stream system, but it is so slow moving (other than during floods) that the ground is seldom. dry.

Dominant species: *Thespesia popuinea* (Seaside mahoe), *Hippomane mancinella* (Manchineel), *Bucida buceras* (Whitewood), *terminalia catappa* (Indian almond), *Annona glabra* (Ghaut or Pond apple), *Sapindus saponaria* (Soapberry); *Acrostichum danaefolium* (Swamp fern); *Nymphaea spp* (Water lilies).

Location: Restricted to Antigua, where the only remaining communities are along Black Ghaut and Bristol Ghaut between Collings Reservior and Gaynors, and the North Sound.

D2. Aquatic Plant Formation - Freshwater Swamp

Unlike in the "Riparian Forest", water movement through this low-lying community is more as a widespread sheet rather than concentrated in a stream. There also may be differences in substrate between the two communities, however, the most obvious difference between the "Riparian Forest" and the "Freshwater Swamp" is in the species composition.

Dominant species: *Bucida buceras* (Whitewood), *Annona glabra* (Ghaut or Pond apple). *cordia obliqua* (Clammy cherry), *Pithecellobium unguis-cati* (Bread and Cheese), *Thespesia populnea* (Seaside mahoe), *Coccoloba boxii* (Grape; according to Howard this may be a hybrid, but considered a distinct species in Francis et al, 1992), *Laguncularia racemosa* (White mangrove*), Conocarpus erectus* (buttonwood) and *Acrostichum danaefolium* (Swamp fern). In the breaks and openings, other species include Wedelia calycina (Piss-a-bed), sedges and a few grass spoecies. On the edge oif the swamp, species *include Prosopis juliflora* (Prosopis), *Acacia spp, Tabebuia heterophylla* (White cedar*), Leucaena leucocephala* (Wild tamarind), *Conocarpus erectus* (Buttonwood), *Azadirachta indica* (Neem).

Location: In Antigua, there is one small example of this community remaining at Fitches Creek; bounded on the south by the quarry, on the north by the quarry road, on the east by "Lagoon Forest" and on the west by "Freshwater Marsh". In Barbuda, Bull Hole and some small sink holes; in the latter, Bucida and Coccoloba are absent.

III. Vegetation less than 5 meters

B6. Dry EvergreenbCatctus and Thorn Scrub

Lack of water and or shallow soils restrict height of woody species. this community often occurs near the coast, but is not restricted to it as are the "Coastal" formations.

Dominant species: *Pisonia subcordata* (Loblolly), *Capparis indica and C. cynophalloiphora* (black willow), *Leucaena leucocephala* (Wild tamarind), *Pitecellobium unguis-cati* (Bread and cheese), *Haematoxylon campechianum* (Logwood); *A gave karatio* (Dagger plant), *Philoserceau royenii* (Dildo cactus), *Clerodendrum aculeatum, Pisonia aculeata* (Black thorn).

Location: In Antigua, occurs in Picadilly area, Devil's Bridge, willikies and other pockets on east side. In Barbuda, occurs on northers and northeast face of the Seac Cliffs.

C4. Coastal Formation - Hedge Community

Stunted woody species form thin strips that run parallel to the coast.

Dominant species: *Thespesia populnea* (Seaside maho), *Hippomane mancinella* (Manchieel), *Conocarpus erectus* (Buttonwood), *Cocos nucifera* (Coconut).

Location: Common in Indian Creek area, Pigeon Beach, and Willoughby Bay. (Barbuda?)

C5. Coastal Formation - Rock Pavement

Short, scattered plant and considerable bare ground. The "pavement" is weathered limestone, with a thin covering of soild that often is inadequate for normal root development.

Dominant species: *Mammillaria nivosa* (Pope's head cactus), *Melocactus inortus* (Turk's cap cactus), *Tillandsia itriculata* (common at Mill Reef), *Croton astroites, Phyllanthus epiphyllanthus, Canella winterana* (Wild

cinnamon), *Chamaecrista glandulosa var. swartzil, Pithecellobium unguis-cati* (Bread and cheese), *Dodonaea viscosa* (Hop shrub), *Erithalis fruticosa* (Candlewood), *Erithalis odorifera* (Torchwood), *Philoserceus royenil* (Dildo cactus), *Agave karatto* (Dagger plant).

Location: Willoughby Bay, Mill Reef, and the off-shore islands of Green, Pelican, York and Crump. (Barbuda?).

C6. Coastal Formation - Dune Scrub Vegetation

Low-lying plants growing on the crests of dunes. Dunes do no occur in Antigua; and in each of the three areas where this community occurs in Barbuda the species composition differs.

Dominant species and location: Palmetto Point: *Chrysobalanus icaco* (Coco plum), *Cocoloba krugii* (Wild grape*), Phyllanthus epiphyllanthus, Byrsonima lucida* (Clam cherry), *Tabebuia heterophylla* (White cedar*), Thrinax morrisii (Palmetto palm).* North-east coast: *Hippomane mancinalla* (Manchineel), *Caesalpinia pulcherrima* (Warri), *Erithalis fruticosa* (Candlewood). Cedar Tree Point and Low Bay Point: *Tabebuia heterophylla* (White cedar), *Erithalis fruticosa* (Candlewood), *Coccoloba uvifera* (Sea grape), *Dodonaea viscosa* (Hop shrub), *Dodonaea elaeagnoides*.

C7. Coastal Formation - Beach Vegetation

Common along beaches, from just above high water mark inland as far as sand extends. Low-lying grasses and herbs, with some stunted woody species.

Dominant species: *Canavalia rosea* (Sea or Beach bean), *Argusia gnaphalodes* (Seaside lavender), *Ernodea littoralis* (common in Barbuda), *Borrichia frutescens* (Seaside purslane), *Strumpfia maritima* (Rosemary; common in Barbuda), *Ipomoea pes-caprae* (Beach morning glory), *Suriana maratima, Coccoloba uvifera* (Sea grape), *Ernodea littoralis* (common in Barbuda), *Blutaparon vermiculare.*

Location: Common on both islands.

C8. Coastal Formation - Estuarine and Mud Flat

Distinguishable from "Coastal Formations - Salt Flat and Lagoon Forest" by (i) open access to the sea and tidal influences, and (ii) species composition.

Dominant species: Sea grass and mangrove spp. seedlings.

Location: In Antigua, best example is at Hanson's Bay at the mouth of the Flashes. (Barbuda?)

C9. Coastal Formation - Saline/Brackish Marsh

Characterized by standing water (but saline rather than fresh, as in "D3. Freshwater Marsh" and/or saturated soil; salt-tolerant vegetation.

Dominant species: Sedges, including *Salicornia spp*.

Location: In Antigua, along coast at the Flashes, Aeyr's Creek, Parham, McKinnon's Pond and Willoughby Bay. In Barbuda, occurs on Goat Island and other parts of Codrington Lagoon, but also inland, east of Bull Hole, due to leaching from slat substrate and/or intrusion from saline water table.

D3. Aquatic Plant Formation - Dune Marsh

Characterized by being dry most of the year, with seasonal flooding; and by the dune substrate.

Dominant species: *Canocarpus erectus* (Buttonweood) and *sedge spp.*

Location: Only known from Palmetto Point in Barbuda, where it occurs on older more weathered dunes in north-west section.

D4 Aquatic Plant Formations - Freshwater marsh

Standing water and/or saturated soil for much of the year; vegetation typically less than two feet in height.

Dominant species: Numerous sedge and *grass spp*, including *Eleocharis cellulosa* and *Fimbristylis ferruginea; Nymphaea spp.* (Water lilies).

Location: In Antigua, parts of the Flashes, pasture north-west of Paynters and west of Airport Roat. In Barbuda, parts of Bull Hole.

D5. Aquatic Plant Formation - Pond and Lake

This community regfers to the bodies of water and the terrestrial vegetation that occurs on the lands bordering the water. Thus, the aquatic species of this community differ somewhat from the Freshwater Marsh community species in that the former are adapted to deep standing water conditions versus the seasonal, shallow water cover typical of marshes. The terrestrial woody species (Some of which amy exceed 5 meters in height) associated with the ponds and

lakes benefit from access to the water, but have no special aquatic adaptations. In both islands, ponds and lakes are man-made features.

Dominant species and location: Numerous ponds and small lakes occur in Antigua. In Barbuda, occurs around Codrington.

Aquatic: *Nymphae spp.* (Water lilies), *Eichornia crassipes* (Water haycinth), *Nelumbo nucifera* (Lotus), *Pistia stratiotes* (Water lettuce).

Terrestrial: North part of Antigua: *Prosopis juliflora* (Prosopis), *Bucida buceras* (Whitewood), *Coirdia obliqua* (Clammy cherry), and *acacia spp.* Central Plains of Antigua: *Bucida buceras* (Whitewood), *Cordia obliqua* (Clammy cherry), *Pisonia subcordata* (Loblolly), *Tabebuia heterophylla* (White cedar*), Hippomane mancinella* (Manchineel), and *Acacia spp.* In the south of Antigua: *Roystonea oleracea (Royal palm), Bucida buceras (Whitewood), Bambusa sp. (Bamboo), Elaeis guineensis* (oil Palm), *Cocos nucifera* (Coconut), *Terminalia catappa* (India almond) and numerous fruit tree species.

E1. Terrestrial Herbaceous Formation - Tall-Grass Flood Savanna

Low permeability soils retain water from seasonal floods, resulting in herbaceous community relatively free of woody species.

Dominant species: *Paspalum spp* (Hay grass) and other grass species, and sedge species.

Location: Within the Lesser Antillles, occurs only in Barbuda within Bull Hole, located south of the Highlands in the central-east part of the island.

E2. Terrestrial herbaceous Formation - Mixed Savanna.

Characterized by having more than 25% non-woody ground covering (vs. the various "Thickets" in the "Dry Evergreen Formations"), but less than 75% non-woody ground covering (vs. the other "Savanna" communities and the "Pasture" community.

Dominant species: *Walteria indica* and *W. glabra, abutilon spp, Ludwigia octovalvis, Stylosanthes hamata* (Mother Segal?; Sweet weed), *Chamaesyce hirta*, *Euphorbia cyathophora* (Wild poinsettia), *Grotolaria retusa* (Shack-shack), *Mimosa pudica* (Sensitive plant), *Neptunia plena and N. pubescens, Amaranthus spp* (Spinach), *Trimezia marlinicensis* (Yellow iris), *Spriranthes Ianceolata* and *S. torta* (Ground orchids), *Desmodium incanum* (Sweetheart*), Stachytarpheta jamaicensis* (Vervain).

Location: Does not occur in Barbuda. In Antigua, found primarily in the Central plains, especially around All Saints, Sea View Farm and Freeman's Village.

E3. Terrestrial Herbaceous Formation - Pasture

Grassy Areas of abandoned agricultural lands where woody species are kept in check by grazing from livestock.

Dominant species: Primarily *Paspalum spp* (Hay grass) and scattered woody species browsed to ground level.

Location: Occur throughout Antigua (Barbuda?)

E4. Terrestrial Herbaceous Formation - Upland Savanna

Usually less than an acre in size, these communities are early successional following clearing of moist forest. if no further disturbance occurs, the woody speices of the adjoining forest replace the herbs.

Dominant species: *Trimezia martinicensis* (Yellow iris), *Spiranthes lanceolata* and S. *inouta* (Ground orchids), *Desmodium incanum* (Sweetheart) and numerous sedge species.

Location: Does not occur in Barbuda. In Antigua, only occurs at elevations above 800 feet.

E5. Terrestrial Herbaceous Formation - Citronella Savanna

Virtually monospecific stand of this introduced grass, often 50 acres or more in size, exist where Moist Forest has been cleared. Maintained by fires that are deliberately set by landless livestock owners to promote growth of young palatable shoots.

Dominant species: *Cympogon citratus* (Lemon grass).

Location: Does not occur in Barbuda. In Antigua, occurs mostly in south with good examples in Body Ponds, Brecknock, Hamiltons, McNish, Christian Valley and Dunnings Valley.

C. Plant Species Included in the Ecosystem Classification

Abutilon spp.
Acacia farnesiana
Acacia nacracantha
Acacia nilotica (Cassie)
Acacia tortusa
Acrostichum danaefolium (Swamp fern)
Agave karatto (Dagger plant)
Amaranthus spp (Spinach)
Amyris elenifera (Torchwood)
Andira inermis (Angelin)
Annona glabra (Ghaut or Pond apple)
Argusia gnaphalodes (Seaside lavender)
Avicennia germinans (Black mangrove)
Azadirachta indica (neem)
Bambusa spp. (Bamboo)
Blutaparon vermiculare
Borrichia frutescens (seaside tansy)
Bourreria succulenta
Bucida bvuceras (Whitewood)
Bursera simaruba (Turpentine tree)
Byrsonima lucida (Clam cherry)
Caesalpinia pulcherrima (Warri)
Canavalia rosea (Sea or Beach bean)
Canella winterana (Wild cinnamon)
Capparis indica (Black willow)
Capparis cynophallophora (Black willow)
Capparis indica (Black willow)
Ceiba pentandra (Silk cotton)
Celtis iguanaea (Cockspur)
Chamaecrista glandulosa var. swartzii
Chamaesyce birta
Chrysophyllum argenteum (Star apple)
Chrysobalanus icaco (Coco plum)
Clerodendrum aculeatum
Coccoloba borii (Grape: maybe a hybrid)
Coccoloba diversifolia (Chili grape)
Coccoloba krugii (Wild grape)
Coccoloba uvifera (Sea grape)
Cocos nucifera (Coconut)
Cocothrinax barbadensis
Colubrina arborescens (Mauby tree)
Comocladia dodonaea (Hogwood)

Plant Species Included in the Ecosystem Classification

Conocarpus erectus (Buttonwood)
Cordia obliqua (Clammy cherry)
Cordia spp.
Crescentia cujete (Calabash)
Crotolaria retusa (Shack-shack)
Croton astroites
Cymbopogon citratus (lemon grass)
Clusia major (Mountain cherry)
Desmodium incanum (Sweetheart)
Dudonaea elaeagnoides
Ipomoea pres-caprae (Beach morning glory)
Ipomoea spp.
Jacquinia armillaris
Laguncularia racemosa (White mangrove)
Lantana involucrata (Sage)
Leucaena leucocephala (Wild tamarind)
Lonchocarpus violaceus
Ludwigia octovalvis
Malphigia emarginata (West Indian cherry)
Malphigia linearis (Ram goat cherry)
Mammillaria nivosa (Pope's head cactus)
Mangifera indica (Mango)
Melocactus inortus (Turk's cap cactus)
Mimosa pudica (Sensitive plant)
Morisonia americana (Rat apple)
Melumbo nucifera (Lotus)
Neptunia plena
Neptunia pubescens
Nymphaea spp (Water lillies)
Paspalum spp (Hay grass)
Philodendron spp.
Phoenix dactylifera (Date palm)
Phyllanthus ephiphyllanthus
Piloserceus royenii (Dildo cactus)
Pisonia aculeata (Black thorn)
Pisonia subcordata (Loblolly)
Pistia stratiotes (Water lettuce)
Pitcairnia angustifolia
Pithecellobium unguis-cati (Bread & cheese)
Plumeria alba (Wild frangipani)
Prosopis juliflora (Prosopis
Psidium guajava (Guava)
Rhipalis baccifera

Plant Species Included in the Ecosystem Classification

Rhizophora mangle (Red mangrove)
Roystonea oleracea (Royal palm)
Salicornia spp.
Sesuvium portuculacastrum (seaside purslane)
Sideroxylon foetidissimum
Sideroxylon obobvatum (Boxwood)
Sideroxylon sp. (Mastic)
Solanum racemosum (Canker berry)
Spiranthes inouta (Ground orchid)
Spiranthes lanceolata (Ground orchid)
Spiranthes torta (Ground orchid)
Stachytarpheta jamaicensis (Vervain)
Stigmaphyllon spp.
Strumpfia maritima (Rosemary)
Stylosanthes hamata (Mother sigil)
Suriana maratima
Tabebuia heterophylla (White cedar)
Tabernaemontana citrifolia (milk tree)
Tamarindus indica (Tamarind)
Terminalia catappa (Indian almond)
Thesspsia populnea (Seaside mahoe)
Thrinai morrisitii (Palmetto palm)
Tillandsia itriculata
Tillandsia usneoides (Old man's beard)
Tillandsia utriculata (Wild pine)
Trimezia martinicensis (Yello iris)
Valtheria glabra
Valtheria indica
Vedelia calycina (Piss-a-bed)

APPENDIX 2
List of Plants Used Traditionally in Antigua and Barbuda for Medicinal Purposes

Name	Latin name	Use
Aloe, alas,	*Aloe verabadensis*	Burns, sunburn, hair conditioner, healing of sores, stomach and intestinal disorders (laxative), colds, diabetes (using gel)
Anis, aniseed	*Foeniculum vulgare*	Stomach remedy to overcome nausea, colic and gripes in babies, gas, palpitation
Arrowroot	*Maranta arundinacea*	Diarrhoea
Bamboo	*Bambusa vulgaris*	Coldds, hypertension
Banana	*Musa acrminala*	Leaves used as poultice
Barbados Christmas bush Mother Harriet	*Eupatorium odoratum*	Colds, fever
Bird seed	*Lepidium virginicum*	Gas under heart, pressure
Blue bush	*Indigofera tinctoria*	Jaundice
Breadfruit	*Artoocarpus atilis syn A. communis*	Leaves for hypertension
Calabash	*Cresentia cujete*	Young calabash pulp used for making a syrup for colds, asthma
Cankaberry	*Solanum bahamense*	Ripe fruit used for cleaning tongue and dolly tomato teeth of babies in case of thrush
Cassie balsam		Colds
Castor	*Ricinus communis*	Leaf warmed and used along with soft candle, tied on to chest for colds and fever, swelling, pains in joints. Bud boilded for stomach disorders

Name	Latin name	Use
Cat mint bitter mint	*Marsiplanthus chariaedrys*	Aids in blood circulation by removing clots especially after childbirth, abortion
Cattle Tongue	*Pluchea symphytifolia*	Tea for colds, dried as poultice; leaves used in warm bath to overcome fever; juice for cold, fevers
Chickweed	*Stellaria media*	Bronchitis, pleurisy, coughs, colds, hoarseness, rheumatism, inflammation. Used as poultice for skin disease, boils, scalds, burns
Chickweed	*Euphoribia prostrata*	Bronchitis, pleurisy, coughs, colds, rheumatism, inflammation. Poultice on skin disease, boils, scabs and burns
Children weed	*Phyllanthus amarus*	Diabetes, pressure, stomach gripe in children, clear clots after childbirth
Consumption bush		Colds, fever
Coralita Vine, carlita vine	*Antigonon leptopus*	Poultice on boils (ulcers), swelling, colds and flu, period pains, hypertension, diabetes
Cujo	*Petiveria alleaceae*	In bath for pains
David bush, thorn apple	*Datura stramonium*	Poultice on cuts, swellings, areas of pain, jaundice, fever, colds, biliousness; cold overnight extract used as eye lotion
Drug-a-man	*Berrichia arborescens*	Marasma (heavy colds)
Eucalyptus	*Eucalyptus citrioddora*	Colds
Fever grass, lemon grass	*Cymbopogon citratus*	Boiled as tea; drink for fever and colds, chills; used as soporific
French thyme	*Colleus araomaticus*	Tea used for colds and fevers, nausea and vomiting

Name	Latin name	Use
Ganja, marijuana	*Cannabis sativa*	Asthma, glaucoma. ILLEGAL
Garlis	*Allium Sativum*	Used for hypertension (high blood pressure) and for indigestion, gas
Ginger	*Zingiber officinale*	Indigestion, gout, rheumatism
Guava	*Psidium guajava*	Young fruit, buds and leaves boiled for stomach pains and diarrhoea
Inflammation bush, shiny bush, man to man	*Peperomia pellucida*	Tea for colds, as diuretic, poultice for inflammation
Jumbie beads	*Abrus precatorius*	Colds
Lemon	*Citrus lemon*	Tea
Lime	*Citrus aurantifolia*	Tea for colds, fever, stomach disorders
Long grass		Fever, heavy colds, for cleaning stomach through vomiting
Lord Lavington	*Leonotis nepetaefolia*	Tea for colds, fever, biliousness, baths for prickly heats, poultice for boils. Juice used as an emetic
Love bush	*Bryiphyllum pinnatum*	Leaves as poultice; tea used for coughs, colds, fevers, diabetes, cleaning of kidneys (diuretic), albumin
Mahogany	*Swietenia mahogoni*	Fever, malaria, jaundice, biliousness, stoppage of water
Maiden blush	*Momordica charantia*	Tea for clods, fever, gas, hypertension, diabetes, abortion
Man-better-man	*Achyranthes indica*	Tea used for colds, diabetes, hypertension stoppage of water, poultice for pain
Man-pan-tree	*Phorandendron obtussimum*	Marasma (heavy cold)
Mauby bark	*Colubrina arborescens*	Appetite

Name	Latin name	Use
Mint	*Menta citrate*	Indigestion, nerves, vomiting, coughs
Mother Seagell	*Stylosanthes hamata*	Colds
Myrtle lime		Colds, heart burn
Neem	*Azadirachta indica syn Melia azadirachta*	Pesticide, diabetes, fever, heavy colds hypertension
Noyo	*Merremia dissecta*	Colds
Nu-nu balsam	*Ocimum cannum*	Colds, fever
Onion	*Allium cepa*	Gas
Pawpaw	*Carica papaya*	Boils, ringworm, worms
Periwinkle	*Catharanthus roseus*	Diabetes, high blood pressure, stomach pains
Pigeon peas	*Cajanus cajan*	Cleaning of teeth, gum boil, (pyarhoea). thrush in babies
Piss a bed	*Wedelia bahamensis (Cassia alata?)*	Colds, poultice, bed wetting, abortion, diabetes, hypertension
Pomegranate	*Punica granatum*	Rind as astringent, gripes
Prickly pear, cassie	*Nopalea cochenillifera*	Hair conditioner, food, poultice on swelling
Privy	*Clerodendron sculeatum*	Colds, fever, worms, purgative, reducing tonsils, hoarseness
Pussley	*Portulaca oleracea*	Cooling teas, worms in children
Sage (wild)	*Lantana camera*	Gargle for infected throat, stomach and bowel disorders, colds
Sea moss, irish moss	*Eucheuma isiformmis*	Aphrodisiac, goitre
Six sixty-six Scientific plant Tref	*Aristolochia trilobata*	Abortion, fever, diabetes, hypertension
Soursop	*Annona muricata*	Tea used as a soporific (to induce sleep), bush used to induce perspiration thus reducing fevers
Stinging nettle	*tragia volubilis*	Used in tea for fever and colds, diuretic (stoppage of water)

Name	Latin name	Use
Stinking weed, Wild Coffee	*Cassia occidentalis*	Stomach and kidney troubles, colds, cough, fever, toothache
St. John bush	*Justica secunda*	Colds
Strong man		Stoppage of water, bath to shorten labour pain in pregnant women, underfed and anaemic children, pressure
Sugar apple	*Annona squamosa*	Colds, hypertension
Sweet marjoram	*Ocimum basilicum*	Upset stomach, indigestion in adults and babies
Sweet potato	*Ipomoea batatas*	Mumps (tied on hot on the sweling)
Tamarind	*Tamarindus indica*	Leaves for hypertension, cold
Thistle	*Argemone mexicana*	Cold, fever, coughs
Tisang	*Capraria biflora*	Used as hot or cold tea for diarrhoea, nerves, hypertension, nausea, colds,
Tough whip	*Jatropha gossypiifolia*	Diarrhoea, bath for pain, colds, fever, juice used on sores
Turkey berry, clamon cherry	*Solanum torvum*	Tea for colds, fever
Turpentine	*Burseras simaruba*	Leaves as diuretic, gum for cuts, woulds and bruises
Vervine	*Stachytarpheta jamaicensis*	Tea for colic, fever, pressure, vermifuge, boils, colde, diabetes, stoppage of water, eyedrops
Warri (nickle)	*Caesalpinia bondue*	Consumption (heavy colds)
Water weed, worm grass	*Spigelia anthelmia*	Worms
Whitehead	*Parthenium hysteropherus*	Colds, pressure, fever
Widy-widy bush	*Corchorus silquosus L.*	As vegetable
Wild tamarind	*Leucaena leucocephala*	Gas, colds, to wash swollen feet
Worm bush	*Chenopodium ambrosiodes*	Vermifuge

Name	Latin name	Use
Yellow balsam	*Croton balsamifer*	Yellow juice from leaves used for healing cuts and wounds. Tea used for coughs and colds.

Source: Chemistry and Food Technology Division, Ministry of Agriculture, Antigua/Barbuda.

Acknowledgement

When the guidelines for the country report on the International Conference and Programme for Plant Genetic Resources (ICPPGR) was circulated, my first impression was in order to prepare a report of this magnitude I ought to involve professionals of different disciplines.

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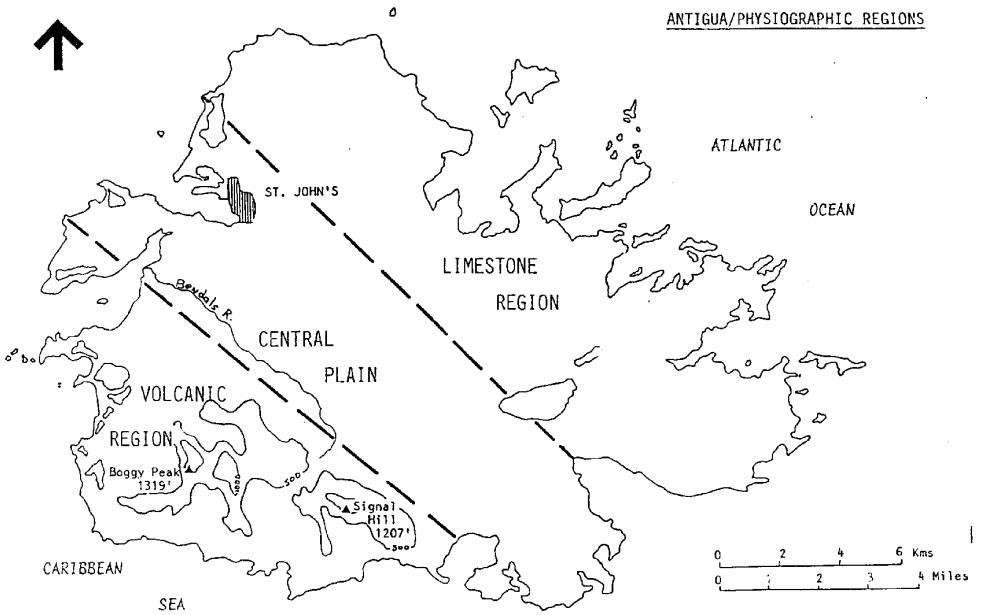

Figure 1 Physiographic regions of Antigua (source: Loveless, 1960).

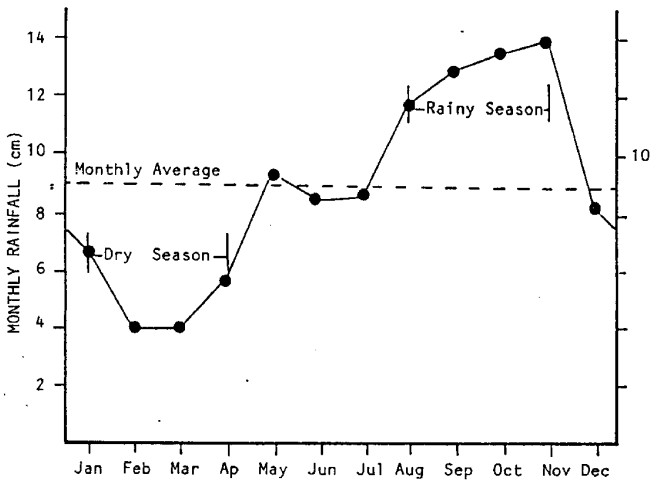

Figure 1.2(1). Monthly distribution of rainfall, Antigua, based upon figures recorded at nine stations over periods varying from 12 to 50 years (source: Loveless, 1960).

fig 3