

Protected Areas Management

Proceedings of the Eighth Meeting of Caribbean Foresters
at Grenada

June 3-7, 1996



A Publication of the Puerto Rico Conservation Foundation and the
International Institute of Tropical Forestry
United States Department of Agriculture Forest Service
Río Piedras, Puerto Rico
1997



Participants of Eighth Caribbean Foresters Meeting, June 1996.

Cover: Lake Grand Etang at Grand Etang National Park, Grenada.

PROTECTED AREAS MANAGEMENT

PROCEEDINGS OF THE EIGHTH MEETING OF CARIBBEAN FORESTERS AT GRENADA

JUNE 3-7, 1996

Edited by:
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International Institute of Tropical Forestry

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PREFACE

The Caribbean Foresters met for their eighth biennial meeting in St. Georges, Grenada from June 3 -7, 1996. Fifty-two representatives from 18 countries of the wider Caribbean participated in the meeting to develop the theme of "Protected Areas Management". Field trips were taken to Grand Etang and Levera National Parks, and the Morne Delice Nature Trail. In addition, Drs. Gene Pollard and Theodore Ferguson gave presentations regarding the menacing pink mealybug and its threat to the region's vegetation. The group traveled to the Les Avocate watershed to witness the devastation caused by this pest to a blue mahoe plantation.

The meeting's guest speakers were George Vincent of the Organization of American States, who had been instrumental in setting up Grenada's first national parks, and Mr. Felix Gregoire, a Permanent Secretary in the Dominican government and a long-time supporter of the Caribbean Foresters.

Mr. Gregoire discussed the "way forward" in his speech to the group at the closing banquet. He stressed the need for the forest managers to have confidence and commitment, to believe in themselves as foresters, and obtain training. He expressed the importance of communication skills, and the imperativeness for managers to "come out of the forest" and promote forestry among the ministers and communities. Examples of successful public awareness programs such as that sponsored by RARE, where school children to prime ministers are reached, were highlighted. Mr. Gregoire mentioned approximately 15 active international sponsors and supporters of conservation in the region. He highlighted the Tropical Forestry Action Programme proposal to establish a regional forest service, and stressed the importance of groups such as the Caribbean Foresters to encourage information sharing and unity in the fight to conserve our forests.

The following country reports included in this publication reflect some of Mr. Gregoire's points. Several resounding themes are repeated in the papers. These common elements recognized by the authors are (1) the need to classify protected areas into land management categories with clearly defined objectives including the long-term desired conditions of each identified area and the benefits and products that the nation intends for the area to provide, (2) the need to involve communities in decision making and the execution of local activities, (3) the importance of educating policy makers and legislators regarding the environmental, social and economic values of natural resources, (4) the rich biodiversity enjoyed by many of the islands, (5) the importance of ecotourism to the conservation of each country's natural resources, (6) the importance of clearly defined responsibilities among the national agencies charged with resource management and (7) the importance of NGO's and international agencies in promoting conservation at the national and regional levels.

We thank Alan Joseph and the Ministry of Agriculture for hosting the Eighth Caribbean Foresters Meeting, and for their wonderful organization of the event and its various functions. Funding for the meeting was provided by the USDA Forest Service, the Puerto Rico Conservation Foundation, the RARE Center, and the Government of Grenada.

ARIEL E. LUGO

CARLEEN YOCUM

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ADDRESS BY THE MINISTER OF AGRICULTURE, LANDS, FORESTRY AND FISHERIES - GRENADA

Joslyn Whiteman

On behalf of the Government and people of Grenada and on my own behalf as Minister of Agriculture with responsibility for forestry, let me extend to you warm and fraternal greetings. I have learned that for many of you it is your first visit to our shores. Others have visited some time in the past. Let me wish that your busy schedule will allow you the opportunity to enjoy our hospitality and to experience the warmth and friendliness of our people. For me, it is a pleasure to address you on this historic occasion as you gather to discuss common issues and problems, and to share and learn from each other's experiences. Let me at this point commend the organizers and sponsors of this conference, namely, the USDA Forest Service's International Institute of Tropical Forestry, and the Puerto Rico Conservation Foundation who have collaborated with our local Forestry Division to stage this most important exercise. By this action Mr. Chairman, you have demonstrated in a most profound manner, your recognition of the importance of forestry and the need to approach its use and development in a sustainable manner.

I would like to make some general remarks regarding the importance I referred to previ-

ously. The earth's forests rank among the ecosystems having the greatest importance for human beings and their survival. They cover about 25 percent of the earth's surface and support more plant and animal species than any other type of ecosystem. Such an invaluable biological diversity deserves to be accorded highest priority. Our forest reserves are also our main water catchment and storage areas. They decrease incidents of soil erosion and consequently sedimentation and siltation problems, they provide a habitat for wildlife and natural predators, and generate a wide range of products for the timber and craft industries. Large communities in many countries of course are dependant on the forests for fruits, nuts, vines, roots and tubers, leaves, honey, medicinal herbs, and meats for their survival. These forests also provide fodder for their livestock, and thatch and needs for erecting their shelters.

Since so many sectors depend on forestry in so many ways, it means that countries, especially small island states, should adopt forestry management and protection programmes to ensure the continued existence and use of those measures, not only for the present, but for generations yet unborn.

PROTECTED AREA SYSTEM IN ANTIGUA AND BARBUDA: A WAY FORWARD

Everette Williams

OVERVIEW

The concept of a protected area system in any developing nation is paramount to its overall development. Antigua and Barbuda, like most of the region, poses a great potential for conservation, scientific research, and environmental management—with a firm socioeconomic spin-off. Antigua and Barbuda boast of a variety of geological and coastal seascapes accompanied by undulating topography, all of which merge to give the 170 square miles many pockets of scenic locations. Many of these areas are in need of mechanisms for protection of the natural, scenic, historical, and archaeological heritage.

LEGISLATIVE SUPPORT

Presently, the legislative base which seeks to promote the management of natural resources in Antigua and Barbuda is unclear, with overlapping jurisdictions of the responsible agencies. This situation, in most cases, leaves wide gaps with subsequent negative consequences for conservation issues.

The National Parks Act of 1984 and the Fisheries Act of 1983 are the key pieces of legislation which presently seek to ensure any policy of protection in the state. To date, only the National Parks Authority, under its supportive legislation and regulations, has designated an area under the protection of national parks—the Nelson's Dockyard National Parks (some 12 mi² of land). The National Parks Legislation initially sought to set up a National Authority to oversee the conservation and development of the natural, historical, and aesthetical value of the Nelson's Dockyard area for national development and tourism enhancement. Part two of the Fisheries Act of 1993 gives the Minister responsible for fisheries the power to declare suitable areas within the waters of

Antigua and Barbuda and any adjacent and surrounding land as marine reserves. No area has been designated as marine reserve in Antigua and Barbuda to date.

In addition to the National Parks and the Fisheries Division, there are other public agencies responsible for the management of ecological resources in Antigua and Barbuda. These include the Land Division (crown lands), the Forestry Sector (forest estates), and the Public Works Department (quarry and sand mining activities). There is, however, the need to develop the National Parks Act and/or the Forestry Act to include legislative parameters and institutions for a well needed system of protected areas for Antigua and Barbuda.

BENEFITS OF PROTECTED AREAS

Nationals and visitors have several ways of benefiting from the implementation of a system of protected areas in Antigua and Barbuda. These include opportunities for the following:

1. Enjoyment of nature. Areas protected for recreation values may be developed for activities such as hiking, bird watching, fishing, enjoyment of natural aesthetics, and ecotourism.
2. Opportunities for rural development. Most of the potential protected areas are found outside the city limits of St. John's. These include areas of scenic beauty, archeological sites, numerous pastoral scenes, coral reefs, and mangrove systems. Forested areas are all scattered around rural communities.
3. Provision of employment for nationals. A well organized system of protected areas may provide employment opportunities such as tour operators and tour guides, video production and photography, park patrol officer, etc.

4. Environmental awareness and education. This is an avenue which is of paramount importance to the continual development of the nation's minds in areas of conservation. Such an awareness and education may be gained through a well managed and documented protected area system.
5. Opportunities for scientific study and research. A system of protected areas is the way forward in protecting areas of outdoor diversity laboratories for scientific study and research.
6. Ecological services for national development. Protected areas are known to ensure socio-economical development by fostering quality domestic, agricultural and commercial water quality, soil renewal, flood control, and regular foods production (including sea foods).

PROPOSED PROTECTED SITES

There are several critical areas in Antigua and Barbuda which should immediately be considered under a national system of protected areas. It is imperative that these important locations be safeguarded from the ever over-aggressive monster called "unscrupulous development". The areas mentioned in table 1 are important either for their historical value, biodiversity value, scientific research potential, tourism/recreational value, or soil and water conservation value.

CONCLUSIONS

As we sail into the 21st Century, it's imperative that systems of protected areas be legislated and instituted as the conservation vehicle of

Table 1. –*Proposed protected areas.*

Proposed sites	Value	Protection proposed
Wallings Forest	historical, biodiversity and ecotourism	Forest Reserve/Recreational Park
Christian Valley Forest	watershed/biodiversity	Forest Reserve
Dark Wood Swamp	wildlife (water fowl)	Wildlife Sanctuary
Codrington Lagoon (Barbuda)	wildlife (large frigate bird nesting site)	Wildlife Sanctuary
Boggy Peak and surrounding hills and valleys	watershed/biodiversity	Forest Reserve
Off shore islands (north sound area)	wildlife, reserve, recreation	Marine Park/Wildlife Sanctuary
Fig Tree Drive Forest	ecotourism/watershed	Forest Reserve
McKinnons Swamp	fish/wildlife	Wildlife Sanctuary
Body Pond	watershed	Forest Reserve

each fragile micro-state here in the Caribbean Basin. Each land mass consists of scarce resources, worthy of protection measures so as to ensure our environmental, social, and economical survival as members of the global village. The fact that we are loosing our limited (natural, historical, and archaeological) resources at a tremendous rate should be cause for great concern. The question is the following: Are we, as custodians of our land, conserving the resources placed in our care for our children and their children's children? Today we should be convinced that systems of

protected areas for Antigua/Barbuda and the wider Caribbean as a whole is a great step forward in conserving and preserving our resources beyond the boundaries of time.

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PROTECTED AREA MANAGEMENT IN BARBADOS

Nigel Jones

INTRODUCTION

Barbados has suffered wide-scale destruction of its natural habitats since its colonization in 1625. Soon after colonization, the early British settlers systematically cleared large tracts of the original vegetation, to make way for agricultural crops such as cotton and indigo, where clean cropping was the norm. By 1647, a considerable amount of deforestation had occurred (fig. 1), and by 1665, except for steep gullies and a few isolated pockets in the Scotland District, the entire island was more or less deforested (Watts 1966). The sparse remains of woodlands in existence today (fig. 2) is an indication of the extent of such destruction. Even today, the natural terrestrial habitats of Barbados continue to face considerable pressure, especially over the last two decades, from physical development. Statistics from the Town and Country Planning Department for the period between 1970-1988 (fig. 3) reveal a continuous increase in the quantity of applications for land development, with over 80 percent of the applications being approved. More recently, some 2,750 out of 3,393 applications to develop land in Barbados were approved by this Department. The observed trend, given the size of Barbados (431 km²), its population density of 592 individuals/km² - which ranks as one of the highest in the world, the current thrust towards increasing the tourism product, and the gradual opening of the land resources to foreign financial investment, leads one to expect that pressure for the development of these resources will increase year after year. The pressures on the natural marine and terrestrial ecosystems are further exacerbated by the high annual influx of tourists.

In terms of the natural environment, the geological base of Barbados has given rise to a unique terrestrial and marine environment. The resultant rugged terrain, white sandy beaches, water quality, and diverse marine ecosystem is comparable to that of the tropical moist forest

of South America which is considered to be the most diverse ecosystem in the biosphere.

ECOSYSTEMS OF BARBADOS AND THEIR IMPORTANCE

The sustainable use and management of any natural resource involves three fundamental interrelated principles: knowing, using, and preserving.

We know that our marine environment is used year after year both by locals and tourists for diverse recreational activity, from which a high degree of utility is derived. There is, therefore, no doubt as to the great economic and recreational importance of the existing environment to the country, and the need for a special effort to preserve, as best as possible, what is left, with particular reference to unique and original areas.

There are three basic areas in Barbados to which particular importance needs to be attached in terms of habitat protection: littoral habitats, marine habitats, and terrestrial habitats.

Mangrove and Littoral Habitats

Barbados has scarcely any mangrove swamp vegetation left. Scientific evidence still exist to support the belief that prior to colonization, mangrove swamp existed at a number of locations around the Leeward side of Barbados. Such areas are Holetown, Porters, Sandylane, Brandons, Indian River, St. Lawrence, Chancery Lane, the Constitution River Estuary, and Graeme Hall (Gooding 1965). Most of these areas were cleared during the 1940's for coastal development, and today only a few isolated mangrove species exist at Holetown and a small area of near-forest at Graeme Hall. These species are confined to brackish/saline conditions.

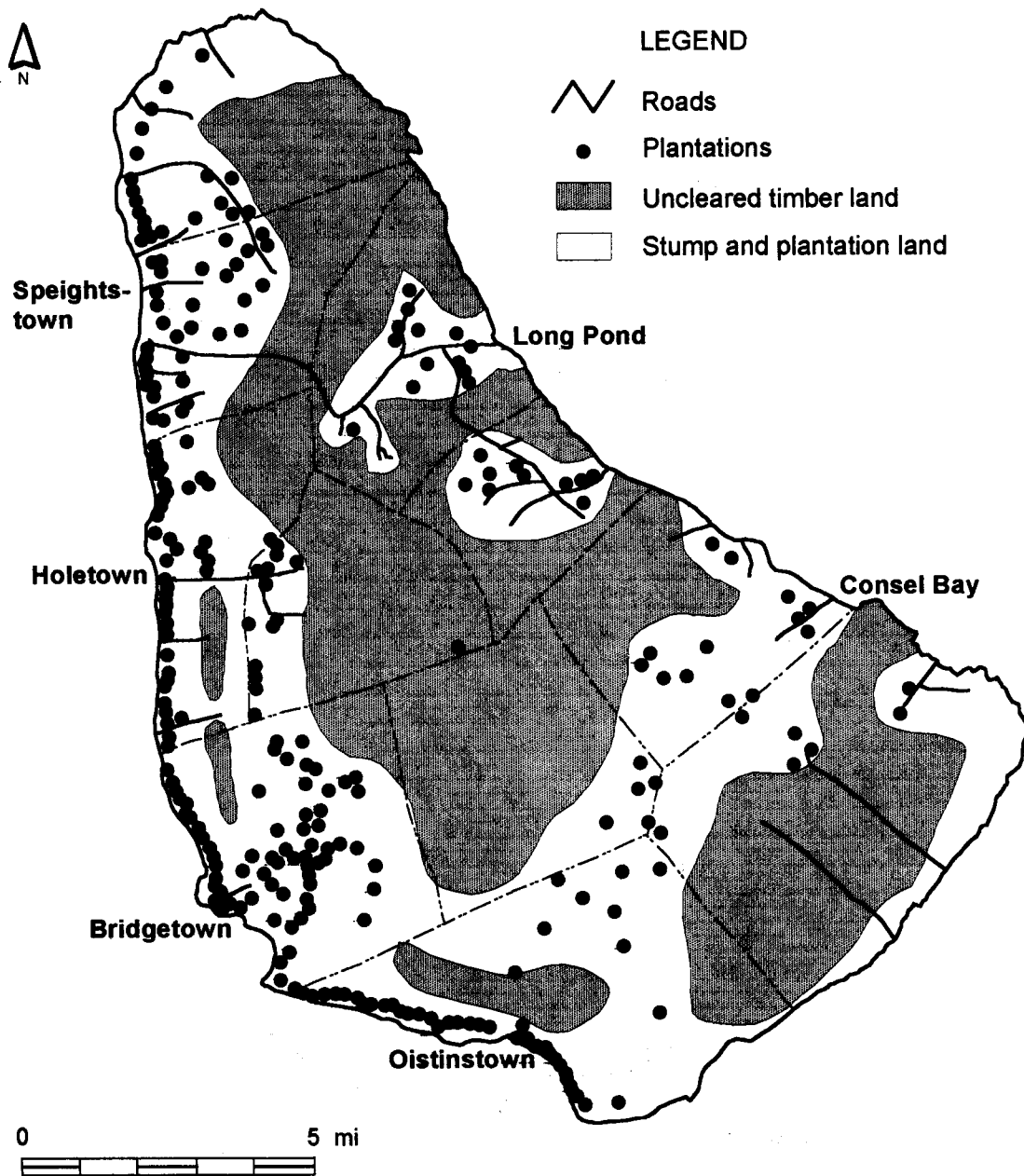


Figure 1. -Standing timber in Barbados, circa 1647. (Based on Watts 1966, adapted by IITE, 1997).

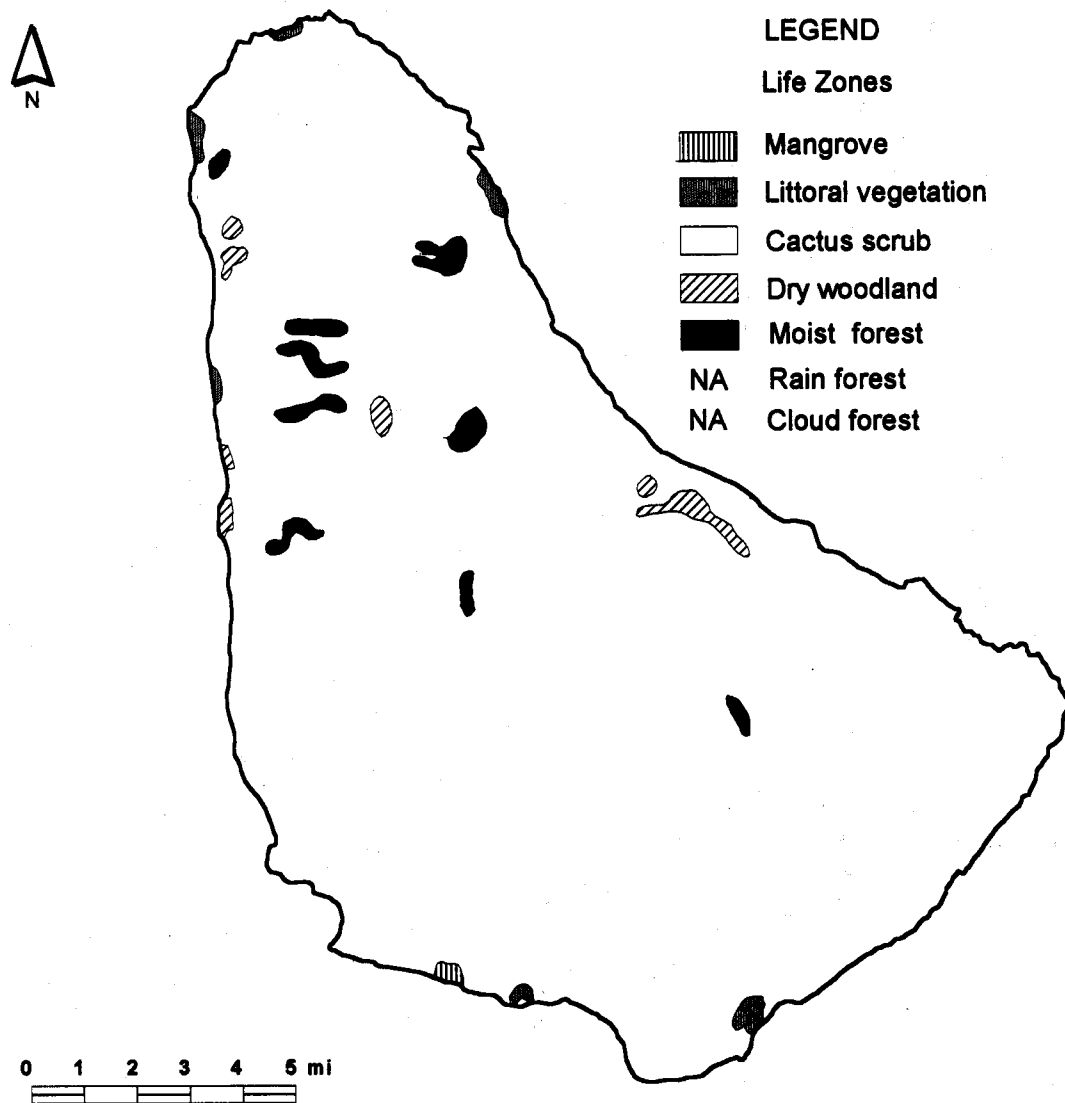


Figure 2. -Terrestrial habitats remaining in Barbados, 1980. (Based on map by Eastern Caribbean Natural Area Management Program, 1980, and adapted by IITE, 1997).

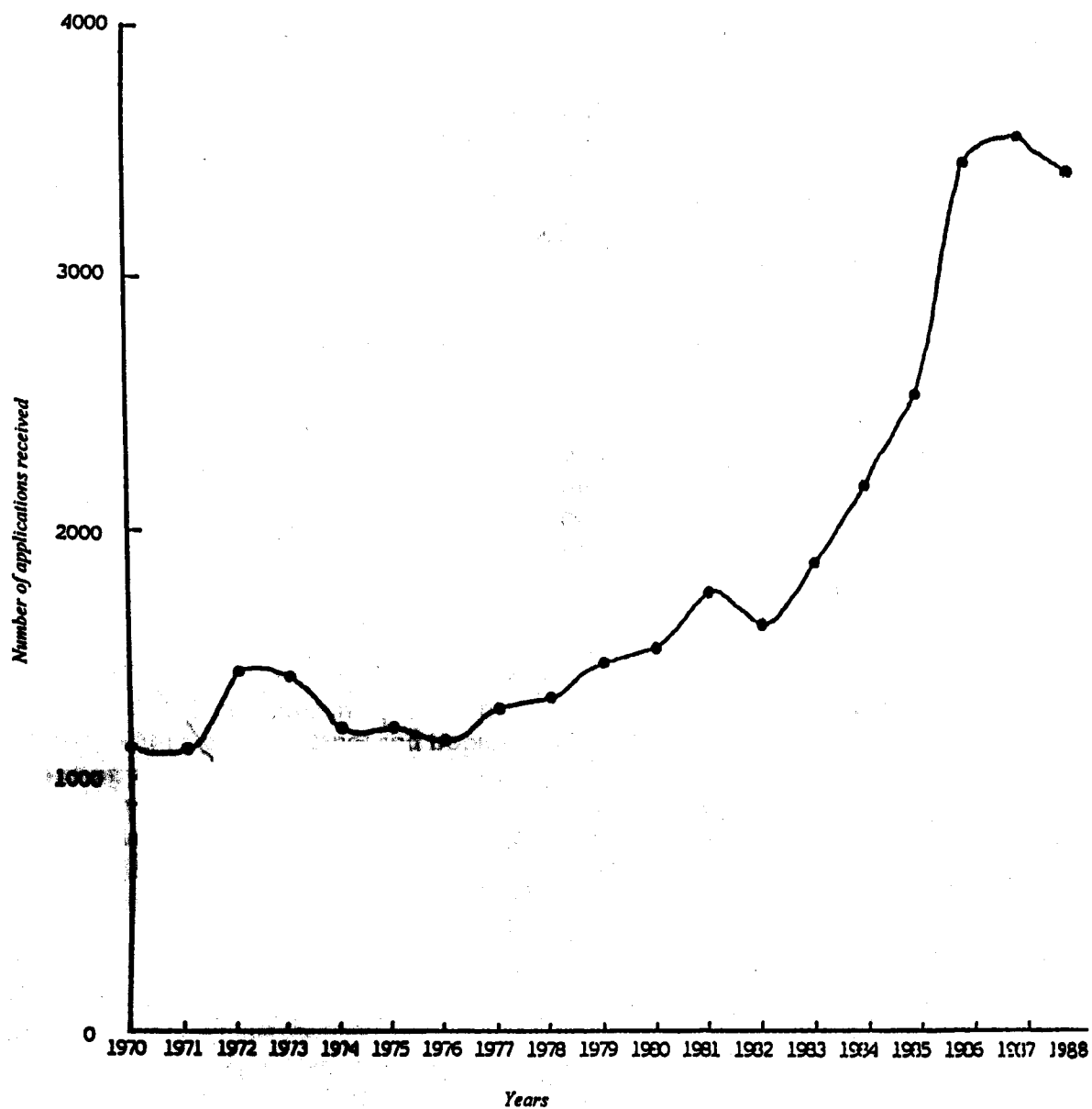


Figure 3. -Formal applications received by Town and Country Development Planning Office, Barbados, 1970-1988 (TCPO, Barbados 1989).

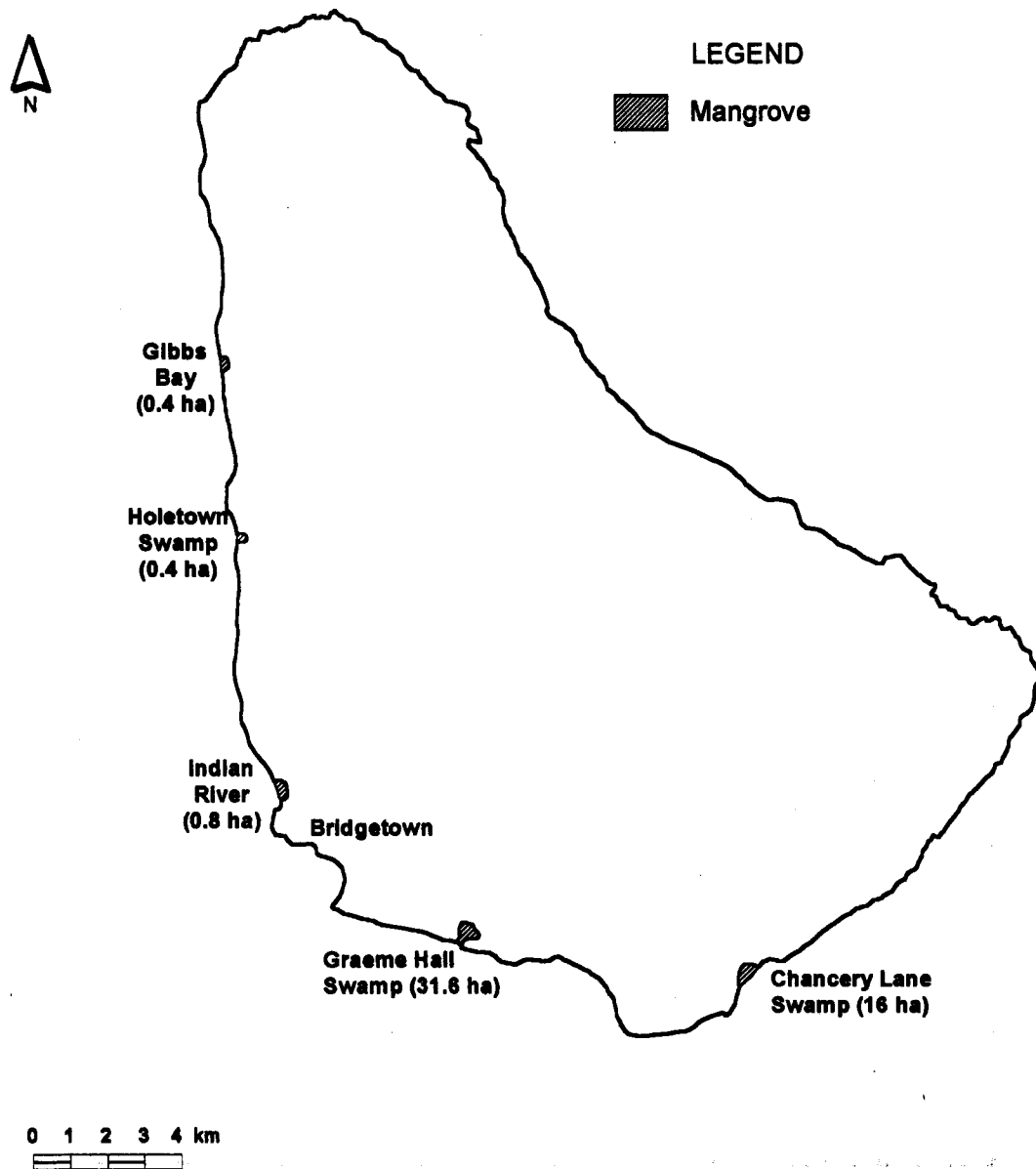


Figure 4. -Remaining mangrove communities of Barbados. (Author's original map adapted by IITF, 1977).

In Barbados three species of mangrove exist (Carrington 1993, Gooding 1965). The red mangrove (*Rhizophora mangle*) found at Graeme Hall is the only remnant of this species left on the island. The white mangrove (*Laguncularia racemosa*) and the button mangrove (*Conocarpus erectus*) also exist at Graeme Hall and at a few other localities around the island (fig. 4). Currently, there is no recreation nor management plan to protect and preserve the remaining 31.6 ha of our mangrove vegetation. What is even worse is that current legislation favors more and more coastal development. In fact, speculations are that the lone red mangrove at Graeme Hall is fighting for survival against a proposed golf course and sewage treatment facility to be sited at this location, even though a scientific study suggests the area should be a wildlife sanctuary.

Similar to the mangrove, littoral habitats are being threatened by destruction at the expense of tourist activities. Again, the appropriate legislation is not in place to prohibit such. The few remaining littoral habitats still provide stabilization and decoration for the coast line.

Importance of Coastal Vegetation

The coastal associations in Barbados act as buffer zones to reduce high windspeeds moving inland. With more hurricanes and tropical storms being predicted, greater attention should be placed on the preservation of these. The mangroves have functioned as a breeding area for shallow coastal fish species that cannot tolerate sea water-strength saline conditions during infancy. They have also functioned as a housing area for avifauna, crabs, mollusks, reptiles, and mammals. Two of our endemic birds, the red Sea Coot (*Gallinula chloropus barbadensis*) and the golden warbler (*Dendroica petechia petechia*), both presently endangered, reside at Graeme Hall. These associations have reduced siltation in the shallow coastal marine environment, therefore protecting our coastal reefs. They have also helped to control coastal erosion, with their root systems, at the same time loosening the soil and sand, making it easy for

turtles to open cavities for laying during the nesting season. Infrastructural development projects undertaken on the coast within the last decade have led to the reduction in beach width and, in some cases, to the total demise of beaches, with consequential negative impacts on reptiles and other faunal species.

Terrestrial Environment

The small size and limited terrestrial resource base of Barbados poses acute problems for balancing the competing interests of habitat conservation, development for commercial, recreational, agricultural and residential use, and for waste disposal and other activities including potable water protection. Today, the only relatively undeveloped area of the island is the Scotland District (figs. 5 and 6). A 1983 study done by N.C. Pennington (1983) also suggested this area as the only area in Barbados having the qualities to merit national park designation; as natural ecosystems were not materially altered by human exploitation and occupation, and where plant and animal species geomorphological sites and habitats are of special scientific, educational, and recreational interest.

Areas of Special Interest

The following areas within this region were classified as worthy of special protection.

Turners Hall Woods. -This area is the only precolonial exhibit of the vegetation cover of Barbados (Hult 1981, Gooding 1965). The area lies at an elevation of 180 to 250 m above sea level, is 800 m in length, and 100 m in width, and is approximately 30 ha in size. The soils are clays of the Scotland series, supporting a forest with three strata and over 100 flora species, of which 30 are trees, another 30 are shrubs, and the remaining 40 are herbs, climbers, and epiphytes. The endemic macaw palm (*Aiphanes erosa*) forms fairly dense stands as a third tree layer in some parts of the Woods at the lower north-east portion. The Woods, however, lacks two common characteristics of the true tropical

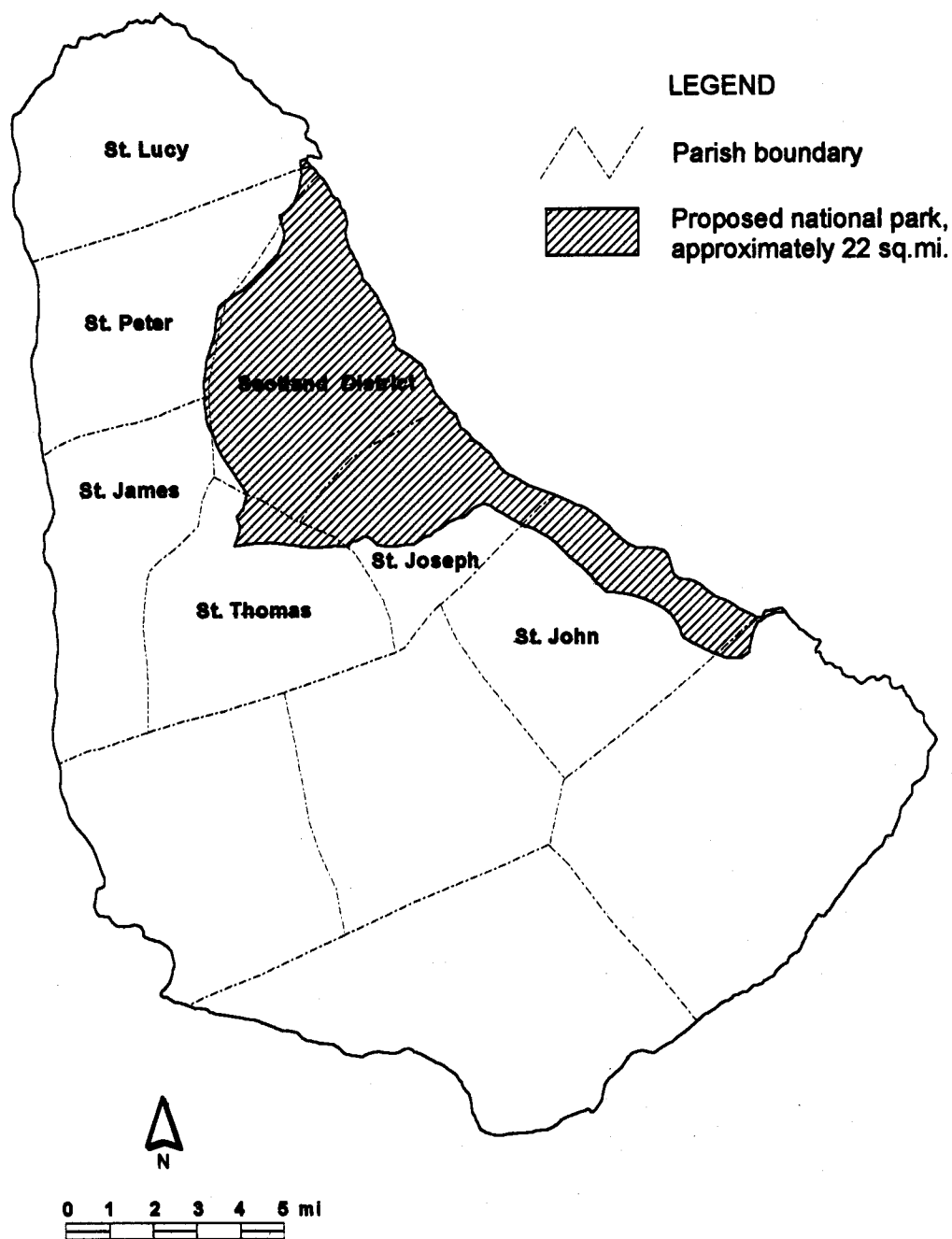


Figure 5. -Scotland District. (Author's original map adapted by IITF, 1997).

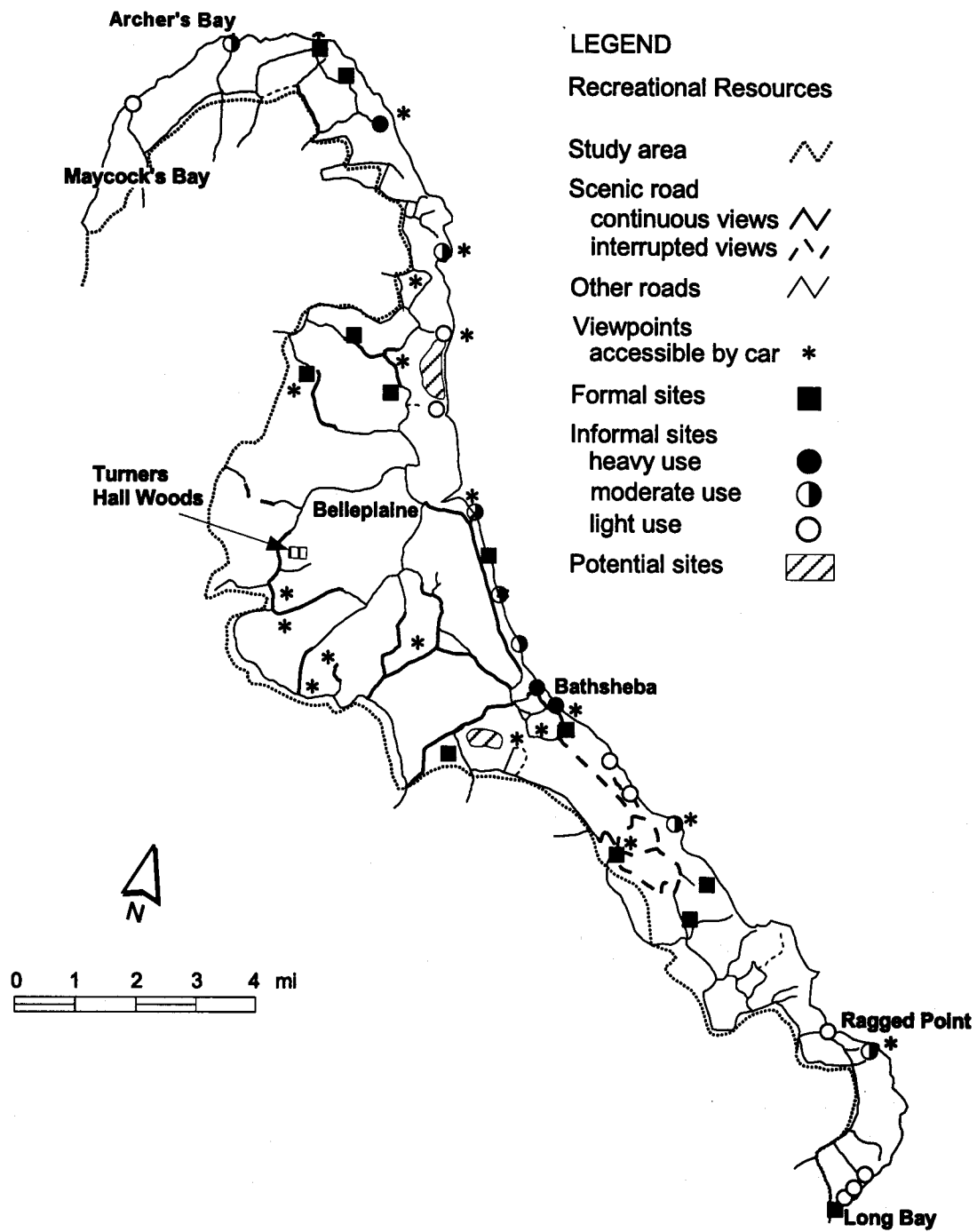


Figure 6. -Enlargement of proposed national park. (Author's original map adapted by IITF, 1997).

moist forest, namely, a high endemic species count, and lianas. The forest has low soil moisture levels during the dry season as a result of rapid evaporation when the deciduous canopy sheds its leaves. Despite the absence of these characteristics, the high flora diversity found at Turners Hall is of great biological importance, and merits some degree of protection. At present there is no special piece of drafted legislation to protect this area. Laws relating to vegetation around Barbados are more or less of a general nature. Currently, no trails or paths exist in Turners Hall Woods, but an eastern road passes through the middle providing access to walkers, horse riders (currently going on), and even vehicles with persons that may be interested in biological research.

Joel's River Forest. -Subsequent to the fierce deforestation of the 17th, 18th, and 19th centuries, a 39 ha plantation forest was established in 1963 within this District, at Joel's River. Again, as in the case of Turners Hall, there is no special legislation protecting this area. Its location is ideal for "nature walkers" to view the flora diversity and other areas of recreational interest adjacent to the forest. It is an area which shows potential for the development of a nature trail starting from this forest and moving along the Hackleton's Cliff area, where walkers would be able to view the eastern landscape of Barbados from an elevated position.

Other Areas of Special Interest

Other areas of special interest which merit some degree of protection are Walkers Savannah, Greenland Basin, Joel's River Basin, Morgan Lewis, Foster Hall, and the general undercliff area along the northern and southeastern coastlines. Fortunately, some degree of protection is available for the areas of Turners Hall and Joel's River as these fall within the Scotland District. Automatic protection is given to these areas under the jurisdiction of the Scotland District Act (Ministry of Legal Affairs 1957), where the Officer responsible for this area has the authority to (1) prohibit the removal of any vegetational type, if by removing such can contrib-

ute to soil erosion; (2) prohibit adverse agricultural practices including over grazing, if such can destabilize the area; (3) prohibit construction, both residential and commercial, if such can threaten the environment in a negative way; and (4) provide professional advice to various ministries and non-governmental organizations on good conservation practices. A recent change in this Act (1991), gives the responsible Minister, rather than the professionals, ultimate power over this area. So one can only hope this person would be willing to take professional advice.

HABITAT PROTECTION AND PRESERVATION

To maintain the interest and importance of these habitats over the long-term, it will be crucially important for Barbados to take necessary steps to protect and adequately manage both its terrestrial and marine environment (Nicholls 1996). While the marine environment has generally been kept in relatively good condition overtime, within the last decade much emphasis has been placed on the protection of the marine environment and the beaches on the south and west coasts. Attention has also been given to the curbing of discharge of effluents from the domestic and tourist sectors into this environment, principally to protect the tourism product. Escalating tourism activity has required a closer monitoring of our marine and coastal environment, and should precipitate a greater move towards, and an awareness of, the need for its protection. So too is the case of the terrestrial environment. Over the last decade or two, there has been some move towards the establishment of bodies to promote protection and preservation of the environment, and in particular for the protection and preservation of the habitats listed above. I will identify these government bodies next.

Coastal Conservation Unit (CCU)

This governmental body was established in 1983 with a primary role of protecting marine littoral habitats (Nurse 1994). Today, even func-

tioning without the appropriate legislation, it is still able to perform its needed functions which include the following:

- beach erosion control - monitoring is done on over 100 beaches where sand volumes and beach width are measured monthly, quarterly, and/or annually;
- monitoring coastal water quality - to ensure that bacterial and chemical quality meets international accepted standards;
- monitoring of hydrocarbon residues (tarballs) - especially on the east and south-east coast, which degrades water and beach quality;
- monitoring the health of coral reefs - indicators such as abundance and diversity of reef organisms are quantitatively assessed through species counts. The reefs are important because (1) they absorb, reflect, and dissipate incoming wave energy, thus helping to reduce beach erosion; (2) they constitute the main source of sand for beaches; and (3) they are nursery grounds for a large percentage of the fish catch in local waters;
- monitoring and analysis of oceanographic conditions including waves, tides, and currents;
- providing technical advice on coastal development; and
- flow metering of catchment to determine runoff rates and the impact on the near shore environment.

Since its establishment, seven major "Pilot Projects" were executed at a cost of just over US\$2,000,000. Most of this money was from local sources.

National Conservation Commission (NCC)

This organization was set up to assist with the preservation and protection of both marine and terrestrial habitats. In relation to the marine environment, this commission is responsible for keeping the shoreline clean especially at the peak of the tourist season. In addition to that, the NCC is equipped with the necessary marine legislation to prohibit: dynamiting of

reefs, emission of waste into the marine environment, fishing, and harvesting of coral.

Four protected reserve zones were established at Folkstone under the mandate of this Commission. These are (1) a scientific zone - to protect coral reef for research purposes, (2) a northern water sports zone - to allow water sports to proceed while protecting marine life from pollution and harvesting, (3) a recreational zone - to promote educational recreation in an environment protected from water sports, and (4) a southern water sport zone - to protect marine life and coral reef.

The current legislation dealing with the protection of marine environment gives the responsible Minister the authority to designate any portion of the marine zone a restricted area where he or she considers it necessary for the preservation and enhancement of the natural beauty of the area, the protection of the flora and fauna and wrecks found in the marine zone, the promotion of the enjoyment by the public of these assets, and the promotion of scientific study and research in respect to such areas. Even though the CCU and the NCC are different bodies with different pieces of legislation, their roles are quite similar.

All in all, Barbados still has a long way to go in the area of protected area management. Systems have to be put in place, legislation enacted, and a vigorous programme of public education undertaken to realize the goals of protecting and preserving our unique and beneficial habitats.

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BELIZE

Rafael Manzanero and Ted Castillo

GENERAL

Belize is a small Central American country consisting of 22,963 km². The country is bordered on the north by the State of Quintana Roo, Mexico; to the west and south by the Peten district of Guatemala; and in the east by the Caribbean Sea. Although Belize is located in Central America, its culture and political system identifies itself more with the Caribbean. The cultural diversity differs considerably from other Central American countries. The present population of about 200,000 people consists of 9 major ethnic groups, namely, Creole, East Indian, Garifuna, Ketchi Maya, Mopan Maya, Yucatec Maya, Mestizo, Chinese, and Menno-nite. English is the official language, but only a little more than 50 percent of the population is fluent in English. Some 20 percent of the population does not speak English at all, and primarily consists of recent immigrants from Guatemala and El Salvador. For just under 50 percent of the population, Spanish is the main language. Belize's economy has experienced steady economic growth but has stagnated since 1993. The main foreign exchange earners are tourism, fisheries, sugar, citrus, and bananas. Tourists are attracted to Belize mostly because of its relatively intact biological heritage - both terrestrial and marine, and its rich cultural patrimony found in the remnant monuments left by the great Maya culture.

HISTORICAL PERSPECTIVE

Settlers were first attracted to Belize some 600 years after the collapse of the Maya civilization. The first settlers in 1640 made timber resources the primary economic base and remained supporting the settlement into the 19th Century. It wasn't until 1922, with the appointment of a Conservator of Forests, that the country then known as British Honduras established the Forest Department (Belisle 1991). This also became the first step in the

practical application of a proper management of the forest resources and the desire to provide policies for the declaration of forest reserves. Since 1925, the Forest Department maintained steady progress in the area of forest management and succeeded in establishing different categories of protected areas which is now clearly defined in the National Park Systems Act. The establishment of the forest reserves in the 1920's, marked the beginning of the protected area network in Belize. Five of the existing reserves (Freshwater Creek, Sibun, Silk Grass, Vaca Plateau, and Columbia River) were created by 1930 (Salas 1996). By 1984, there were about 16 forest reserves in the country. In fact, today it can be said that the forest reserves form the backbone of the Belize protected area system. The first nature reserve was a portion of Half Moon Caye which was designated in 1928 under the Crown Lands Ordinance.

In 1981, months after Independence, two important laws were passed: the Wildlife Protection Act (WPA) and the National Park Systems Act (NPSA). These laws set the stage for the establishment of areas of core protection to complement the existing forest reserves. The Belize Audubon Society (BAS), the first Belizean conservation organization, founded in 1969, assisted in the formulation of these two laws (Salas 1996). In 1982, the first protected area, Half Moon Caye Natural Monument, was declared. In 1984, the Government of Belize mandated BAS to administer and manage areas declared under the NPSA. Since then, nearly 20 more national parks and protected areas have been declared. Together with the forest reserves, this sets Belize's land protection rate at over 30 percent of our national territory, one of the highest protection rates in the world.

THE PRESENT STATE

The Forest Department in the Ministry of Natural Resources is still responsible today for

the administration of government-declared protected areas under the NPSA, as well as the forest reserves declared under the Forest Act. The NPSA of 1981 provides for the preservation and protection of highly important natural and cultural features, and legally recognizes four main categories of reserves, namely, nature reserves, national parks, natural monuments, and wildlife sanctuaries. The Forest Act provides for the declaration of forest reserves, of which presently there are 17 areas (table 1).

Other existing legislation providing for declaration of protected areas status includes the Fisheries Ordinance of 1977. The two marine reserves found in Belize have been declared under this Ordinance and are the only areas presently managed by the Fisheries Department. The Ancient Monuments and Antiquities Ordinance of 1981 also provides for archaeological reserves with the primary purpose of protecting archaeological and historical resources (table 2).

Table 1. –Protected area designation and administration (Zisman 1996).

Reserve type	Name	Designated under	Administered by
Nature Reserves	Bladen Branch	National Parks System Act	Forest Department
	Burdon Canal	National Parks System Act	Forest Department
	Tapir Mountain	National Parks System Act	Forest Department but currently delegated to Belize Audubon Society
	Bird Sanctuaries	Crown Lands Act	Forest Department
National Parks	Aguas Turbias	National Parks System Act	Forest Department
	Blue Hole	National Parks System Act	Forest Department but currently delegated to Belize Audubon Society
	Chiquibul	National Parks System Act	Forest Department
	Five Blues Lake	National Parks System Act	Forest Department but currently delegated to Association of Friends of Five Blues
	Guanacaste	National Parks System Act	Forest Department but currently delegated to Belize Audubon Society
	Laughing Bird Caye	National Parks System Act	Forest Department
	Monkey Bay	National Parks System Act	Forest Department
	Paynes Creek	National Parks System Act	Forest Department
	Rio Blanco	National Parks System Act	Forest Department
	Sarstoon - Temash	National Parks System Act	Forest Department
Natural Monuments	Half Moon Caye	National Parks System Act	Forest Department but currently delegated to Belize Audubon Society

Table 1. –Continued

Reserve type	Name	Designated under	Administered by
Wildlife Sanctuaries	Mountain Pine Ridge	National Parks System Act	Forest Department but currently delegated to Belize Audubon Society
	Crooked Tree	National Parks System Act	Forest Department but currently delegated to Belize Audubon Society
Forest Reserve	Chiquibul	Forest Act	Forest Department
	Columbia River	Forest Act	Forest Department
	Commerce Bight	Forest Act	Forest Department
	Deep River	Forest Act	Forest Department
	Freshwater Creek	Forest Act	Forest Department
	Grants Work	Forest Act	Forest Department
	Machaca	Forest Act	Forest Department
	Manatee	Forest Act	Forest Department
	Mango Creek	Forest Act	Forest Department
	Maya Mountains	Forest Act	Forest Department
	Mountain Pine Ridge	Forest Act	Forest Department
	Sibun	Forest Act	Forest Department
	Silk Grass	Forest Act	Forest Department
	Sittee River	Forest Act	Forest Department
	Swasey Bladen	Forest Act	Forest Department
	Terra Nova	Forest Act	Forest Department
	Vaca	Forest Act	Forest Department
Marine Reserves	Glover's Reef	Fisheries Act	Fisheries Department
	Hol Chan	Fisheries Act	Fisheries Department

Role of the Communities in Park Management

In order for people to conserve their natural resources they have to obtain economical returns. In Belize, ecotourism has become a leading enterprise. As this occurs local communities are realizing the importance of protecting and maintaining those resources. Several private reserves have been designed in Belize, thereby demonstrating a trend towards utilizing the natural resources such as forested areas as destinations for tourists. The Forest Department endorses such initiatives and believes that these private enterprises form an

integral part of the National Protected Areas Systems Plan. Presently, there are no incentives for the maintenance of pristine areas. In fact, development is equated more with altering rather than conserving the environment. Only one private reserve, the Rio Bravo Conservation and Management Area, is founded on legally-binding agreements. Management objectives here is for the conservation of the natural and cultural heritage of Belize. The area is both owned and managed by Programme for Belize (Wilson et al. 1995). Other private reserves includes Shipstern Nature Reserve, Community Baboon Sanctuary, and Slate Creek Preserve.

Table 2. –Protected area types provided for by existing legislation (Zisman 1996).

Administered by	Reserve type	Main purpose	Legal definition
National Parks System Act (1981)			
Ministry of Natural Resources, through the Forest Department	Nature Reserve	Strict protection with use limited to education and research	Protection to conserve biological communities or species and to maintain natural processes in an undisturbed state in order to have ecologically representative examples of the natural environment available for scientific study, monitoring, education and the maintenance of genetic resources
	National Park	Protection of nationally important recreation areas	Protection and preservation of natural and scenic values of national significance for the benefit and enjoyment of the general public
	Natural Monument	Protection of nationally important unique features for education, research, and appreciation	Protection and preservation of nationally significant natural features of special interest or unique characteristics to provide opportunities for interpretation, education, research, and public appreciation
Minister of Natural Resources, through the Forest Department	Wildlife Sanctuary	Protection of nationally important wildlife, habitats and physical features	Protection of nationally significant species, groups of species, biotic communities or physical features of the environment, requiring specific human manipulation for their perpetuation
	Wildlife Protection Act (1981)		
	No hunting areas	Wildlife protection and game management	Protection of wildlife by measures including bans on killing selected species, gun licensing, prohibition of certain hunting methods, and the establishment of open and closed seasons

Table 2. -Continued

Administered by	Reserve type	Main purpose	Legal definition
		Forest Ordinance (1926)	
Minister of Natural Resources, through the Forest Department	Forest Reserve	Managed timber extraction, watershed and soil protection	Protection of forests for management and exploitation, plus the conservation of soil, water, and wildlife resources
		Fisheries Ordinance (1977)	
Minister of Agriculture and Fisheries, through the Fisheries Department	Marine Reserve	Management of fish stocks, protection of the marine environment, education, and recreation	Protection, research, recreation education, and controlled extraction in relation to marine and freshwater species and their habitats
		Ancient Monuments and Antiquities Ordinance (1981)	
Minister of Tourism and Environment, through the Department of Archaeology	Archaeological Reserve	Protection of cultural resources and management of visitors	Protection of archaeological and historic resources

Problem Areas

Approximately one third of the country enjoys a certain level of protection. As impressive as this may seem, there is a deep need to place management presence in many of the protected areas (table 3). Recently, the Forest

Department appointed a protected areas officer whose primary role is to activate protected areas management plans. This officer is also charged with the overall coordination of the enforcement of the NPSA, and the research and coordination of the environmental education and public awareness activities.

Table 3. –*The status of reserve management (Zisman 1996).*

Reserve type	Significant management	No significant management
Nature Reserve	Tapir Mountain	Bladen Branch Burdon Canal Bird Sanctuaries
National Park	Blue Hole Chiquibul Five Blues Lake Guanacaste Laughing Bird Caye	Aguas Turbias Monkey Bay Paynes Creek Rio Blanco Sarstoon - Temash
Natural Monument	Half Moon Caye	
Wildlife Sanctuarie	Cockscomb Basin Crooked Tree	
Forest Reserve	Chiquibul Columbia River Freshwater Creek Maya Mountains Mountain Pine Ridge	Commerce Bight Deep River Grants Work Machaca Manatee Mango Creek Sibun Silk Grass Sittee River Swasey Bladen Terra Nova Vaca
Marine Reserve	Glover's Reef Hol Chan	

Because of the size of the area found under protection, the Conservation Unit, which has been mandated to ensure overall coordination and implementation in the management of protected areas, cannot undertake this mission alone. Traditionally, all Forest Department personnel have been encouraged to assist in the monitoring, enforcement, and patrolling of these protected areas, but the Department is aware that officers need training in the fields of protected areas management. Expertise in the field of protected areas management is not readily available, thus the Forest Department depends largely on foreign assistance. At a time when the Forest Department is becoming active in protected areas management and in implementing management plans, training is both critical and urgent. Officers need to understand the regulations and policies regarding park management as well as prosecution procedures. The management capability of park management bodies in Belize, which include Forest Department, Fisheries Department, Belize Audubon Society, and Programme for Belize, are in many cases under-resourced in terms of finance, equipment, infrastructure, and qualified staff (Wilson et al. 1995).

The protected areas system acreage has always been set as approximations. Several of the areas change constantly. The best method of approximation is to utilize the statutory instruments (the legal, official document which declares an area). However, it has been realized that many reserves have had areas leased out by the Land Department. This results in a discrepancy between the legal extent of the reserves and their physical limits on the ground (Zisman 1996). Several other areas suffer high encroachments, and incisions are constantly being done. The Forest Department has very limited field personnel, for instance the Conservation Unit maintains a staff of seven, and transportation to the sites is limited. Under this situation, it has become difficult, if not impossible, to patrol the protected areas.

Collaborative Efforts

The Forest Department realizing that resources are very limited, and acknowledging

that inputs from other interested parties can help build a better mechanism for co-management of resources, has officially agreed for Belize Audubon Society to manage six of its protected areas. Although the agreement was just recently signed, BAS has been involved in park management since 1984. Belize Audubon Society has demonstrated over the years an exemplary stewardship of those protected areas and has proven that committed organizations can work in collaboration with government agencies to help protect a country's national treasures. Management plans have been written and a physical presence established in all parks. The Society is responsible for generating its funds, and is collecting entrance fees. The agreement provides for the apportioning of the fees collected as follows:

- the Government - 10 percent to be paid into the consolidated revenue funds,
- Protected Areas Conservation Trust - 20 percent to be used for purposes of the Trust, and
- the Society - 70 percent to be used for the management and development of protected areas.

Five Blues Lake National Park is being similarly managed by Friends of Five Blues Lake. The association is presently demarcating the boundary line and is encouraging visitors to the area. The nearby community of Santa Martha has developed bed and breakfast facilities, and locals have been hired to serve as park wardens. At Laughing Bird Caye National Park a Friends of Laughing Bird Caye Committee was legally registered with the primary objective of managing the park. A management plan was drafted and awaits a formal agreement with the Forest Department. These ventures have created healthy relationships not only with the pertinent agencies but also with the communities peripheral to the reserve. The initiatives have been relatively successful.

RECENT ACCOMPLISHMENTS

In the past, the greater majority of protected areas were established without any scientific

basis. Natural areas were initially set aside as protected areas because of their outstanding natural features and unique geological formations, or scenic beauty. In the past, there were no set criteria for the selection of protected areas, or definitions of protected area boundaries. With financial support from the Natural Resource Management and Protection Project (NARMAP), an assessment of the current protected area network was recently completed. The assessment report made recommendations that, when adopted and implemented by the Government of Belize, would lead to a comprehensive National Protected Area System with an appropriate support system. A gap analysis of protected area coverage was completed using vegetation classification and mapping methodologies. Vegetation types were used as biodiversity elements to determine what habitats or eco-units were not adequately represented in the current protected area network. In effect, a set of criteria for protected area selection was developed and defined the importance of a geographic area based on a number of vegetation types represented within the area. While this is an extremely valuable tool, the approach could be strengthened by including detailed faunal components to provide a more complete picture of the importance of a particular geographic area.

To address the presently diffused institutional framework and the significant overlap in responsibilities, the protected area assessment report recommended the establishment of a Protected Area Coordination Unit comprising of relevant government bodies, the environmental non-government organizations (NGO's) directly involved in protected area management, representatives of the key interest groups, and the bodies involved in rural development. Another milestone mechanism built for the financing and maintenance of the protected areas has been the Protected Areas Conservation Trust (PACT) Act which passed in January 1996. This Act allows for the establishment of a national PACT fund that will be exclusively dedicated to the conservation and management of the cultural and natural resources of Belize. Under this revenue generation strategy,

departing visitors from Belize are now charged US\$3.75 effective June 1, 1996.

UPCOMING PROJECTS

Protected areas are considered rich biological diversity zones. However, several of these areas are fragmented and do not provide for the exchange and flow of biodiversity material. Scientists now realize the importance which the interrelationships of genes, species and populations play in the maintenance and survival of ecosystems. In view of this, the Mesoamerican Biological Corridor Project is being developed. This project has the primary role to identify gaps in the National Protected Area Systems Plan and help create a corridor system, both national and regional. Recently, the Central American countries, including Belize, appointed national coordinators and held national forums. Information on protected areas is being assimilated and priority areas for designation are being identified. The project also has a key role for promoting institutional capacity building and providing alternative mechanisms to help maintain the biological corridors of Mesoamerica through community participation.

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CUBA

Antonio Perera

INTRODUCTION

The Republic of Cuba comprises the Island of Cuba, the Isle of Youth and 4,195 islands and islets, totaling an area of 110,992 km². The marine platform has an extension of 67,831 km². The most common vegetation is the mesophytic semi-deciduous forest. Botanists have identified 28 different vegetation types. The tropical rain forest, the serpentine xeromorphic shrubs, the white (silica) sand savannas, and the karstic vegetation complex are the most important because of their endemism. Other outstanding vegetation types, because of their ecological role, are the mangrove forest and the coastal wetlands.

One of the most important features of the biodiversity in Cuba is the high degree of endemism; which reaches 51.4 percent of the 6,700 higher plants, 40 percent among mammals, 93 percent for the amphibians, and 81 percent among reptiles. Cuban biologists estimate that 959 species of plants and 129 species of vertebrates are threatened. Cuba occupies fourth place in Latin America in the extent of destruction of the country's original vegetation. When Christopher Columbus arrived on the island in 1492, more than 90 percent was covered by natural forest. Human impacts started with the search for gold and silver. But soon Spanish colonizers realized that the main richness of the island was the soil. Consequently, the destruction of natural habitats became the main objective to establish sugar cane plantations and to use the semi-precious woods to build ships and palaces in Spain. In the late 1800's, forest covered only 56 percent of the island, and important species were already extinct and some others became endangered. This situation continued, and in 1959, only 14 percent of the forest remained. Due to reforestation efforts the forest coverage at the present time reaches 21 percent. Despite this, Cuba still has the highest species diversity in

the West Indies. The archipelago has a lot of scientific values to preserve, also many species are still undiscovered, and some areas are not yet totally explored.

EVOLUTION OF PROTECTED AREAS IN CUBA

First ideas for conservation in Cuba started in 1930 when the first national park in Pico Cristal was declared, which recognized the high importance of this mountain area, but this park never became real except on paper. In the 30's and 40's five other areas were declared as national parks and wildlife refuges due to the pressure of biologists and naturalists, but they share the same bad luck as the first one.

In 1959, when the Revolution was won, the Law on the National Reforestation Plan was enacted, which in its Article 20, created nine national parks. Between 1962 and 1966 the government established five natural scientific reserves which are still under this category of management. In 1968, the Institute of Botany, as part of the Cuban Academy of Sciences, recommended the creation of more than 100 protected areas under the category of "natural reserves", basically using a phytogeographic approach. During the 70's, new protected areas (PA's) were identified and established by different institutions. Therefore, in 1980 more than 200 protected areas were considered in national and local development programs in order to preserve them from negative impacts. Law 27 of 1980 provided for the creation of a large protected area, comprising several different conservation units, with management category designations from full protection to multiple use. This large area considered the protection of the Sierra Maestra Mountain System as a whole, under the principle of multiple use, and called it Grand National Park Sierra Maestra. Since 1980, two national parks have been established and are under management.

One important step toward the conservation of nature in Cuba was reached in 1981 when the Law for the Protection of Environment was enacted. This law unified policies and actions on protection and rational use of natural resources, providing the legal basis for the protection and improvement of environment. Article 78 created the National Network of Protected Areas "for the protection of wild flora and fauna, the landscape and geological features of scientific interest". Years later, in 1985 and 1986, UNESCO recognized four biosphere reserves: Guanahacabibes, Sierra del Rosario, Baconao, and Cuchillas del Toa. In 1986, Cuban conservationists started to analyze the existing and proposed protected areas in order to evaluate the biogeographical representation and coverage, as a way to identify gaps, priorities, and guidelines to create a well designed system of the most important units for a National System of Protected Areas. This study was the starting point for a national review of the protected areas network.

In 1994, sound institutional changes started in the environmental field with the creation of the Ministry of Science, Technology and Environment. The National Center for Protected Areas was the institution created within the Ministry, with the task of "being the leading center in the integrated management of the National System of Protected Areas guaranteeing its direction and control". The Center conducted a national study to assess the present situation of the PA's and to identify new areas to be protected. Around 289 were identified in two levels: PA's of national significance - 88; PA's of local significance - 201. The PA's of national significance comprise the following, including their World Conservation Union (IUCN) classification: 6 natural preserves (Category I); 14 national parks (Category II); 20 ecological preserves (Category II); 4 natural outstanding elements (Category III); 10 wildlife sanctuaries (Category IV); 13 managed floristic preserves (Category IV); 4 natural parks (Category V); and 17 managed resources PA's (Category VI).

CURRENT INSTITUTIONAL AND LEGAL FRAMEWORK

The Ministry of Agriculture was for years the main agency responsible for PA's establishment and management. With the creation of the Ministry of Science, Technology and Environment and its National Center for Protected Areas a new scenario was created. At present, a process for perfecting the System management is ongoing. The legal aspects are receiving special attention. A law for the National System of PA's is in process to be enacted. At present, the legal basis for the System is poor. Most of the existing areas are created by decision of the Ministry of Agriculture, and need a powerful legislation. The new legislation will strengthen the existing PA's and create new ones.

THE SYSTEM PLAN

The Second National Workshop of Protected Areas was conducted in 1995 with the aim to update a diagnosis, and design the System Plan. Thirty five priority actions were identified in the following fields: administration, coordination and control; legislation; national and international financial support; planning and management; tourism; forest guards; community relationships; environmental education; research; training; and publicity.

The approach for establishment and management of PA's in Cuba has moved from strictly protection to multiple use, but always keeping in mind the idea of maintaining PA's as core areas of the multiple use ones. This evolution has been a result of a process of land use planning in the most extensive, fragile, and economically relevant natural areas like mountain ridges, wetlands, and small islands. Following this approach, 52 areas of national significance level, classified as strictly PA's (Categories I to IV, IUCN), are included as core areas in the planning systems of managed resources PA's (a multiple use category) as part of their territory. Use of management and operational plans as a tool for management started to be developed and used in 1986. The

management plans developed since that date have been made for the categories of national park and ecological reserves. Only very recently has the development of management plans started for managed resources PA's declared as biosphere reserves.

In the last five years, the economic situation provoked on one hand a shortage of resources, and on the other hand deep changes in the land use systems related to the natural areas. The main reason this happened was that tourism, until then poorly developed, was identified as one of the main ways to activate Cuba's economy. As a result of this, the ideas for income generation from tourism activities started to become relevant. Trails and interpretation activities have been particularly developed lately. A total of eight parks and other PA's have trails and interpretation services. Since tourism development has gone faster than PA's legislation, the mechanisms to obtain revenues have been developed on a case by case basis. No fees have been officially established. However, in the agreements reached with tour operators to bring groups to some areas, the prices ranged between 5 to 10 US dollars. Very recently, cruise ships have started to operate in the country. One line has asked for the environmental license to visit one national park, thus opening a new era of income generation opportunities as well as potential impacts. In this case, revenues will be directly invested in the first year by the cruise line owners in infrastructure and personnel for the park.

Even if tourism is perceived as the most important way to obtain revenues (mainly in hard currency), other activities related to timber and non-timber forest products, compatible with the different management categories of PA's, have been and will continue playing an important role. That is the case of honey

production and products resulting from the wildlife population and forest management.

International projects supported by nongovernment organizations (NGO's) started to play an important role. The first organization fully involved in supporting biodiversity conservation by means of strengthening PA's management was World Wildlife Fund (WWF), which is financing nine projects so far. Some others like the Food and Agriculture Organization (FAO), the United Nations Educational, Scientific, and Cultural Organization (UNESCO), Oro Verde, and the United Nations Environmental Programme (UNEP) have supplied technical and financial support.

FINAL REMARKS

Cuba has a well designed National System of Protected Areas which includes 88 areas of national significance and 201 of local significance. The main authorities dealing with PA's establishment, management, and control are the Ministry of Science, Technology and Environment with the National Center for Protected Areas; and the Ministry of Agriculture with the Forest Division and the National Enterprise for the Protection of Flora and Fauna. A process which includes a new System Plan is being carried out after the creation of the Ministry of Science, Technology and Environment last year. The approach of PA's management in the new plan combines multiple use management with strict protection in the most valuable and pristine areas. The shrinking economy of the last five years and the resulting new organization that arose in order to adapt to the new scenario provoked the intensive search of financial support for PA's. This has met with recent significant success by means of international projects, and income generation mainly from tourism.

PROTECTED AREAS MANAGEMENT: THE COMMONWEALTH OF DOMINICA EXPERIENCE

Kelvin Alie and Colmore S. Christian

INTRODUCTION

The Commonwealth of Dominica, hereafter referred to as Dominica, is the most northerly and largest of the Windward Islands, and has been heralded as the region's premier nature island. With its very rugged terrain, perennial streams, rivers and waterfalls, and its great diversity of flora and fauna, Dominica's mostly unspoiled landscape is considered by island aficionados to be among the most beautiful and pristine in the world. With a land area of 751 km² (289.8 mi²) Dominica is located at 61°25' West longitude and 15°25' North latitude. The island is only 46.7 km (29 mi) long and 25.8 km (16 mi) at the widest point.

Topography

The country is characterized by very rugged and steep terrain. The northern half of the island is dominated by the cones of the island's highest mountain, Morne Diablotin, which rises to 1,438 m (4,747 ft) above sea level, and Morne Aux Diable 856 m (2,826 ft), while a chain of seven other mountains extend from the island's center to the south. These mountains are less than 7 km from the sea. The island's topography is also characterized by a large number of deep, narrow river valleys. Flatter areas are restricted primarily to river valleys, coastal areas of the northeast, and other areas in the center of the island. The main river valleys are also found in the center of the island.

Geology and Soils

The geology of Dominica is similar to that of other volcanic islands in the Lesser Antillean archipelago. Evidence of volcanism is present in the region of the Valley of Desolation and the Boiling Lake, as well as in the north and south of the island. Seventy-five distinct soil types have been identified on Dominica, and these

have been divided into five main groups (Lang 1967). Deep, strongly weathered allophonic and kaolinitic clay soils with good physical properties account for 51 percent of Dominica's soils. Coral limestone areas are almost non-existent on the island, and are restricted to a few outcrops on the west coast, for example at Canefield, Massacre, Guelle Lion area, Gimmit, and Morne Bruce (Lang 1967).

Climate

Dominica's climate is classified as humid tropical marine. There is generally very little variation in seasonal and diurnal temperatures. Steady trade winds, blowing generally in a westward direction are the common wind patterns.

The island is among the wettest in the Caribbean, a factor which contributes to its lush vegetation. Rainfall increases from the leeward side eastward towards the central parts of the island where it reaches approximately 7,620 mm (300 in) annually. On the leeward side of the island rainfall levels drop to about 1,270 mm (50 in) in rain-shadow areas. Eighty percent of the island receives 2,540 mm (100 in) or more rainfall annually. The seasonality of the island's rainfall has led to two seasons—a dry season from January to June, and a rainy season (which coincides in part with the hurricane season) from July to December. Tropical weather systems impact Dominica, and the island experiences a major hurricane at least once every 15 years. In 1995, the island was severely affected by Tropical Storm Iris, Hurricane Luis, and Hurricane Marilyn within a period of 19 days.

Relative humidity is high on the island, usually in the region of 95 percent, and seldom drops below 85 percent in the interior. On the leeward coast which is less humid throughout the year than the windward, relative humidity

ranges between 58 and 86 percent (Caribbean Conservation Association 1991).

Economy

Dominica, more than any other country in the Eastern Caribbean, depends heavily upon agriculture, with bananas being the dominant crop, followed by coconuts, citrus, and other tree crops. Tourism is playing an increasingly important role in the island's economy, and much emphasis is being placed on ecotourism. Manufacturing and services are also increasing in importance. The island's population is approximately 72,000, and includes the descendants of the Caribbean indigenous peoples - Caribs. A large percentage of the island's work force is employed in the agricultural sector.

Dominica's Natural History

In Caribbean tourism circles, Dominica is known as "The Nature Island of the Caribbean", and has a variety of natural attractions. These include several rivers and streams, deep river gorges, waterfalls, fumarole areas, the world's second largest boiling lake, and three cold freshwater lakes. The marine areas around Dominica have been described as being as diverse as the terrestrial area, with a wide variety of marine life and dramatic underwater topographical features, including sunken volcanoes, and steep drop-offs.

Dominica's relatively high latitudinal range, coupled with its high rainfall, have given rise to a variety of vegetation types on the island. The relatively undisturbed tracts of natural vegetation on the island have been identified as the most extensive in the Lesser Antilles, while its rain forests are considered as the finest in the insular Caribbean (International Council for Bird Preservation 1990; Evans 1986; Butler 1989). Over 60 percent of the island is still under some form of natural vegetation but during the last few years, the country has lost about 10 percent of its forest cover (particularly rain forest) due to expanding agriculture, particularly bananas.

The island's natural flora includes over 1,000 species of flowering plants. Seventy four species of orchids and 200 ferns and fern-allies have been recorded for the island. At least 22 endemic species of plants have been identified on the island to date, including bwa kwaib (*Sabinea carinalis*), which has been officially designated as the island's national flower. The following is a list of the vegetation zones found on Dominica with their area coverage in 1984 according to Prins (1987) citing other sources:

Vegetation types	Area (ha)	Total land area (%)
Mature rain forest	24,490	31.0
Montane rain forest	3,640	4.6
Secondary rain forest	9,090	11.5
Montane thicket	800	1.0
Elfin woodland	170	0.3
Littoral woodland	140	0.2
Scrub woodland	6,240	7.9
Semi-evergreen forest	7,170	9.1
Swamps	30	0.1

In Dominica there are two types of designated protected areas: the national parks and forest reserves. Land management objectives within the national parks are different from those within the forest reserves, though both are government managed land areas.

THE NATIONAL PARKS SYSTEM

The national park lands are managed primarily for the preservation of natural ecological conditions. Outdoor recreation, education, and scientific study are compatible activities, but activities such as agriculture, logging and hunting are incompatible and prohibited. Several secondary objectives are met by managing land in a natural state. These secondary objectives include watershed protection, wildlife management, and prevention of

water pollution (Shanks and Putney 1979). In the 1960's international and local concerns about identifying a more effective way of preserving Dominica's rain forest led to discussions between the Dominican Government and donor assistance agencies concerning the feasibility of establishing a national park system on the island.

The National Park and Protected Areas Act of 1975 provides for the Government to designate lands as protected areas for the preservation of natural features, for the conservation of historic sites and land marks, and for the development of recreational areas. Under this legislation two national park units have already been created and another is proposed. The first unit, the Morne Trois Pitons National Park, which is about 6,872 ha (16,980 acres) was established in 1975, in the highlands of south-central Dominica. The park includes almost 405 ha (1,000 acres) of rain forest donated by a part-time Dominican resident, Mr. John D. Archbold. This donated land, known as the Archbold Preserve, was important because it represented an extensive area of rain forest within the park, and thus provided an opportunity to include a key ecosystem in the park without requiring the government to forego potential revenue from state lands. The Archbold Preserve was held in trust by The Nature Conservancy from 1974 to 1982 when an official transfer of ownership to the Commonwealth of Dominica was executed.

The second park, Cabrits National Park, is a much smaller unit being only 532 ha (1,313 acres), and is situated in the northwest, just outside the town of Portsmouth. It was established in 1986, and incorporates within its boundaries both marine and terrestrial areas, such as a representative sample of dry forest vegetation, one of the country's two most important woodlands, and the ruins of the nation's most significant historical monument. A cruise ship berth has recently been constructed within the Cabrits National Park, in order to facilitate cruise ship visitor use of the area.

Proposed Morne Diablotin National Park

The proposed Morne Diablotin National Park in the north of the island is being developed and is primarily a protected area for the two species of endemic Amazon parrots. When established, it will consist of an area of approximately 2,495 ha (6,163 acres) which is presently part of the Northern Forest Reserve, in addition to 82.5 ha (204 acres) of acquired private lands, for a total area of 2,580 ha (6,367 acres) (Butler 1989, International Council for Bird Preservation 1990). The proposed park also contains the tallest peak on the island, Morne Diablotin, and some of the best stands of tropical rain forest in the region.

Trails

The island of Dominica is relatively small. Therefore, both existing and proposed national parks and other protected areas are small. Consequently, the Forestry and Wildlife Division has adopted the policy of encouraging "day use" of parks and protected areas on the island. To support this policy a network of trails has been developed throughout these natural areas, and other trails are proposed. Trails of a high standard have been developed at Cabrits, Emerald Pool, Boiling Lake, and Syndicate, to name a few. Both trail construction and trail maintenance on Dominica have proven to be very challenging, partly because of the high rainfall experienced on the island, the soil types encountered, and the island's mountainous topography. In addition, funding is not always readily available to effect timely maintenance.

Funding National Park Activities

Dominica has depended on external sources for most of the funding used for the provision of facilities within parks and protected areas. Over the years, assistance has been received from both regional and international sources. As the pool of external funds becomes smaller the Government of Dominica has mandated Forestry and Wildlife and Tourism officials to identify strategies to generate revenue from

parks and protected areas. One of the revenue generation options being considered is user fees. In this regard, issues such as (1) the level of fee, (2) whether local residents should pay, and if so, at what ratio in comparison to non-residents, (3) whether entrance fees should be charged to all sites, or only to sites where basic facilities (trails, toilets, and interpretive signs) have been provided, (4) and collection procedures are being examined. It is anticipated that some level of entrance fees to parks and protected areas should be in effect by 1997 at the latest.

Other revenue generation options which are being considered at various levels include concession fees, fees for conducting research within parks and protected areas, and the idea of a fee for bus operators/taxi drivers for bringing visitors to the Botanical Gardens. In addition, more creative strategies for attracting overseas funding are being considered. Some consultants such as de Romilly and de Romilly (1995) are very optimistic about the revenue generation potential of our parks and protected areas. We are not as optimistic. However, we do appreciate the need for revenue generation and the fact that the protection exists for generating some revenue from use of parks and public places.

FOREST RESERVES

The forest reserves in Dominica provide many of the same benefits as the national parks. The major difference is that timber harvesting is allowed in the forest reserves but under controlled conditions. Dominica has two forest reserves, namely the Northern Forest Reserve which is 8,000 ha (21,745 acres) in area, and the Central Forest Reserve which covers 410 ha (1,013 acres). Under the Forest Ordinance, restrictions or prohibitions are placed on activities such as forest product extraction, hunting, and land clearing within the forest reserves. This legislation also gives the Forestry and Wildlife Division the authority to manage forest on state lands.

COMMUNITY PARTICIPATION

Our experience in community participation is limited, except for our involvement in the sub-regional Environmental and Coastal Management Project (ENCORE). Under this project Local Site Management Committees (LSMC) have been organized at the two project sites (Portsmouth and Soufrière/Scotts Head) and these Committees have been actively involved in the identification, planning, and implementation of project activities. Various challenges have been encountered because of this approach. However, overall, the project has been a success.

ENVIRONMENTAL EDUCATION

In terms of our resource management efforts one of our key activities is environmental education. Some of the environmental education activities in which we are involved include the following: school visits, annual Forestry Week activities, the production and distribution of several publications, production and screening of several educational videos, and production of weekly radio programs.

FUTURE PLANS

Future plans for the comprehensive management and conservation of Dominica's natural heritage include the expansion of the island's National Park System. Possible areas to be included in the system are the proposed Morne Diablotin National Park, the proposed Soufrière Sulphur Springs National Park, and the proposed Indian River National Park. Environmental education will continue to be an important element in our conservation efforts.

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PROTECTED AREA MANAGEMENT IN THE DOMINICAN REPUBLIC

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COUNTRY ASSESSMENT AND HISTORICAL PERSPECTIVE OF THE PROBLEM

The Dominican Republic, with an extension of 48,442 sq. km., is located in the western part of the Antillean Archipelago, the island chain that separates the Caribbean Sea from the Atlantic Ocean. It occupies the eastern two-thirds of Hispaniola Island, known in the 18th Century as the most important sugar colony of the West Indies. The Dominican Republic is favored by considerable mineral and renewable natural resources. Nevertheless, a number of historic and cultural factors have negatively impacted the sound development of the country.

There were an estimated 600,000 Indians when Columbus discovered Hispaniola in 1492. Sixteen years later, due to overwork, physical cruelty, war, and diseases brought in by the new colonialists, the native population was reduced to 60,000. Ten years later, notwithstanding the importation of an additional 40,000 Indians from neighboring islands, the number had dropped to 3,000. As the number of Indians dwindled, the colonists looked to the importation of African slaves to mine the gold that had been discovered shortly after Columbus' arrival. However, the gold mines were quickly depleted, and when the Spaniards realized the potential value and richness of the island's natural vegetation, they began to harvest the precious woods for export to Europe. The native species of mahogany became famous in the markets of colonial Europe. The colonist also turned to cutting the natural lowland forests to establish agricultural fields, mostly sugarcane (which was introduced in 1506), tobacco and cattle grazing. Santo Domingo, the capital city founded in 1496, grew into the busiest port city in the New World principally due to the growing sugar industry.

By 1540, the boom was over. Spanish mercantilism, heavy taxes on production and speculation by colonial bureaucrats weighed heavily on the agriculture industry. Even the richness of Hispaniola's land resources could not assure profitability in the face of these depredations. Migration to México and Perú began, allowing some restoration of the original natural ecosystems. Although sugarcane cultivation and other lowland agriculture continued, most highland ecosystems, located on the four major mountain chains (the Cordillera Septentrional in the north, the Cordillera Central, and the Sierra de Neyba and Sierra de Bahoruco in the south), remained virgin until the late nineteenth century.

Over the last 100 years, however, the Dominican Republic has experienced a progressive loss of vegetative cover. At the turn of the century, the country was estimated to be about 80 percent forested (broad-leaf precious species in the lowlands, and pine in the mountainous regions). Starting in 1916 the modernization of the communications and road systems first allowed access to major forest regions, which in turn brought new settlements, new areas under cultivation, and eventually deforestation. In 1920, commercialization of precious wood for exportation to Europe (a process first carried out during colonial times) started without concern for the long-term viability of Dominican natural resources. Most of the lowland forests of the southwest and north were devastated. Since 1930, accelerated exploitation of pine began, which in turn has led to the deterioration of major watersheds. This has caused a reduction in water flow or the complete disappearance of about 300 rivers and springs (Rodríguez 1982).

The complete destruction of Dominican forestry resources is a real possibility as population growth puts pressure on forest ecosystems. As the Dominican population has

grown (currently 2.7 percent/year), increased demands have been placed on food production, land to produce the food, and fuel to cook and prepare it. During the last decade, average food production has increased at a rate three times lower than the population growth. During the last 30 years, the Dominican Republic's demographics and economic profile have changed drastically. As recently as 1960 the Dominican Republic was predominantly a rural agricultural nation, with 70 percent of its population residing in rural areas. Now it is predominantly urban, with a service-based economy that is dominated by industrial free zones and tourism. Urbanization, industrialization, and tourism have brought about their own sets of environmental problems.

PROBLEM ANALYSIS

The threat to the Dominican Republic's environment and natural resources can be divided into three categories: land degradation, destruction of marine and coastal ecosystems, and general environmental pollution.

Land Degradation

Land degradation is a complex problem resulting from economic, physical, and cultural conditions. As pressure of land increases, subsistence agriculture is pushed into natural forest environments. This usually takes place where there are poor mountain soils. The traditional practice of slash and burn agriculture adds to this vicious cycle of soil loss. Agricultural productivity decreases due to the loss of the organic matter, and infiltration capacity is lowered as a result of burning and denuding the soil surface. The migration of farmers every few years to "newer" lands compounds the problem.

The setting of forest fires is a common practice in the mountainous regions of the country. Small farmers set timber lands on fire so that the newly cleared area can be used for agriculture. Forest fires set for the purpose of slash and burn agriculture frequently go

beyond the control of the farmers, and more forest acreage is destroyed than intended. This leads to even faster soil erosion and watershed destruction.

Overgrazing of cattle on hillside forest areas directly contributes to land degradation by compacting the soil and rendering it useless for agriculture, as well as exacerbating soil erosion which leads to silting of watersheds. Vast regions of lands otherwise suitable for agriculture and forests are devoted to cattle grazing, making it difficult for poor farmers to access productive lands where they can grow crops. Small farmers are forced to graze their cattle on the more marginal lands.

Approximately 70 percent of the population uses wood or charcoal to meet their domestic energy needs. Cutting down trees to be utilized as fuelwood or charcoal is an on-going activity in many rural areas of the country. It is common to see women and children along rural roadsides fetching wood to meet domestic needs. Energy produced from wood and charcoal amounted to the equivalent of 2.795×10 (cubic) barrels of oil in 1985, representing 12.93 percent of all the fuel source used in the country (Rodríguez et al. 1986). A more recent study conducted by the National Commission for Energy Policy (COENER 1993) reports this figure as 26 percent.

Additional pressure is placed on the land by commercial forest operations. Although banned since 1967, except by special permit, small farmers and entrepreneurs continue tree cutting operations on an illegal basis in upper watersheds. Since the activity is illegal, there has been no effort at managing these forest resources to insure the integrity of the various watersheds. About 80 percent of the forest cover lost over the last 25 years has occurred on an illegal basis often involving the corruption of government officials.

The direct consequence of slash and burn agriculture, overgrazing, extensive fuelwood and charcoal production, and forest fires is

deforestation. At the present time only 12 percent of the Dominican Republic's 48,442 sq. km. is forested with pine and broad-leaf species. This slow proportion of forest cover is a significant contributing factor to the high process of soil erosion, which ultimately leads to the destruction of watersheds, decreased flow of streams and rivers, and decreased agricultural productivity.

Destruction of Marine and Coastal Ecosystems

Marine, coastal, and freshwater ecosystems are important biological components of the country's natural resources. Nonetheless, as has happened with forest ecosystems, they too are under considerable pressure. Threatened and endangered species inhabiting coastal wetlands and marine areas including birds, reptiles, and marine mammals have lost their habitats due to draining and clearing of wetlands and the harvesting of mangroves by commercial operations, developers, and local community populations. Overfishing is widely practiced throughout the country without thought of preserving young catches in order to protect the species and assure sustained yield.

Mangroves, a fragile ecosystem essential for growing certain species of crustaceans and maintaining certain species of associated fish, are often cut for fuel-wood, tanning, and construction materials, and are now in danger of being destroyed. The same can be said for the many coral reefs once so abundant off the shores of the country. Many have been subjected to overcutting and damage, especially the black coral which is used for crafts manufacturing. Damage to the reefs caused by tourism is also significant, and many are now in danger of extinction.

Despite existing laws prohibiting the capture of endangered species, hunting for sport, meat, and eggs continues, many times because of local beliefs about their aphrodisiac properties. All four species of sea turtles that exist in the waters surrounding the DR have

been declared endangered due to overhunting and habitat destruction. The country's crocodile population, one of the world's largest, and other endemic reptile species such as the iguana, are also in danger of extinction.

The tourist industry, once defined as "the industry without chimneys" and thus considered harmless for the environment, may now be compounding the country's environmental problems, especially those of the marine and coastal ecosystems. More than 1,000,000 tourists visit the Dominican Republic each year. Tourism can be classified into two general categories: pleasure tourism and green or ecological tourism. If not properly handled, both can create significant negative impacts on the environment. Marine and coastal ecosystems of the Dominican Republic have been and are being exposed to strong pressure by increasing number of tourists, as well as by tour guides lacking adequate knowledge about how to control visits to sensitive areas without causing long-term damage. Also, hotel facilities often lack appropriate trash and sewage disposal systems. Sewage is often dumped into nearby waters, adding to the problem of water pollution.

General Environmental Pollution

Over the last decade, there has been a modest decline in the rate of population growth, but it continues to be high (recent estimate of 2.7 percent per year). As the population grows, more forest land is depleted to meet food, shelter, and fuel-wood needs. Problems of trash disposal, provision of proper sanitation facilities, in addition to air, noise, and water pollution compound this problem.

PROTECTED AREAS ESTABLISHMENT

Legal Framework

One of the most serious problems that we have to face in the Dominican Republic concerning protected areas is the lack of a law that

allows the proper management, organization, administration and development of a national system of protected areas. The current Law 67 does not have the necessary elements that allow the establishing of precise rules for setting the right management categories. Article 2 of Law 67 establishes two management categories: scientific natural reserve and national park. This is a handicap that has generated a dilemma, because with that low degree of flexibility, it only leaves two options to establish new protected areas. Yet in spite of this, protected areas in the Dominican Republic are often declared with management categories different to the ones indicated in Law 67. Protected areas establishment is a direct response to counteract the process of resources degradation that the country has been facing over the last part of this century.

The following provides a chronological list of the most relevant legal initiatives that have led to the existing protected areas of the country.

- In 1928, through Law 1052, the first protected site of the country was established to preserve a portion of the Cordillera Central (Central Mountain Range) as Vedado (preserve) Yaque del Norte. Its purpose was to stop the process of timber exploitation that was taking place without the basic forestry principles.
- The first national park was established in 1933 by the Law 530 and was named Las Matas. The park was eventually decimated and converted to grazing land, since there was no organization to regulate the protected areas.
- In 1938, the Vedado Constanza was established by the Law 29 to protect a humid forest composed of pine trees and broad-leaf species. Constanza is the highest valley of the Caribbean Region where there is an intensive vegetable production of potatoes, garlic, flowers and some apples.
- The second national park named El Puerto, consisting mainly of coniferous forest and the native *Pinus occidentalis* was established by the Law 1410 of 1947. Since then that area has been degraded.
- In 1950, with the Law 6845, 16 "vedados" were established in the Cordillera Central to preserve pine forest, watersheds and associated fauna. Most of those "vedados" today are part of one or two national parks.
- The above mentioned areas, have lost the conditions and the characteristics that motivated their creation. They were never really protected because the institutional base for that purpose was nonexistent. Nevertheless, the laws by which they were declared have not been abolished.
- In 1958 the Law 4991 established the Zona Vedada (Preserved Zone) of the Haina and Duey Rivers. This law is to protect the watersheds whose flow feeds into Santo Domingo's aqueduct.
- Law 5066 of 1958 declared the fourth national park of the country -Parque Nacional José del Carmen Ramírez, located on the southern side of the Cordillera Central.
- Law 3841 of 1954 created an institution to organize the protected areas of the country, and established the preservation of forest for watershed protection. It declared a large area as Reserva Natural Integral (Integral Natural Preserve). Two years later, in 1956, by means of Law 4389, it created the third national park of the country, Parque Nacional Armando Bermúdez. Bermúdez was conducting forest exploitation. The Bermúdez family donated the land to establish the park under pressure from Trujillo, the then dictator President of the country.
- By means of the Law 5579 of 1961 the Zona Vedada Alto Bandera was created, in a picturesque valley 2,000 m above sea level.
- The above mentioned legislation were enacted to protect areas within the Cordillera Central. In this region, some of the best examples of species belonging to the humid forest can be found. Both coniferous and broadleaf forests occur, along with their associated fauna.

- The Law 5697 of 1961 established the first protected area outside of the Cordillera Central. It was the "Vedado Diego de Ocampo", the highest peak in the Cordillera Septentrional (Northern Mountain Range).
- In April 1962 the Law 5856 was enacted which created the Dirección General Forestal (General Directorate of Forest) to protect, among others things, the "vedados" that, up to that date, were not legally protected.
- In 1962, for the first time, a protected area was established by the means of a Decree. Decree 607 declared the Vedado Isabel De Torres, also located in the Cordillera Septentrional.
- By the Decree 269 of 1963 the Cordillera Central was declared a protected zone, although a large part of it was already under legal protection. Law 470 of 1964 established another preserve area in the Cordillera Central in a valley called Valle Nuevo.
- In 1967, Decree 1269 established the Saona Island Forest Reserve.
- The Haitises Forest Reserve, which eventually became one of the most important parks of the country, was established by Law 244 of 1968. Then in 1976, Law 409 declared the reserve a national park.
- The Law 95 of 1971 declared a coastal line surrounding the city of Puerto Plata as Parque Nacional Litoral Norte. As other preserved areas in Santo Domingo, this area does not meet the objectives of national park category. This is a very frequent problem in our legislation for protected areas.
- In November of 1974, Law 67 was enacted to create the National Park Directorate.
- Law 654 of 1974 established the Parque Nacional Cabo Francés Viejo on the northern coastal zone.
- Law 654 of 1974 established Isla Cabritos National Park to protect two important wildlife populations: the largest number of American crocodiles found in a single area, and two endemic iguanas, *Cyclura cornutta* and *C. ricordii*.
- Decree 722 of 1975, which was eventually converted into Decree 1311, established the boundaries of a large protected area in the eastern most portion of the island, Parque Nacional del Este.
- Decree 1863 of 1976 set up the Reserva Científica Natural (Scientific Natural Reserve) Villa Elisa.
- Decree 2924 of 1977 established the Historic National Park La Vega Vieja.
- Decree 268 of 1978 declared an Archaeological Zone in the Pomier-Borbón and Las Maravillas.
- Decree 301 of 1978 mandated the coordination of activities between the Dirección Nacional de Parques (DNP) and the Dirección General Forestal.
- Decree 1315 of 1983 established three National Parks: the Jaragua, the Sierra de Bahoruco (located in the southern mountain range, of the Dominican Republic and continuing into Haiti as the Massif de la Selle); and Monte Cristi National Park. That Decree also set up the Scientific Natural Reserves of Valle Nuevo, Isabel de Torres, Laguna Cabral O Rincón and Lagunas Redonda y Limón.
- The Decrees 155-86, 156-86 and 157-86, all passed in 1986, specified the physical limits of the National Parks Jaragua, Monte Cristi and Sierra de Bahoruco. Since the Decree 1315 in 1983 has neglected to do this.
- Decree 159-86 of 1986 declared the Vía Panorámica (Panoramic Way) Aceitillar as part of the Cabo Rojo-Aceitillar road.
- Decree 176-86 of 1986 changed the name of the Scientific Natural Reserve Villa Elisa to Doctor Orlando de la Cruz Franco, in honor of a close friend of the President of the Republic who died near the reserve.
- Decree 319-86 of 1986 set up the Parque Sub-marino (underwater park) La Caleta, the only one of that kind in the Dominican Republic.
- Decree 319-86 of 1986 established the Santuario de Ballenas Jorobadas (Hump-backed Whales Sanctuary) and Banco de la Plata in Puerto Plata.

- Decree 479-86 of 1986 eliminated part of the area of the Reserva Científica Natural Lagunas Redonda y Limón for tourism development purposes.
- Decree 286-87 of 1987 established the Refugio (Refuge) de Aves Marinas, Cayos Siete Hermanos (Seven Brothers Cayes). Under Decree 1315 of 1985 the cayes had been protected.
- Decree 297-1987 declared all the caves of archaeological value as Natural Patrimony of the Nation.
- Decree 417-88 set up the Reserva Científica Natural Ebano Verde, in order to protect the endemic species of *Magnolia pallescens*.
- Decree 138-91 of 1991 established the Vedado Loma del Curro in the province of Barahona.
- Decree 322-91 declared a tourist zone in the southwest of the country within the Jaragua National Park.
- Decree 82-92 of 1992 established the Reserva Científica Natural Loma Quita Espuela in San Francisco de Macorís in the northeastern part of the country.
- Decree 147-92 of 1992 declared the Ecological Park Cayetano Germosén in Santo Domingo City.
- Decree 16-93 of 1993 extended the limits of the Parque Nacional Monte Cristi, and created a tourist zone.
- Decree 81-93 extended the limits of the Parque Nacional Los Haitises.
- Decree 183-93 of 1993 established the Cinturón Verde de Santo Domingo, a vegetated area surrounding Santo Domingo City.
- Decree 295-93 of 1993 that declared the Reserva Científica de Valle Nuevo to be under the Dirección General Forestal.
- Decree 219-95 of 1995 transferred the Parque Nacional del Este to a foundation.
- Decree 221-95 of 1995 established two new national parks: Nalga de Maco and Sierra De Neiba; and a Natural Monument Las Caobas.
- Decree 309-95 declared 10 new protected areas, took away part of the Reserva

Científica Natural Lagunas Redonda y Limón, and changed its management category. This Decree established four new categories and added two to the Law 67 therefore making six new management categories. These are the six set up by the IUCN. This change goes against Law 67.

After 45 years of legislation and the establishment of 23 protected areas, Law 67 of 1974 established the Dirección Nacional de Parques (National Park Directorate) to organize, administrate, and manage the protected areas. This Law has failed to accomplish its purposes, mainly because it only includes two management categories: scientific natural reserve and national park. By 1978, the IUCN (International Union for the Conservation of Nature) set up new management categories. However, Law 67 has not been updated to meet the new protected area management criteria.

As can be appreciated, our legislation for protected areas is reiterative, confusing and massive. In addition, most of the decrees that are the result of an attribution of the President according to Article 55 of the Constitution, are illegal because they violate the Law 67. We have taken the initiative to work on a bill that will replace Law 67 for a piece of legislation more moderate. This legislation will have a wide field of action and will be more complete. It will cover most of the ecological and social aspects that are involved in the management of the protected areas. This potential law will derogate all the legislation presented here so that we have to deal with just one law. This way, we will have a precise tool to establish the rules of the game.

Establishment Process

The establishment of protected areas in the Dominican Republic originates from the need to protect and preserve some natural spaces threatened with destruction due to deforestation. The three main reasons for deforestation are: timber exploitation, expansion of the agriculture frontier, and establishment of grazing

lands. Some areas have been protected for the endemic species they contain and others to preserve river basins. The reason behind the creation of protected areas in the Dominican Republic are of different kinds, in many occasions there has been a combination of factors, but the process has not followed a plan or program designed to establish a national system of protected areas. Very few have been protected based on previous investigations, and most have been declared hastily and in an inconsiderate way. Traditionally, individual protected areas have been set aside for various and disparate reasons that were not always logical or efficient in terms of overall habit and environmental protection and management. Unfortunately, there has also been a history of poor communication between the President and the DNP, the former often making unilateral decisions which greatly affected the management capabilities of the DNP.

The President issues decrees establishing new protected areas, and the Dirección Nacional de Parques knows about it when it appears in the paper or on the radio. They do not receive the economic resources to provide the new areas with a minimum of protection. Decree 309 of December 31, 1995 is a dramatic and common example of that situation. It created 10 new areas that, for all practical purposes, are only protected on paper. This incredible situation is a reality because of Law 67, which does not offer the adequate legal framework to prescribe the scientific requirements to create protected areas. This is the reason that the Law can't be applied and it is not followed. Up until now, the DNP has felt very little support from the government, and the workings of an often inefficient beaurocracy and contradictory policies have greatly hampered the efficiency of the DNP.

THE PROTECTED AREAS IN THE DOMINICAN REPUBLIC AND THEIR CATEGORIES

One of the most serious problems that we face in the Dominican Republic concerning

protected areas is the lack of an ideal law that allows the proper management, organization, administration and development of a national system of protected areas. The actual Law 67 does not have the necessary elements to allow the establishment of precise rules for setting correct management categories, and having only two legal categories is a serious handicap. When a decision has to be made on protecting an area, it does not make a difference if the characteristics of the area do not meet the requirements of either management category. It is necessary, to forcibly choose between them. As a result, it will be impossible to manage the area properly.

Some areas were protected a long time ago, and the conditions or reasons for why they were protected have since disappeared. They do not form a part of the protected areas under National Directorate of Parks jurisdiction in spite of the fact that the laws that created them are enforced (but not in use). The protected areas managed under the Dirección Nacional de Parques, are as indicated in table 1.

As mentioned earlier, inspite of Law 67, a variety of management categories are assigned. In addition to the set of national parks listed above, there are 15 other protected areas that include different conservation categories (table 2). These include scientific reserves, historic national parks, a marine sanctuary, panoramic ways, and natural monuments. In total, there are 30 protected areas in the country. This is equivalent to 17 percent of the national territory. Each of these areas falls under one of the six conservation categories established by IUCN, namely: (1) Restricted Natural Reserve [I], (2) National Park [II], (3) Natural Monument [III]; (4) Habitat-Species Management Areas [IV], (5) Protected Marine and Terrestrial Scenery [V], and (6) Protected Area with Managed Resources [(VI)]. In addition to these categories, there also exists a previous classification that is still used in the country to include scientific natural reserves, wildlife sanctuaries, natural monuments and panoramic ways, and archaeological reserves.

Table 1. -Protected areas managed by Dirección Nacional de Parques.

Area Name	Extension (km ²)	Temperature (°C)	Rainfall (mm)
Monte Cristi	1309	28.5	600
Los Haitises	1600	24-26	1900-2000
Jaragua	1400	27	500-700
Armando Bermúdez	766	12-21	1000-35000
Parque del Este	420	26.5	1300
Isla Cabrito	26	26	500
Litoral Sur	10	25	2000
Litoral Norte	26	20	2000
La Caleta	10	25	2000
Sierra de Bahoruco	800	15-20	1000-2500
Cabo Francés Viejo			
Nalga de Maco			
Sierra de Neyba			

EFFORTS TO ADDRESS THE PROBLEM OF PARK PROTECTION: NGOs' AND GOVERNMENT PARTICIPATION

Past Government Efforts

What little environmental awareness exists in the country is mostly due to various nonformal programs carried out by ecological groups. For example, the National Botanical Garden and Zoological Park have programs for training school teachers in basic environmental principles, facilitating visits of groups of students to the park grounds, and delivering short presentations on environmental topics. While these programs have been of benefit, they are small, reach few beneficiaries, and are not coordinated.

In 1985, the GODR issued Law 295, making it mandatory to include environmental education as part of the regular school curriculum at all levels of the public and private education system. The publication of this law did not reflect any coordination within the Ministry of Education, nor did the law establish mechanisms for its implementation. As a

direct response to Law 295, the textbooks used to teach natural sciences were modified by adding ecology and natural resource topics. No teacher training, however, accompanied these modifications, and to this day most school teachers are not familiar with the subject. No further action was taken to include environmental education in the school curriculum until late 1992 when an environmental education strategy was defined by a multidisciplinary and inter-institutional team with strong support from the Ministry of Education, and participation of the National Park Directorate.

Current Government Efforts

The national environmental education strategy states as its principal purpose the raising of environmental consciousness through the introduction of environmental education in the existing public school curriculum. The strategy has the following specific objectives: (1) development of environmental education policies, (2) institutional support, (3) continued research, (4) teacher training, and (5) curriculum development. At the present time, the

Table 2. -Current protected areas and their management categories under the DNP.

Name	Management Category	Coordinates		Area	Additional Description
		Latitude North	Longitude West		
1. Valle Nuevo	Natural Scientific Reserve	18° 47' 30"	70° 38' 00"	409 km ² 40,900 ha	This protected area is located at the very center of the country, in the province of La Vega.
2. Quita Espuela	Scientific Reserve/ Natural Estrict Reserve	19° 19' - 19° 26'	70° 05' - 70° 14'	200 km ² 2,000 ha	This area is part of the Cordillera Septentrional and is located at 15 km to the north east of the city of San Francisco de Macorís.
3. Lagunas Redonda y Limón	Natural Scientific Reserve	18° 56' - 19° 02'	68° 45' - 68° 01'	107.7 km ² 10,770 ha	This area is located near Miches, in the province of Higuey, at the eastern part of the country. This area contains two beautiful lagoons and several miles of white sand beaches.
4. Laguna Cabral o Rincón	Natural Scientific Reserve	18° 15' - 18° 19'	71° 12' - 71° 18'	47 km ² 4,700 ha	This area is located between the provinces of Barahona and Independencia. The Cabral O Rincón Lagoon has 30 km ² and is largest fresh water body in the country. It is in the south-west part of the Dominican Republic.
5. Ebano Verde	Scientific Reserve/	19° 00' - 19° 06'	70° 31' - 70° 36'	23.10 km ² 2,210 ha	This area is located in the eastern. Natural Estrict Reserve of the Cordillera

Table 2. -Continued

Name	Management Category	Coordinates		Area	Additional Description
		Latitude North	Longitude West		
6. Isabel de Torres	Natural Scientific Reserve	19° 45' - 19° 47' 70° 41' - 70° 44'	22 km² 2,200 ha	Central, the provinces of La Vega and Monseñor Nouel. This area is formed by the mountain Isabel Torres which goes up 800 m above sea level. It is part of the Cordillera Septentrional (Northern Range) and it shades the city of Puerto Plata.	
7. Villa Elisa	Scientific Reserve	19° 45' - 19° 46' 71° 15' - 71° 16'	0.08 km² 8 ha	This area protects a rare orchid <i>Oncidium henekenii</i> commonly known as "cacalica" (small spider) a beautiful black orchid.	
8. Los Haitises	National Park	18° 56' - 19° 14' 69° 23' - 69° 53'	1,600 km² 160,000 ha	This National Park is located in eastern part of the country within the provinces of Samaná, Monte Plata and Hato Mayor.	
9. Jaragua	National Park	17° 27' - 17° 58' 71° 17' - 71° 45'	1,374 km² (48 km² is inland 790 km² is marine)	It is located in the provinces of Barahona and Pedernales in the southwest.	
10. Monte Cristi	National Park	19° - 19° 55' 71° 31' - 71° 47'	1,309.5 km² 130,900 ha	It is located within the provinces of Monte Cristi, Dajabón and (1,108 km² Puerto Plata are marine) and borders on Haiti, in the northwest.	

Table 2. -Continued

Name	Management Category	Coordinates		Area	Additional Description
		Latitude North	Longitude West		
11. Del Este	National Park	18° 06' - 18° 24'	68° 33' - 68° 51'	800 km ²	It is located in the province of Higüey, in the eastern part of the country. This National Park is the most visited by tourists.
12. Sierra De Bahoruco	National Park	17° 56' - 18° 06'	71° 28' - 71° 42'	800 km ² 80,000 ha	It is located with the provinces of Pedernales, Independencia, and Barahona, and it is on the Haitian border in the southwest.
13. Armando Bermúdez	National Park	19° 17' - 18° 52'	71° 27' - 70° 46'	766 km ² 76,600 ha	This is the most important protected area in the Cordillera Central. It is located in the provinces of La Vega, Santiago, and Santiago Rodríguez. This national park is in the north central part of the country, and it has the biggest mountain of the Caribbean; Pico Duarte with 3,085 m above sea level.
14. José del Carmen Ramírez	National Park	19° 17' - 18° 52'	71° 27' - 70° 46'	764 km ² 76,400 ha	This Park is located in the provinces of Azua, San Juan de la Maguana, and La Vega. It is on the opposite side of the Parque Nacional Armando Bermúdez in the south central part of the country.

Table 2. -Continued

Name	Management Category	Coordinates		Area	Additional Description
		Latitude North	Longitude West		
15. Sierra de Neiba	National Park	18° 42' - 18° 36'	71° 47' - 71° 20'	179.7 km ² 17,970 ha	This area is located in the Sierra De Neiba (a mountain range) in the southwest of the country, in the provinces of Bahoruco, Elías Piña, San Juan de la Maguana, and Independencia. This park is on the border with Haiti.
16. Nalga de Maco	National Park	—	—	—	This area was declared in 1995 by Decree 221-95. The DNP does not have enough information about it. It is located in the northwest of the country, in the provinces of La Estrelleta, Dajabón, and Santiago Rodríguez. Within this procted areas starts the Artibonito River, which is the biggest river crossing Haiti.
17. Isla Cabritos	National Park	—	—	25 km ² 2,500 ha	It is located within Lake Enriquillo, the only lake in the Dominican Republic. The Cabritos Island is some 40 meters below sea level and is located in the southwestern part of the country, in the provinces of Bahoruco and Independencia between two mountain ranges, Sierra de Bahoruco and Sierra De Neiba.

Table 2. -Continued

Name	Management Category	Coordinates		Area	Additional Description
		Latitude North	Longitude West		
18. Litoral Sur de Santo Domingo	National Park	18° 25' - 18° 26'	69° 59' - 69° 41'	10.75 km ² 1,075 ha	This area is located on the southern coast of Santo Domingo. It is an urban space.
19. Sub-Marino La Caleta	National Park	18° 25' - 18° 27'	69° 41' - 69° 43'	10 km ² 1,000 ha	This is the only sub-marine protected area and is located by the south shore at the east side of Santo Domingo near the International Airport.
20. Cabo Francés Viejo	National Park	19° 40'	69° 56'	1.25 km ² 125 ha	This area is on the northern coast, in the province of María Trinidad Sánchez.
21. Litoral Norte de Puerto Plata	National Park	19° 36'	71° 15'	0.75 km ² 75 ha	This area is located in the north of the coast of Puerto Plata.
22. La Vega Vieja	Historic National Park	—	—	—	This is the archaeological remains of a town built in the XVII century. It is located in the province of La Vega.
23. La Isabela	Historic National Park	—	—	—	This area gathers the archaeological remains of the first town built in the new world. It is located on the north shore of the country to the west of Puerto Plata.

Table 2. -Continued

Name	Management Category	Coordinates		Area	Additional Description
		Latitude North	Longitude West		
24. Banco de la Plata	Sanctuary of Humpbacked Whales	—	—	—	This is a marine area on the open sea, in the Atlantic Ocean, 148 km from the north coast of the country. The humpbacked whales (<i>Megaptera novaeangliae</i>) come here to mate and spawn.
25. Del Pomier	Anthropological Reserve	—	—	—	This area is formed by two sets of caves, one covers five caves and the other seven for a total of 12 caves with significant vestiges of Taíno culture. The caves are located in the limestone hills by San Cristóbal, a town some 25 kilometers to the southwest of Santo Domingo.

institutional mechanisms needed within the Ministry of Education and Fine Arts (SEEBAC Spanish acronym) to implement the environmental education strategy have not been completely defined. The Ministry has started a process of curriculum review to include environmental topics. However, no final decisions have been made. The Ministry has designated a staff member to coordinate the process for the implementation of the strategy in the schools. Peace Corps/Dominican Republic continues to work in close coordination with the Ministry to ensure effective implementation.

Beyond the formal educational structure, there are other efforts by government and the private sector to counteract the environmental degradation process and promote environmental awareness. For example, the National Park Directorate has made significant efforts over the last few years to increase the surface of natural protected areas, conserve wildlife, and promote watershed protection. The National Forestry Directorate is also working in soil and water conservation, reforestation, and agroforestry promotion.

NGO's Participation in Protected Areas Management

There are several NGO's actively involved in environmental awareness and environmental programs. PRONATURA works to establish national parks and protected areas. It also works as an umbrella organization providing support to a wide range of smaller NGO's working in conservation of natural resources. Plan Sierra, located in the Cordillera Central, has established, with support from the MacArthur Foundation and other international organizations, a summer environmental education program for school teachers and primary students.

The Foundation Progressio, Loma Quita Espuela, and Moscoso Puello work closely with the National Park Directorate through specific bilateral agreements, and each one of them has

assumed responsibility to manage a specific protected area.

NATIONAL PERSPECTIVE IN PROTECTED AREAS MANAGEMENT

Decree 309 of December 31st 1995, declared 10 new protected areas. The Dirección Nacional de Parques does not have details of those areas for two reasons: the institution didn't take part in the declaration of those areas, and the Dirección Nacional de Parques has not yet received any economic means to start taking protection measures.

These are the new protected areas and their management categories:

- Monumento Natural "Lagunas Cabarete y Goleta",
- Monumento Natural "Bahía de Maimón y Chiquita",
- Monumento Natural "Bahía Puerto Viejo",
- Monumento Natural "Isla Catalin",
- Refugio de Fauna "La Gran Laguna",
- Refugio de Fauna "Bahía La Gina",
- Refugio de Fauna "Laguna Bávaro",
- Refugio de Fauna "Laguna Mallén",
- Vía Panorámica "Río Chavón",
- Vía Panorámica "Río Soco".

Due to the precarious nature of protected area management within the DNP, as we have already explained, the chances of improving the conditions of our protected areas now depend on the political future of the nation. It is very important that the Protected Areas Bill becomes a law in the near future, since we cannot continue to manage these areas under an obsolete legislation like Law 67. With the new law, each protected area would have a management category more in line with its original objectives. The management categories arranged in the bill are the six ones established by the IUCN in 1990 in Perth, Australia and ratified in 1992 in Caracas, Venezuela. The new law will indicate the management objectives of each category. That law would substitute all other existing laws, so that there would be just one law to

organize and rule the protected areas, and for the first time in the country, there would be a national system of protected areas established.

The new law would define the relationship between the communities around protected areas, which would give the inhabitants of those communities a wider and more decisive participation in the management activities of the areas. Rules for this co-management will be established between the NGO's and some public institutions. This potential law would be the starting point to institutionalize the DNP. In the Dominican Republic, there is a group of NGO's that are working in a series of different projects in the protected areas, and that is a way (since we don't have the resources) to cover a wide number of needs and priorities of great importance. The main problem facing the DNP is lack of resources to develop programs to improve the protected areas in a general sense.

The Dominican Republic has a great potential to develop ecotourism using protected areas as the resources base. Fortunately, this fact has been recognized at various levels of the decision making affecting natural resources. We have great expectations that the activities of tourism and ecotourism will generate resources in the short term. As a matter of fact, by the end of the year we could be collecting around one million pesos a month on tourist visitations to the protected areas. With that money we would be able to greatly correct and improve the current situation. Ecotourism provides opportunities, not only for the actual protection of the natural resources, but also for the betterment of the living conditions of communities surrounding or living near protected areas. Ample opportunity exists to exploit non-traditional forest products without affecting the biological conditions of the ecosystem being protected. Ecotourism also promotes the development of cottage industry and handicrafts to be sold to visitors. In order to achieve a strong, ecologically and culturally sound ecotourism industry in the country strong conservation practices will have to be established in the near future. It will imply

better staffing and financial support, and a managerial and policy system that provides for the participation of the private sector and civil society in the process. In the same line these actions need to comply with existing international agreements and treaties which the country has signed.

We have taken the initiative to work on a bill that would replace Law 67 with more modern legislation that is more action oriented and more complete. It would cover most of the ecological and social aspects that are involved in the management of the protected areas. We have a big challenge ahead of us. The new protected areas, added to the old ones, plus the ones still to be created by the new law, will represent altogether almost 23 percent of our national territory. That may put us in a unique position in the Caribbean, but also creates a lot of problems.

PROSPECTS FOR PROTECTED AREAS IN THE COUNTRY

The future for protected areas in the Dominican Republic awaits the same steps as the other development sectors and likewise suffers from a weak legal framework and many developmental initiatives being too centralized by the central government. The agriculture sector along with free zone industries, tourism, building and construction have undergone relative improvement over the last 20 years. However, the natural resources sector, education, health and social services (energy, transport), and other social support sectors require significant improvement in the near future if the country is to pursue a health sustained development process.

The new governmental authorities resulting from the election that took place last June, have expressed their recognition of the country's need to establish a real protected areas system as a key component of the general development model that needs to be established as a practical and realistic means to meet the challenges of a globalization process that will be unavoidable as we enter the next century.

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THE CONSERVATION OF THE COASTLINE AND LAKESIDE SHORES IN GUADELOUPE

Pascal Perfettini

COASTLINE RESOURCES

With its 652 kms of coastline along the 7 islands which compose the archipelago, Guadeloupe provides an incredible variety of sites, all of them of outstanding beauty and rich natural features. The white or black sands of the beaches together with the cliffs or the mangrove swamps add up to form very diverse landscapes and natural environment, which is notable in a French department measuring only 1,705 km² in size.

COASTLINE MANAGEMENT

History

The National Forestry Commission (ONF French acronym) manages about 185 km (nearly 1,500 ha), of coastline grouped under the name of FDL (fig. 1). Most of this estate comes from the stretch of land called "the fifty geometrical steps". Actually the 50 geometrical steps, also called "the king's steps", appeared in the 18th Century at the time when the pieces of land were granted to people. Initially, the objective was to set up a reserve of coastal lands for public interest, and specifically for the defense of the shores. Each step was 5 ft. long, meaning that the strip of land was 76.2 m wide from the limit of high tide. The land estate of the 50 geometrical steps now belongs to the public coastal estate. However numerous portions of this coastal land have had different fates. Some were bought by private individuals or by towns or local communities, most were incorporated into the private state property (FDL) between 1955 and 1986. Since the "coastal property" law was passed in 1986 it has been impossible to transfer public property to private ownership. That's why the ONF proposes that some pieces of land be handed over to the Conservatory of the Coastline (CELRL French acronym), which in

turn would sign an agreement entrusting the ONF with their management.

The Mission of CELRL

Founded in 1975, the CELRL is a government-owned corporation. Its responsibility is to buy the natural sites which are threatened little by little to be destroyed, or even bound to disappear. The aims of CELRL are to conserve natural beauty, preserve the habits of flora and fauna, and protect any ecological features of the sites for future generations. The CELRL has no staff in Guadeloupe, that is why they've chosen the ONF to represent the corporation, to help them acquire, manage, and sustain the sites to be protected.

Partnership With Local Communities

The land purchase process begins with initial contact between the local communities concerned and the ONF. A work session then takes place each year, during which the proposed purchases are examined and discussed. This group includes elected regional, departmental and town representatives, together with the concerned authorities. The purchase program proposed by Guadeloupe is then examined by the French Shores of America Council (CRFA French acronym), founded in 1977 and made up of 12 elected local citizens from the 3 regions of the West Indies and French Guyana: that is to say, 2 general councillors and 2 regional councillors for each French department of America. Eventually, the CRFA decides on the projects to be presented to the Board of Directors of the Conservatory, for Guadeloupe, Martinique and Guyana. The Board of Directors of the CELRL meets twice a year and examines the proposals made by all the regions of France. It has the responsibility to finally decide which purchases are to be financed.

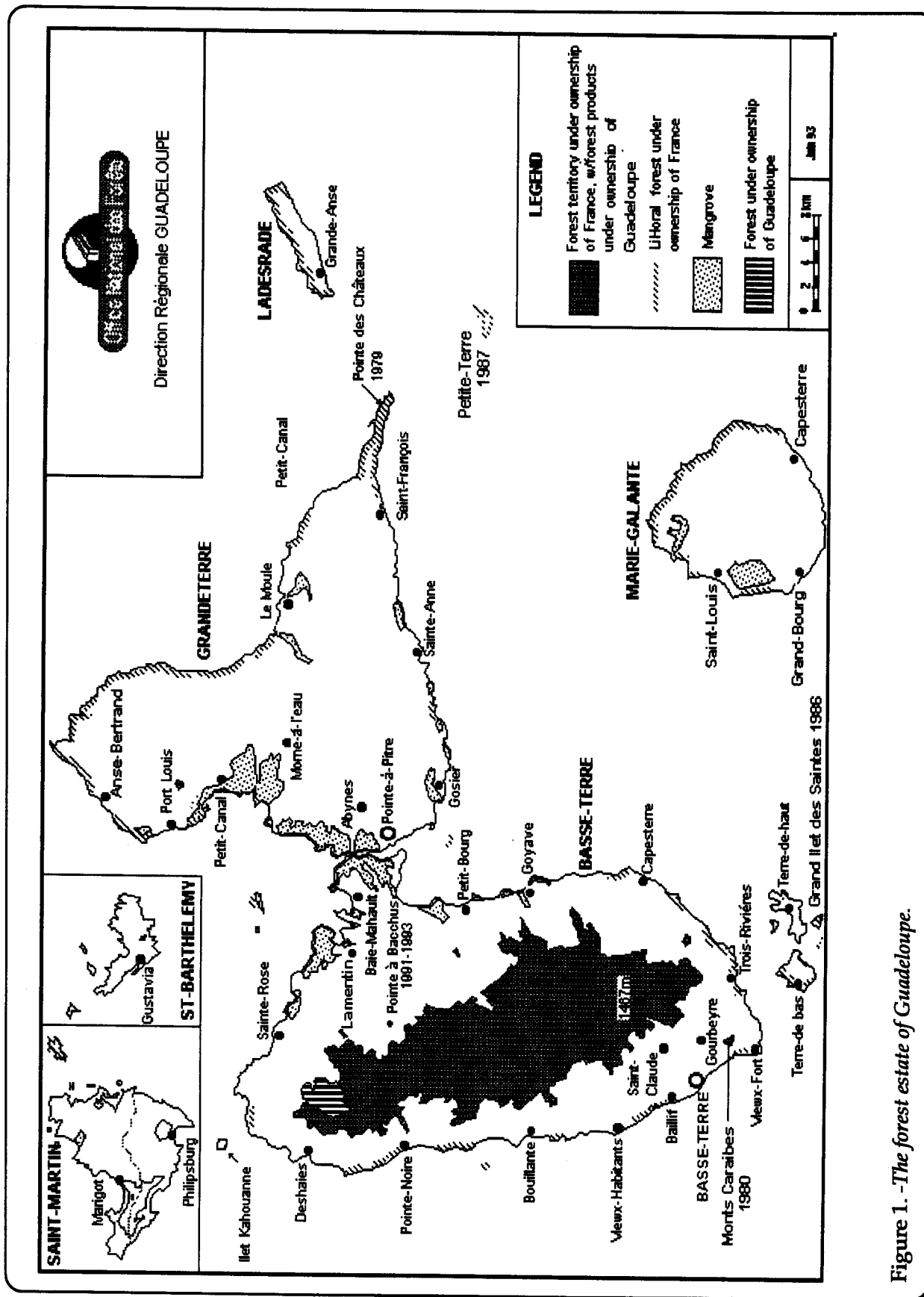


Figure 1. -The forest estate of Guadeloupe.

A NATIONAL HERITAGE TO BE MANAGED

Since 1977, the CELRL has invested much money in Guadeloupe. Numerous projects of various purchases have been examined. Yet, some of them have failed to succeed due to lack of agreement with the owners. Nevertheless, five major sites have already been acquired (fig. 1): La Pointe des Châteaux, les Monts Caraïbes, la Pointe à Bacchus, le Grand Ilet des Saintes, and Petite Terre de Désirade. Other projects are going well. As a last resort the Conservatory may issue a State-approved expropriation order, as is the case of the small island of Kahouanne. To ensure the sustainability of these sites, the Conservatory has asked the ONF to prepare management plans. The concept of these plans lies in the following methodology.

Principles of Development, a Tool for Long-Term Management of Ecosystems

Analysis

Natural Environment. -richness, potentialities, dynamics, ecological stations, biodiversity, forestry planting, wildlife protection, natural risks.

Economical and Social Needs. -requirements, obligations, evolutions, protection of environment and landscapes, collecting wood and various products, reception of public, recreational activities, i.e. hunting, fishing, preservation of cultural elements.

Past Management. -critical survey.

Synthesis

Choice of Objectives. -protection of the environment or of the landscape: biological protection, reception of the public.

Classifying Objectives. -according to their respective importance.

Zoning. -according to the objective which determines the major actions.

Main decisions

Long-Term Perspectives. -choices concerning the length of the development.

Program of steps to be taken (Management Scheme)

Program of felling areas and methods of cultivation.

Program of maintenance and investment. -forestry actions, civil engineering, environmental engineering, recreational equipment.

STRATEGY FOR LONG-TERM MANAGEMENT OF THE COASTLINE

These past years, the strategy used has been to thoroughly protect the coast from the multiple aggressions to which it is subjected. The mangrove swamp requires special care. The protection of coastal environment must come within the scheme of a long-term management plan. This goal should be reached through the Regional Development Scheme which takes into account the various environmental, economical and social problems at stake at the national level.

Tourism is a powerful incentive in the long-term development scheme in Guadeloupe, a country confronted with great social and economical difficulties. The policy today is aimed at proposing a variety of tourist activities: country tourism, outdoor recreational activities such as sports, discovery of natural sites etc. This sector should be developed, in light of the profit potential it offers to the country.

PARTICIPATORY PLANNING AND MANAGEMENT IN A NATIONAL SYSTEM OF PROTECTED AREAS: THE GUYANA CASE

Maesood Hoosein and Ivelaw Evans

SUMMARY

For conservation of forest resources and the protection of the environment, the support and involvement of all stakeholders is essential. In a country with vast tracts of forest land and a low per capita income, the exploitation of the timber, non-timber, and sub-surface mineral resources in these areas is a likely source of national economic growth. Private investment in the exploitation of the resources in these areas will accentuate weaknesses: an absence of protected areas, and a lack of capacity to monitor activities in the hinterland. For a country that is only now utilizing its immense forested areas and their resources, the assurance of the wise use and management of these resources and of the continuation of the environmental services that they provide must involve wide participation of local communities and all other stakeholders. Right from the planning process this is being done. Such type of involvement is expensive and poses immense logistical difficulties as well as language problems, but is too important in value not to be institutionalized. For the safeguarding of the interest of protected areas, Amerindian communities are being sensitized, provided with training, and involved in the making of decisions. They have been regarded as among the fittest people to monitor the forest, their environment, and protected areas in a country where it is difficult to obtain and retain persons from the coast for these tasks.

GEOGRAPHY

Location and Size

Guyana is the largest country of the English speaking Caribbean (215,000 km²) yet it has a population of 808,000 (IBD 1993). It is located on the northern coast of the South American continent with the Atlantic Ocean, Venezuela, Brazil, and Suriname bordering its territorial

limits in the north, west, south, and east, respectively.

Topography

The country is divided into five topographical regions (fig. 1).

1. The coastal plain, which stretches along the entire coastline, is made up of clay, peat, and sand "reefs", is flat and lies mainly below sea level.
2. The savannas, are of two types. The wet savannas are located close to the coastal plain, and the Rupununi savannas are located in the Rupununi region in the south west, and have pronounced wet and dry seasons. They are contiguous with those of Brazil.
3. The lowland region, accounts for most of the country and is the area within which the timber industry is presently operating. It consists of hilly areas with rolling topography as well as lowland swampy areas in the north west.
4. The Pakaraima Highlands occupy the midwest of the country, forming many spectacular escarpments, waterfalls, and the highest parts of the country. It is quite inaccessible.
5. The southern upland region consists of the remotest areas of the country, and includes the Kanuku Mountains. It is extensively forested.

DEMOGRAPHY

The vast majority of the country is largely uninhabited with 10 percent of the population living on the fertile coastal plain that constitutes some 5 percent of the total land area. The rest of the country is called the "hinterland", "interior", or "bush" and is inhabited by less than 5

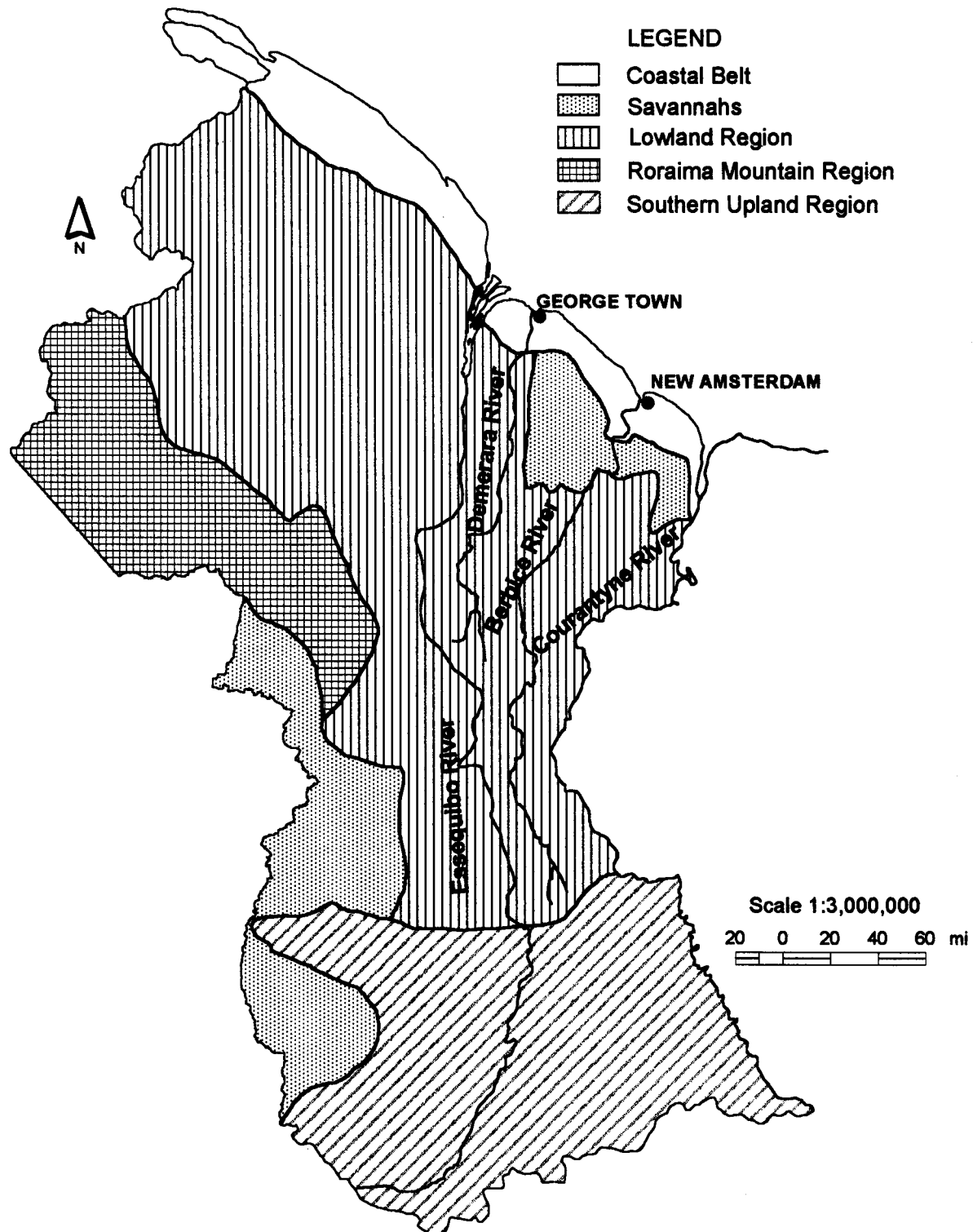


Figure 1. -Guyana topographical regions. (Author's submitted map adapted by IITE, 1997).

percent of the population, virtually exclusively indigenous Amerindians.

NATURAL RESOURCES MANAGEMENT

Development has been concentrated on the coastal plain, with the hinterland, due to low population and inaccessibility, remaining mainly unexploited. The coastal plain is the chief site for the country's agricultural production of rice, sugar, miscellaneous "cash crops" and offshore fishing and shrimping.

The livelihood of Amerindians who live in the hinterland is based on subsistence agriculture, hunting, gathering of forest products, making handicraft or working as waged laborers with timber and mining companies. The latter two industries have received significant emphasis, and their frontiers are extending rapidly in the hinterland as the country seeks to maintain the positive economic growth it achieved only a few years ago, improve its balance of payment deficit, and improve the standard of living for its citizens. Commercially exploited natural resources in the hinterland are timber, mineral (bauxite, gold, and diamonds), white sand and wildlife. A fledgling tourism industry directed at the vast interior is the country's newest economic thrust. Forestry and mining have both made significant increases in contribution to the gross domestic products over recent years. Until recently, there was little threat to the vast, inaccessible, relatively unexploited hinterland except for the limited mining and selective logging operations. It provided little, if any, reason to give protection and conservation of this vastness any consideration, let alone priority. The natural resources of the area enjoyed fortuitous, but unplanned, protection.

Biological Diversity

The country can be divided into some thirteen ecosystem types (Ramdass and Hanif 1990), representing forest, savanna, and coastal biomes. These provide a variety of habitats for the country's flora and fauna. Although the

knowledge on the biological diversity of Guyana is far from complete, the existing information already indicates several important species and sites in the country. A number of plant species are already known to be endemic to Guyana (Persuad n.d.). A number of sites are either known or believed to be of high biodiversity and/or endemism.

The country is home to a number of endangered species including the harpy eagle, giant otter, arapaima, giant river turtle, and scarlet macaw. It is home to 711 bird species, 123 mammalian, 102 reptilian, and 77 amphibian (Guyana/UNEP 1992), with 144 vertebrate species from the CITES Endangered Species List. There are at least 6,000 species of flowering plants in the country (Centre for Biodiversity 1996).

Indigenous Reserves

There are nine Amerindian tribes in Guyana who live mainly in the hinterland, inhabiting forested areas, savannas, and mountains (fig. 2). They live in areas reserved under the Amerindian Act. Except for sub-surface resources, they have full and exclusive rights over the resources within the boundaries of these areas. Permission is required for non-Amerindians to enter these areas.

Forest Reserves

The Morabilli Forest Reserve is the only gazetted forest reserve in Guyana (fig. 3) even though a number of other areas are or were being used for research or field trials. The Guyana Forestry Commission, which has responsibility for the management of the reserve, has a list of areas which it proposes to convert to forest reserves.

Mangrove forests, which are extensive but increasingly being degraded, are not reserved but are granted some protection under an archaic Sea Defenses Act. Watershed "buffer" strips have no protection status.

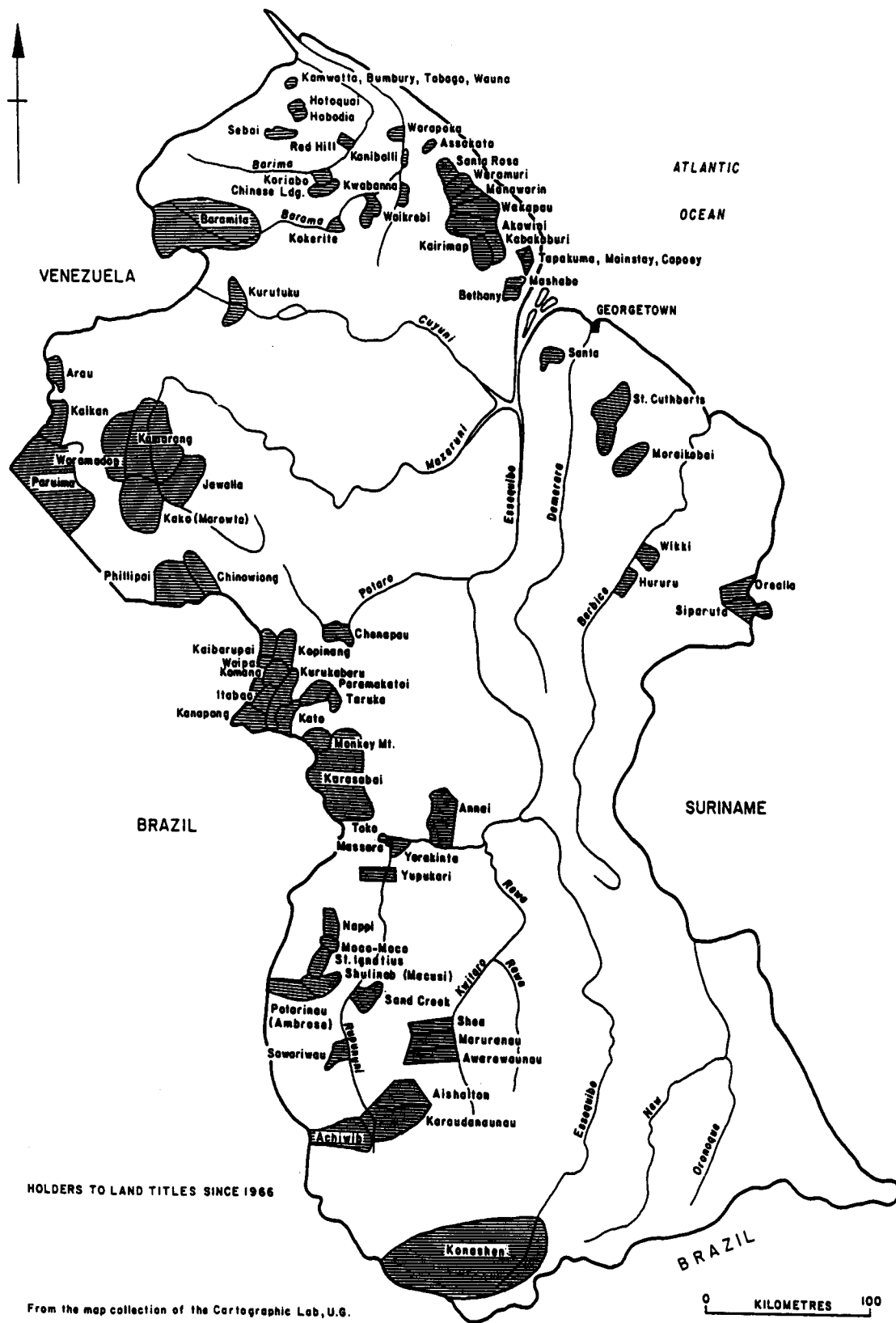
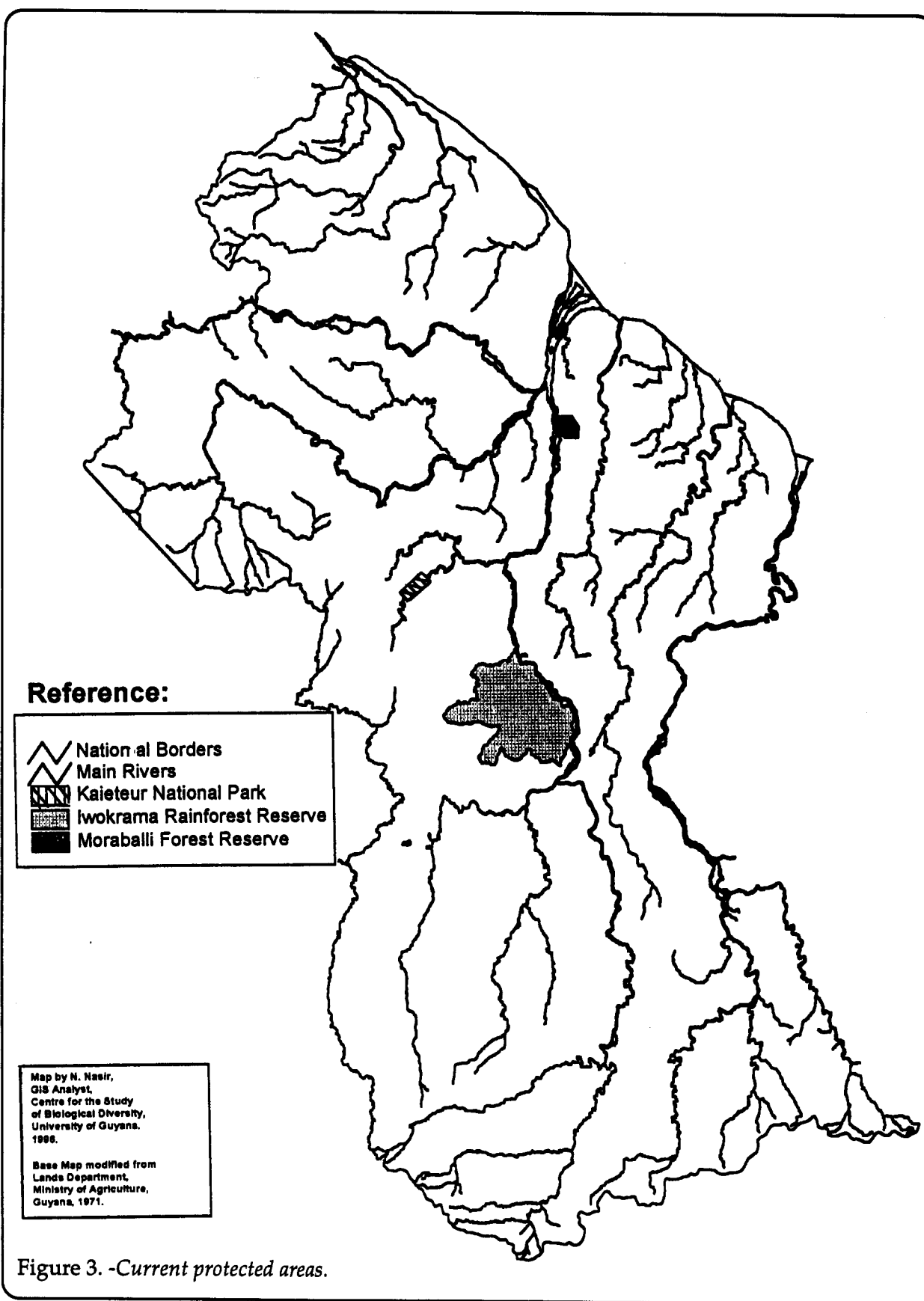


Figure 2. -Guyana Amerindian lands.



Protected Areas

There are two protected areas in Guyana: the Kaieteur National Park, which is the oldest protected area; and the Iwokrama Rain Forest Reserve.

Kaieteur National Park

Legislation. –Governed by Kaieteur National Park Act and the National Parks Commission Act. The Commission has responsibility for the administration of national parks, among other areas.

Area. –116 km² (fig. 3).

Management. –Conferred protection as a national park. Never subjected to a management plan or any type of management. Only staff are three untrained park wardens.

Uses. –It is the principal tourist attraction in the country due to the spectacular Kaieteur Falls, for which the park was established to protect. Has asphalted airstrip. Boundaries not demarcated. Reports of illegal aircraft landings, mining, visitor removal of resources.

Resources. –Unique plant communities, fairly well inventoried but under-promoted as an attraction. Fauna includes cock-on-the-rock and swifts, but has never been inventoried and therefore largely unknown. High rock escarpment of sand stone and very thin soils characterize the area. Watershed protection for falls area of Potaro River.

Iwokrama Rain Forest Reserve

Legislation. –Iwokrama International Centre for Rain Forest Conservation and Development Act.

Area. –360,00 ha (fig. 3).

Management. –Independently managed and governed by a Board of Trustees. Is part of Guyana forest "dedicated to the international community." Has a director general, project manager, GIS specialist, and forester. Soon to

hire forest rangers and other staff. Has a five year operational plan.

Uses. –Mainly to demonstrate sustainable utilization of tropical rain forest. Up to half of the area can be used as a "wilderness preserve." Also plans to encourage tourism. Overall objectives include the demonstration of sustainable tropical forestry, conservation of biodiversity, sustainable human development, and environmental awareness and education.

Resources. –Large area, mainly of lowland rain forest with timber, wildlife, and other non-timber forest resources. A few Amerindian communities near the periphery of the site.

THE NATIONAL PROTECTED AREAS SYSTEM (NPAS)

Guyana is embarking on a project to create a national system of protected areas. The objective of the National Protected Areas System of Guyana is to conserve areas of high biological importance and to gazette and manage these areas as an essential element in the sustainable management of the country's natural resources. The design and establishment of the system is being carried out through a phased participatory process which includes all stakeholders (Amerindians and other local communities, mining, forestry, agriculture, and tourism).

A project document was prepared for submission to the Global Environment Facility, which will provide an amount of funding for the system. The project hopes to accomplish the following:

- consolidate the necessary data to provide the scientific basis for the design of a national protected areas system (NPAS);
- determine priority areas for protection and conservation through a comprehensive process involving public consultation and participation;
- develop the long-term capacity of the government to manage a NPAS through the establishment of appropriate institu-

tional, legislative, policy, and financing frameworks;

- assist the establishment of an appropriate institutional structure to manage the protected areas, including provision of technical assistance, equipment, and training;
- raise public awareness regarding conservation and protected areas issues; and
- support the government in the preparation and implementation of management plans for two pilot areas.

PARTICIPATORY PLANNING AND MANAGEMENT

There is a large number of stakeholders in the subject of protected areas. In Guyana these can be identified as the following: local communities (chiefly Amerindians); commercial interest (miners, loggers, fish and wildlife collectors, tour operators, collectors of non-timber products); government (central and local); non-governmental organizations (NGO's, environmental, Amerindians); research and teaching institutions; and international agencies (support, conservation).

It has been recognized that the successful planning, establishment, and especially, management of a protected areas system could not take place without the participation of the many stakeholders. Since it was government that initiated the process for a NPAS, the other stakeholders who would be key to its success would be the local communities and the commercial interests. The NPAS will obtain control over resources that both groups use, and both would be potential threats to the success of a NPAS because of potential conflicts with their use of the resources in these areas to be designated. Their understanding of the need for a NPAS, of its value to them and the nation, and their support to protected areas is, therefore, necessary. In addition, both groups have advantages over other stakeholders and non-stakeholders groups: knowledge of local areas, and knowledge of local natural resources and their uses.

Local Communities

Moreover, local communities can provide important personnel for the managing and monitoring of protected areas, in a country in which the hinterland is inaccessible and considered difficult and inhospitable to the majority of the population, which lives on the coast. The project summary (World Bank 1995) states that, "where possible, priority would be given to Amerindians for training, especially where a protected area is located near Amerindian lands." In the project preparation phase so far, local communities have been involved in two ways: (1) participation by consultation, and (2) interactive participation. The project preparation phase involves two consultations, one being a workshop for Amerindian Captains and the other being for the wider stakeholder groups.

The workshop for Amerindian Captains established that the subject of protected areas was a novelty to Amerindians. Two fears were constantly raised: (1) that protected areas were areas that would be out of bounds to Amerindians either for passage by river or trail or for the carrying out of traditional subsistence activities such as hunting, fishing, and gathering of other forest products; and (2) that protected areas will absorb and restrict land that Amerindians traditionally used and presently extend territorial claims to.

The workshop was aimed at introducing the subject of protected areas, giving examples from other countries of local involvement, and the benefits of protected areas and the need for the same in Guyana. Out of it came agreement for the involvement of Amerindians in project planning through the medium of a special Amerindian Committee, and for annual meetings of Amerindian Captains on the project.

Iwokrama

The Iwokrama Rain Forest Reserve was declared in 1989, but without any form of public consultation. Much apprehension and uncertainty was generated among local Amerindian

communities and the wider Guyanese public with an interest in the subject. Today, the programme has made significant accommodation of Amerindians:

- The Site Resources Manager is a knowledgeable and prominent member of one of the neighboring communities. Likewise, most of the staff at the field station, including the medex and the cooks, are Amerindians.
- The programme is offering, in collaboration with the Government of Guyana, a "Training Course for Forest Rangers, Park, and Game Wardens." The programme will sponsor and subsequently hire eight of the participants from among men and women from any of the 12 nearby settlements. The others will be sponsored by the government.
- Villagers from the 12 settlements, many without land titles, have formed a local Community Board to liaise with the Iwokrama management.

Government Training

The Government of Guyana has decided that the Amerindians are the fittest people to monitor forests and natural resources in the hinterland. In May of 1996, therefore, the government initiated a programme of "Training for Hinterland Residents in Environmental Management." The Programme seeks to provide training to Amerindians, the majority of whom would have no education beyond primary level, and little access to radio and newspaper. The training will focus on management, monitoring, inventory, and surveying of natural resources.

National Land Use Planning Process

A very related activity is the National Land Use Planning Process. This process is equally

participatory. The process has gone through three stages so far: (1) sensitizing local communities to the subject of land use through local workshops, (2) eighteen local consultations with Amerindian communities on the subject, and (3) one national consultation in which 33 Amerindians from 18 communities participated. In addition, the National Land Use Steering Committee has representation from the Ministry of Amerindian Affairs and the Amerindian NGO's.

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PROTECTED AREAS IN HAITI

Dalberg Claude

BACKGROUND

"Protected area" is not a new term in Haiti. Rapid destruction of natural resources due to population growth, poverty, and the mountainous topography of the country made it necessary to adopt a policy aimed at the preservation of forest and wildland. Despite some effort, forest cover continues to disappear at a very fast rate. Actually, less than two percent of the vegetative cover is represented by forest. One of the first laws aiming at setting aside area for preservation was the February 3, 1926 Law on National Forest Reserve. In August 1936, the Cerisier Plaisance Reserve Zone was established. In the following years many other laws and decrees related to national forest or protected areas were promulgated.

During the 1980's with the increasing rhythm of deforestation, destruction of ecosystem, and habitat loss, many people in and out of the country voiced their concerns for preservation of special sites. Studies were conducted by the scientific community, with support from the Ministry of Agriculture. In April 1983, a presidential decree added two national parks-La Visite and Macaya (annex 1 and 2) -to the existing ones.

To date, preserved areas in Haiti encompass national parks and other protected lands with no clear status. The following list displays the national parks:

Fort Mercredi	5
Fort Jacques et Alexandre	9
Lac de Péligre	100
Parc National La Citadelle	250
Parc National Pic Macaya	2000
Parc National La Visite	2000

MANAGEMENT OF PROTECTED AREAS

Role of Protected Areas

The first protected areas were established in Haiti in order to set aside pristine areas against deforestation. The role of some of them, such as Cerisier Plaisance, is to protect sources of potable water threatened by the activities of local people. The two last ones, Macaya and La Visite, contain endangered plant and animal species in critical sites that need protection.

Experience in Managing Protected Areas

Haiti has little experience in managing protected areas. Once declared protected by presidential decree, there has been little significant action to enforce the measures recognized by the legislation. Some donors have allocated funds to the Macaya and La Visite Parks. These funds have been allocated to nongovernment organizations (NGO's) which often work alone without the government or well defined policy.

Governmental Distribution of Responsibilities for the Management of Protected Areas

Responsibilities for protected areas are spread among various agencies: the Ministry of Agriculture, Natural Resources and Rural Development (MARNDR); the Institute for the Safeguard of National Patrimony (ISPAN); and the Ministry of Tourism. The MARNDR actually manages most of the protected areas. However, Parc National La Citadelle, Fort

Name	Area (ha)
Sources Puantes	10
Sources Chaudes	20
Sources Cerisier Plaisance	10

Mercredi, and Fort Jacques et Alexandre, which have historical monuments, are managed by ISPAN. The newly created Ministry of Environment will probably be assigned a role in the management of these areas. The Department of Natural Resources (DNR) in the MARNDR has the responsibility for all natural resources. Its Service of National Parks and Natural Sites (SPNS) manages the protected areas.

Problems

The country faces many problems in the setting up of a solid protected areas network. Even though some funding has been made for some parks, the money has been mainly used for studies and technical assistance to farmers surrounding the parks. The two bigger ones, Macaya and La Visite, have no well defined demarcation line. This is a severe handicap that prevents the application of the enforcement measures. Encroachment is very common because of the local population socio-economical situation. The Park Service is unstaffed and therefore is very ineffective in setting up a surveillance system. The Service is handicapped by a lack of financial resources. Until now, the network has no coastal and marine protected areas. There is no clear-cut definition among "national reserve", "natural site", "national park", and other terms. Any plan to improve the system has to take into account all these deficiencies.

Trends and Prospect

A project is now under way to allow the Ministry of Agriculture to formulate a policy and implement a management plan for the La Visite and Macaya National Parks. Funded by the World Bank, this project will allocate funds to delineate the two parks and to increase productivity in the zone that surrounds them in order to lessen the pressure of the local population on the resources. The project also envisions the creation of a new park and the enhancement of the capability of the institutions in the management of protected areas.

Annex 1. –Some data on La Visite National Park

Location	La Selle range at 22 km from Port-au-Prince
Creation	June 1983 presidential decree
Area	2000 ha
Most elevated point	2282 m
Interest	Important water catchment; interesting panoramic view; 300 species of vascular plants with 12 orchids; 3 conifers and 60 ferns; 20 species of butterflies; 40 species of mollusks; 67 species of birds, with 17 endemic ones; unique habitat of <i>Plagiodontia</i>

Annex 2. –Some data on Macaya National Park

Location	La Hotte range at 36 km from Cayes City
Creation	June 1983 presidential decree
Area	2000 ha
Most elevated point	2347 m
Interest	Important water catchment for seven important rivers; pine reserve; numerous endemic species; unique reserve of black-capped petrel; endemic orchids; unique habitat with <i>Solenodon paradoxus</i> (animal); exceptional panoramic view; isolated place; more than 500 species of vascular plants; 11 species of butterflies; more than 57 species of mollusks; 73 species of birds with 24 endemic ones; habitat for migratory birds

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PROTECTED AREAS MANAGEMENT IN JAMAICA

Albert C. McKenzie and Patrick Barrett

INTRODUCTION

The Jamaica National Five-Year Development Plan states that "sustainable management of our natural resource" is the basic environmental policy goal. Jamaica's environment has to be managed and sustained in such a way as not to compromise the welfare of our future and present generations. The Government of Jamaica (GOJ) has accepted the challenge and has taken concrete measures to support sustainable development of the environment. The realization that forest resources are indispensable for the country's social, economic and environmental development further necessitates these measures. The GOJ recognizes the value of this for the sustainability of life of its 2.6 million people as well as that of plants, birds, and animals, and to remain attractive to tourism which is the main foreign exchange earner.

In former years Jamaica was well endowed with forest resources. Prior to Hurricane Gilbert (1988), total estimated forest area (more than 10 percent covered with trees) was between 308,000 and 550,000 ha. Apart from Gilbert devastation, however, there has been a long history of largely uncontrolled forest exploitation resulting in great reduction of the natural forest. It has been estimated that the annual rate of deforestation is between 3.5 and 5.3 percent. Forest resources in government reserves now stand at 107,190 ha, and 152,200 ha in private forest. Less than 77,000 ha (6 percent) of Jamaica's total land area currently is undisturbed natural forest. This loss in forest cover is due also to increases in population, resulting in severe pressure to convert lands into agriculture, housing and industrial usage. Consequently, severe adverse effects have impacted timber and water production, soil, flooding, siltation and environmental degradation such as loss of biodiversity, wildlife habitat and aesthetic values.

JAMAICA'S EXPERIENCE IN SETTING UP PROTECTED PARKS

In 1987, the Jamaica Country Environmental Profile reported that Jamaica's natural habitat areas were being destroyed at a very rapid rate and quick action to halt or reverse this trend was urgently needed. Out of this concern came the Protected Areas Resources Conservation (PARC) programme of which the Blue and John Crow Mountains (BJCM) National Park, Montego Bay Marine Park (MBMP) and the Conservation Data Centre (CDC) pilot projects were implemented. Funding for the PARC project came jointly from the GOJ and United States Agency for International Development (USAID) in keeping with the project agreement signed between them in 1989.

Blue and John Crow Mountains National Park

The mission of the BJCM National Park is to manage the park for its cultural and natural value by integrating conservation of the diversity of species with sustainable economic development for the well-being of Jamaica. The BJCM National Park area covers the Blue Mountain Forest Reserve which is about 78,212 ha of forested area, and includes parts of the parishes of St. Andrew, St. Thomas, Portland and St. Mary. Together, the Blue and John Crow Mountains are areas of tremendous economic and ecological value to Jamaica. They are two of the few areas of pristine and unspoiled forest in the island. The park is a vital natural resource for the following reasons:

1. It is the most biologically diverse area in the island, possessing six distinct forest types with a range of climate and vegetation from tropical to near temperate.
2. It is home of the Jamaican hutia (*Conies*), snakes, tree frogs, the giant swallowtail butterfly (*Papilio-homerus*), birds such as the

diminutive Jamaica tody (robin red breast), and other species.

3. Much of the plants and animals in this area are endangered.
4. The park includes within its borders important watersheds, such as the Yallahs Basin, which supply Kingston and most of the eastern parishes with water.

Two major objectives guided the development of the park: management of the area's natural resources for long-term sustainable use; and provision of opportunities for income generation by park management and local communities through the promotion of the park's natural, cultural and recreational attractions (ecotourism). A guiding principle measuring the park's success was that in order for it to be successful in its efforts to preserve valuable forest land and wildlife, it must be accepted by, and receive support from, the local community.

A report following project evaluation carried out by the Island Resources Foundation of the US Virgin Islands (November 1992) found that "the development of the BJCM National Park represented a remarkable work-in-progress effort. Within the less than three years that this element has been functional, the park has taken its first steps... from a paper abstraction to an operational park that is a source of pride and income for people living in adjacent areas".

After the successful overcoming of the various challenges such as staffing and management, the BJCM National Park was officially opened February 28, 1993. The first phase of the PARC programme ended on October 15, 1993, and since then the second phase has commenced.

Developing Trails

The Blue Mountains have been used for various purposes since the colonial days, therefore, there is an excellent system of existing trails, most of which are centuries old. However, although they are well laid out, they

suffer from lack of maintenance and overuse. It is planned to develop one such trail, namely, the Fairy Glade Nature Trail, at Hollywell, in the Blue and John Crow Mountains National Park. This trail will diversify the tourism product to integrate it into rural areas, assist in the park trail network/system and provide learning opportunities for nature studies, targeting school children, colleges, other learning institutions and students of nature studies. The trail is 1.6 mile in length and stretches from the Hollywell Park via Mt. Horeb to Catherine's Peak. It meanders through misty evergreen montane forest characterized by over 40 percent of the endemic flowering plants largely confined to the Blue and John Crow Mountain Region. Tour companies recommend users fee of US \$10 although financial analysis shows viability at US \$3. The total cost of the plan development is US \$50,142.

Involvement of Local Committees

Local Advisory Committees (LAC's) comprised of representatives from the local communities were formed in three areas: Minto district, parish of St. Thomas; Hollywell district, parish of St. Andrew; and Millbank district, parish of Portland. Regular interagency coordinating meetings are held at which community needs are identified, and consensus and strategies are decided.

Tour guiding and small skill programmes have been successfully planned and carried out with the community members deriving financial benefits. Additionally, employment has been generated in the renovation and construction of Hollywell, Portland Gap and other park facilities.

Schools in the communities have also benefitted from a comprehensive environmental education programme funded by the RARE Centre for Tropical Conservation. This activity targetted schools in the county of Surrey (St. Andrew, St. Thomas, Portland and St. Mary), and focussed attention on the plight of the rare and endangered giant swallowtail butterfly (*Papilio homerus*).

Montego Bay Marine Park

The Montego Bay Marine Park (MBMP) extends from the Sangster International Airport to the Great River, a distance of about 9 kilometers. The Marine Park includes the sea-floor to a depth of about 100 metres, which is an approximate area of 15.3 square kilometers. The purpose of MBMP is to conserve and manage Montego Bay's marine resources for the benefit of the people of Jamaica and visitors to the island. The MBMP is characterized by warm, white sand beaches, clear blue water, colorful coral reefs, exotic tropical fish, lush seagrass beds, and dense mangrove swamps - all found along the shoreline of the city of Montego Bay in the Parish of St. James, in western Jamaica. The MBMP is very important and interesting because of the variety of marine environments and diverse plant and animal life found within it, such as seabirds, conch, and lobster. In the MBMP one can swim, snorkel, scuba-dive, sail, waterski, windsurf, ride in glass-bottom boats, enjoy the beach, paddle about and learn about corals, seagrass beds, mangroves, fish and other sealife.

The MBMP has uniformed rangers on staff who have law enforcement authority within the park boundaries. Regulations have been developed to conserve and protect the resources of the MBMP, so as to increase and enhance enjoyment. In general, the regulations affect the following activities:

1. Fishing. This activity is regulated or restricted to designated areas to protect fish populations.
2. Watersports. Such activities are restricted to designated areas to prevent incompatible activities in the same areas, such as water skiing and snorkelling. Boats are required to keep away from snorkellers and divers.
3. Anchoring. Boats are required to use mooring buoys when available so that anchors and anchor chain will not damage corals.

GOVERNMENTAL JURISDICTION OR DISTRIBUTION OF RESPONSIBILITIES FOR THE MANAGEMENT OF JAMAICA'S PROTECTED AREAS

Different types of protected areas have been designated under several pieces of legislation, falling under the management and administration of several government agencies. Some of the legal foundations follow: Forest Act (1937), repealed and reenacted in 1995; Bark of Trees (Sale Prevention) Act (1929) reenacted in Forest Act 1995; Morant and Pedro Cays Act (1907); the Local Improvements Act (1914); Country's Fire Act (1942); Town and Country Planning Act (1958); Wildlife Protection Act (1945); Beach Control Act (1956); Fishing Industry Act (1975); Watershed Protection Act (1963); and the Jamaica National Heritage Trust Act (1985). The main failing of these laws are low fines and penalties, lack of cooperation between and among agencies, and need for public education and awareness.

The Natural Resources Conservation Act (NRCA) (1991) provides the legislative framework for the development of a system of national protected areas. The development of such a system necessitates the coordination of policy, planning and implementation among the agencies with responsibilities for different types of protected areas. Additionally, effective coordination and implementation will require legislative changes, as well as accompanying regulations. Specifically, the act empowers the Minister to designate national parks, protected areas, and marine parks, and to arrange for the management of areas so declared. Marine Park Regulations (1992) and National Park Regulations (1993) are now in force, and the Blue and John Crow Mountains National Park and the Montego Bay Marine Park have been gazetted under these regulations.

Experience gained in managing the BJCM National Park and the MBM Park has shown the need to amend the NRCA Act, chiefly to (1)

show the extent of the NRCA's responsibility in the establishment and regulation of a national protected area system, (2) provide a more specific definition of protected area, and (3) allow NRCA to guide the management of protected areas. Sites soon to be established are Cockpit Country National Park, Black River National Park, Negril Marine Park and Port Antonio Marine Park.

SUMMARY

This paper briefly outlines some of the effort to protect Jamaica's natural resources. Further, detailed information can be obtained from the author. The PARC programme is a joint effort of the GOJ and USAID to establish a system of parks in Jamaica. The programme started in 1989. Two pilot projects have been established under the PARC System, the Blue and John Crow Mountains National Park and the Montego Bay Marine Park. Both of these parks' success to date has been due mainly to

the community support through the Local Advisory Committees. LAC's are composed of community members whose chief function is to give advice as to the needs of the community, and plan strategies to satisfy such needs.

Mention of the part played by the Conservation Data Centre to the PARC Programme should also be made, which is primarily to record data of all rare and endangered endemic species in Jamaica. This has been set up at the University of West Indies, Mona Campus. Out of this stage, a Systems Plan of National Parks and Protected Areas for Jamaica has been written and presented to NRCA for presentation to GOJ. Finally, mention must be made of the Jamaica National Park Trust Fund which was established initially in 1992 with a "Debt for Nature Swap" allocation of J\$12.3m which now amounts to J\$36m (J\$40 = US\$1). Recently, the salaries of the workers of the two pilot parks have been met from this trust fund investment.

BUILDING A STRATEGY FOR PROTECTED AREAS IN MARTINIQUE

Dominique Chabod

INTRODUCTION

Martinique is located at the middle of the Lesser Antilles archipelago, between Dominica to the north, and St. Lucia to the south. Its geology is interesting because here are juxtaposed parts of the three volcanic arcs whose succession has given birth to the present archipelago. Most ancient terrains are located in the southern peninsulas of Ste. Anne and Caravelle (25 M years), and most recent ones in the northern part of the island. These different ages explain the topography everybody can observe to the south, hills very similar to those of the southern part of Antigua for instance; to the north of the capital, Fort de France, mountains jumping up over 1,000 m, with the Pitons du Carbet (1,100 m) and Montagne Pelée (1,397 m).

Martinique is the largest island of the Lesser Antilles, with 1,080 km². It is also the most populated, with 384,000 inhabitants, and the population density is among the highest in the insular Caribbean, comparable to that of Puerto Rico (355 inh/sq.km or 945 inh/sq.mi). Nevertheless, there are 46,500 ha of natural vegetation types left, that is about 43 percent of the island, and of this, 15,500 ha are public forests managed by Office National des Forêts (ONF). ONF is a State Authority created in 1966 for the management of all public forests (state, regional, and community forest).

Rainfall ranges from circa 1 to 8 m/year, with the classical dissimetry between Windward and Leeward coasts. Geological and climatic diversity induces a large range of terrestrial ecosystems, since nearly all these of the biogeographical province of Lesser Antilles are concentrated on this island. Biodiversity is also important, considering the flora, with about 1,800 species of *Phanerogams* and more than 200 species of ferns. The endemism rate is far from that of the Greater Antilles but similar to those of Dominica and Guadeloupe, the other large islands of the Lesser Antilles.

After the two local species of parrots became extinct by the end of the 18th Century only two endemic bird species remain: the Martinique oriole (*Icterus bonana*) and the white-breasted thrasher (*Ramphocinclus branchyurus*).

PROTECTION OF THIS NATURAL HERITAGE

Quite a number of flora and fauna species are protected through national by-laws enacted by the end of the 1980's. With regard to the protection of habitats, there are only two strictly protected areas: two terrestrial natural reserves relevant to the Category I of management categories of The World Conservation Union (IUCN).

When some of you attended the 6th Caribbean Foresters Meeting, 4 years ago in Martinique, you were probably told about the Regional Natural Park, that covers more than 60 percent of the island. In fact, it is not, properly speaking, a protected area. Relevant to Category V of IUCN management categories, the concept of regional natural parks was developed in France in the 1970's, in order to preserve at a regional level's initiative, the natural landscape, and cultural and architectural heritage, and to promote a sound rural development. There are now 32 regional natural parks in France. Regional natural parks are administered by a board composed of representatives of the Regional Council that covers most of the budget as well as representatives of local communities, the Departmental Council and state administrations. Even if they are created by a state decree, the activities inside these parks are not specifically regulated, but a charter of the park links together the Regional Council, the local communities concerned, and the state. The charter is revised every 10 years, which is now in process because the Regional Natural Park of Martinique was created 20 years ago.

Among the new goals for the next 10 years, is the creation of new protected areas, marine and terrestrial. Indeed, the two existing natural reserves, only cover together 517 ha, and don't represent the full range of life zones of the island. Natural reserves (125 of them exist in France) are created by a decree. The largest one in Martinique is the Reserve Naturelle de la Caravelle (512 ha). Created in 1976, this reserve encompasses mainly public lands. It is rather similar to the Cabrit's Peninsula in Dominica, since it is secondary dry forest, and because of its historical heritage and beautiful landscapes. It also displays interesting geological features, and hosts the white breasted thrasher. Many visitors, both locals and tourists, practice hiking, along the trails maintained by ONF, where interpretative signs designed by the Regional Natural Park are found. This reserve is administered by the Regional Natural Park Authority. The Reserve Naturelle des Ilets de Ste. Anne (5 ha) was created in 1995 as a refuge for marine birds, and is not open to the general public. This reserve is co-managed by the Regional Natural Park and ONF.

One may consider that only a tiny percentage of the island area is protected if one forgets to mention that the largest part of public forests are in fact managed as protected areas. Indeed, of 15,500 ha managed by ONF, logging activities are authorized only within 2,000 ha, of which 1,600 ha are mahogany plantations. So, about 13 percent of the whole island is preserved from all felling. It is an important rate, but all these 13,500 ha have neither the same value nor the same significance, in terms of biodiversity, landscape, geological, or historical heritage. This is why Office National des Forêts is now defining, with its main partners - the state administrations, the Departmental Council and the Regional Natural Park - a conservation strategy, whose aim is to create a comprehensive system of protected areas called réserves biologiques (biological reserves) in public forests. These reserves will be selected in accordance with the criteria mentioned above. The biodiversity value is appreciated through the inventory of Natural Zones of

Ecological Faunal and Floral Interest (ZNIEFF) made by scientists on the whole island, within the framework designed at the national level.

The biological reserves will be designated through a by-law signed by both the Ministers of Agriculture and the Environment. Within the next two years the following will be designed:

- Réserve Biologique des Pitons du Carbet - 1,500 ha;
- Réserve Biologique du Morne Jacob - 2,000 ha, the two covering the rain and cloud forests zones;
- Réserve Biologique de la Mangrove de la baie de Fort de France - 1,500 ha;
- Réserve Biologique de la Montagne Pelée - 3,000 ha, that I shall detail further;
- Ten other reserves in the south and in the littoral zone - 1,000 ha.

The grand total will be about 9,000 ha.

The inventory of ZNIEFF (Direction Régionale de l'Environnement 1994) includes private lands too, and it will be used either to forbid any clearing for cultivation, or development, or to build a program of acquisition. The purchase could be done by the Seashores Conservatory, whose jurisdiction is extended to the whole surface of the parishes bordering the sea, which is the case in 29 of the 34 parishes on the island; or by the Departmental Council. Such acquisitions have already taken place in such remarkable sites as the North of Montagne Pelée, Caravelle peninsula, Macabou, and Cap Salomon for more than 1,000 ha. They are, or will be, included in natural (Caravelle) or biological reserves (Montagne Pelée or Macabou) for instance.

Let me give you more information on the Montagne Pelée Reserve, which is of regional importance. Field research conducted by well-known botanists such as Portecop, Sastre, Rollet, and especially Fiard have pointed out the outstanding value of this area (Fiard 1992, 1994; Portecop 1979):

1. For its biodiversity
 - All life zones of Lesser Antilles are represented here from the sea level to the summit of Montagne Pelée (there is no circular road in this part of the island).
 - Of 211 tree species, 44 are endemic to the Lesser Antilles, and four of them strictly endemic to Martinique.
 - A great number of rare or endangered plant species are present.
 - The fauna is richer than anywhere in Martinique, with an endemic bird, the Martinique oriole (*Icterus bonana*), and another one that was supposed to have disappeared from the island (*Troglodytes musculus martinicensis*). *Iguana delicatissima* is also living here.
 - Relicts of the primary forest, hygrophytic and mesophytic, are present here. Outside Martinique, only one similar relict of mesophytic forest has been found by Beard; in Grenada, at the summit of Morne Delice.
2. For the variety of succession stages of natural vegetation due to erosion and magmatic eruptions of Montagne Pelée in 1902 and 1929 that destroyed large areas of vegetation.

These last ten years, the importance of this area, and its value at the subregional level have already been recognized. For instance, Montagne Pelée was cited in 1982 by Putney to be protected in the Survey of Conservation Priorities in the Lesser Antilles conducted under the auspices of the Eastern Caribbean Natural Area Management Program, then proposed by the same as a Biosphere Reserve at the workshop on Biosphere Reserves held in St. John, US Virgin Islands in 1983. We may notice that he also made the same proposal for Guadeloupe and the Levera area in Grenada. This year, we shall begin the feasibility study of this Biosphere

Reserve of Montagne Pelée, as all criteria required for a fully functioning Biosphere Reserve seem to be met. After having participated in the creation of the Biosphere Reserve of the Guadeloupe archipelago, that was designated by UNESCO in 1992, I hope to be rather lucky to see the creation of the Biosphere Reserve of Montagne Pelée.

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PROTECTED AREAS MANAGEMENT: A STRATEGY FOR FOREST RESOURCE MANAGEMENT ON MONTSERRAT

Gerard A.L. Gray

INTRODUCTION

Montserrat is a volcanic, mountainous island situated between 16° 40' and 16° 50' north and 62° 9 and 62° 15' west (fig. 1). The climate is tropical maritime having a mean temperature of 26° C with little seasonal variation. It is one of the wettest of the Leeward Islands with rainfall that varies between 1,070 mm at sea level to over 2,540 mm on the mountain tops.

Nearly all of the original forest has been cleared for agriculture or timber exploitation. The present vegetation is, for the most part, secondary forest and scrub regrowth, covering approximately 7,300 ha (71 percent) of the total land area of 10,260 ha (Land Development Authority 1987). About 3,000 ha comprises rain, cloud or moist forest, the balance being dry woodland or scrub (Briscoe 1991). Of the total forest area, 243 ha is classified as inaccessible land suitable only for natural forest, 5,670 ha is suitable for forestry development, and 1,380 ha represent agricultural land that has reverted to forest (Government of Montserrat 1993). Forested areas provide vital protection for soil and water resources, and also supply firewood, charcoal, meat, fruit and small amounts of timber and handicraft materials. However, the forest resources are under-managed and under-utilized. As a result, the direct contribution of the forestry sector to the national economy is recognized to be approximately 0.5 percent of the gross domestic product. Considering that in excess of 7,100 ha has been classified as suitable for forestry or agroforestry development, with proper management, the forestry sector can contribute more to national development (Gray 1994).

DISCUSSION

To bring the forestry sector under proper management so as to satisfy conservation needs and optimize utilization, all aspects of forest management were considered. Therefore, the strategy for forestry development and management was to (1) prepare a comprehensive policy statement on forestry resource development and management, (2) update all forestry legislation, (3) demarcate and declare forest reserves, protected forests and national parks, and (4) develop and execute a forestry sector development and management programme.

Policy

The forest policy consists of an explicit statement presented in a manner that provides a satisfactory basis for the preparation of legislation. The policy statement describes the general features of the forestry and wildlife sectors and outlines a strategy for forestry and wildlife development and management, taking into account the importance of tourism and the limited resources available to Government. It focuses on the role of the sector, imperatives, obstacles to progress, objectives, constraints and strategy for implementation. The imperatives being the essential features on which the policy depends, are critical for the future development of the forestry sector, and must be addressed. Six imperatives were distinguished for Montserrat: water, soil, heritage, outputs, participation and public awareness.

The main socio-economic obstacles or structural problems preventing progress in the management and development of the resources were identified as the following: the lack of a proper basis for effective protection and management of forests, wildlife and national parks; the under-utilization and low productivity of

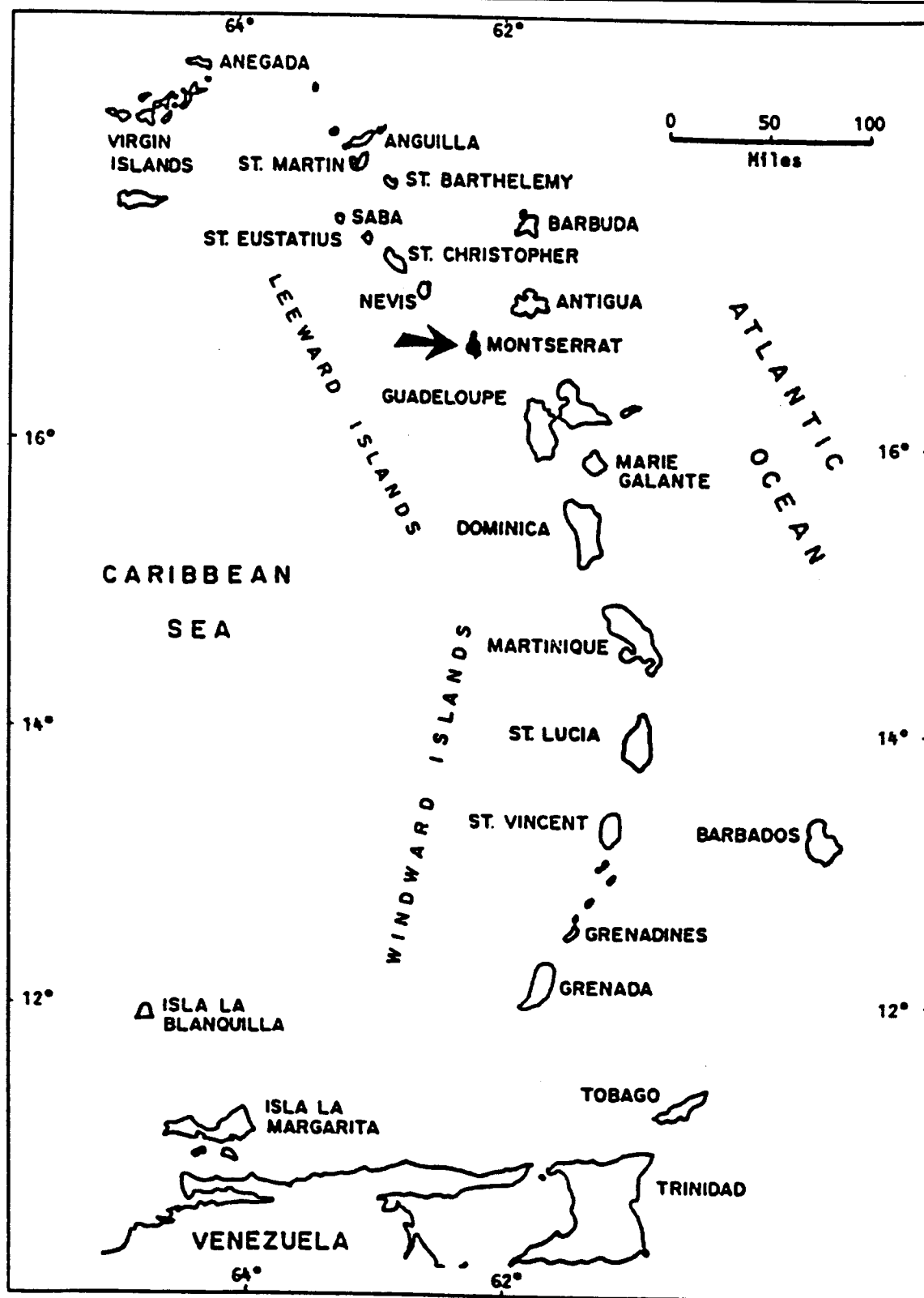


Figure 1. -General map of Eastern Caribbean, showing location of Montserrat. Source: Montserrat Environmental Profile, 1993.

forest land; and the inadequate economic capacity of Montserrat and other small states to support the entire range of forestry, wildlife and national parks activities. To overcome these obstacles the following objectives were proposed:

1. Secure the resource base by identifying and legally declaring protected forest areas, wildlife reserves and national parks, thus safeguarding their vital resources for present and future generations.
2. Initiate development training for the forestry sector, thus bringing the resource under effective management and increasing output in the shortest possible time.
3. Join with other countries in the Eastern Caribbean to seek mutual assistance from foreign donors, thus establishing a framework of common services for the forestry sector.
4. Establish an environmental fund (UNDP 1991).

Legislative and Administrative Framework

The Forestry, Wildlife, National Parks and Protected Areas Ordinance (1996) widens the remit of the Forestry and Environment Division beyond the purely regulatory function to include relevant aspects of forestry, wildlife and national parks conservation, and development and administration, with ecosystem management being the main vehicle.

Legislation

The law provides for varying degrees of protection via the declaration of forest reserves, protected forest, conservation areas, preservation orders, wildlife reserves and national parks. Essentially, these provide for the creation of a forest estate.

Forest reserves are areas of forest land under permanent government control, intended to be kept under forest cover for the production of water and timber, for recreation and scientific research, and managed in accordance

with plans prepared by the Chief Forestry and Environment Officer. All private lands so designated must be acquired by the Crown.

The protected forest category was designed to assist the Chief Forestry and Environment Officer in placing privately owned forest under management by authorizing him to enter into agreements to manage these lands. Incentives, including the remission of property tax, may be granted to owners of land declared as protected forests.

Conservation areas were designed to enable activities to be controlled on critical areas of private land, where these activities threaten the destruction of natural resources through flooding, rapid soil erosion, pollution or other types of environmental harm. Restrictions on the use of these areas may be imposed through regulations (UNDP 1991).

Preservation orders may be declared, in the national interest, by the Forestry, Wildlife and National Parks Board for the preservation of any species of tree or plant or individuals thereof, or any area of vegetation. Except with the written permission of the Board, no person shall cut, lop, uproot or otherwise destroy or damage a tree or plant that is the subject of a preservation order, or carry out any scientific study or research or any operation or work in any area or on vegetation which is the subject of a preservation order (Government of Montserrat 1996a).

The wildlife section of the Ordinance provides for wildlife management and protection, with wildlife recognized as the property of the Crown and subject to regulation by Government. The Governor-in-Council may declare wildlife reserves on private or public lands. The Ordinance also provides for the division of wildlife into three categories: protected, partially protected and unprotected species.

The section on forest fires gives the Chief Forestry and Environment Officer responsibil-

ity for prevention and control of fires in forest reserves, protected forests, conservation areas and wildlife reserves. The national parks sections provides for the declaration of national parks for the purpose of preserving natural beauty, historic sites and areas of scientific and educational importance, and for the purpose of recreation. Any land declared to be a national park must be acquired by the Crown. The legislation also provides for the establishment of an Environmental Fund to consist of sums contributed by individuals and organizations, sums appropriated by Government and all sums from penalties and licenses specified by the Forestry, Wildlife, National Parks and Protected Areas Ordinance. The fund shall be used to finance forestry, wildlife and national parks conservation and management, and for the disbursement of loans and/or grants to tenants and owners of private land for forest management. (Government of Montserrat 1996a).

Administration

A holistic and coordinated approach to ecosystem management is proposed via a multi-disciplinary/multi-sectorial Forestry, Wildlife and National Parks Board. Membership on the Board is such that the interest of all major stakeholders are represented. The functions of the Board are the following: (1) advise the relevant minister on management and administration, and the formulation and implementation of policy pertaining to forestry, wildlife and national parks; and (2) review and revise national and individual forestry, wildlife and national parks management plans.

It is the task of the Forestry Administration to make recommendations in respect to forestry, wildlife and national parks policy, legislation and procedures. Once these have been formally approved by the Governor-in-Council, the Administration is to implement such instruments without fear or favor and to manage the state's forest, wildlife and national park resources efficiently. In addition, the Forestry

Administration provides advice to private land owners. These tasks require well trained and dedicated staff (Dardane 1991). Adequate arrangements for staffing have been made via the development and management programme.

The Chief Forestry and Environment Officer is charged *inter alia* with the conservation, management, development and administration of forestry, wildlife and national parks and related matters. He is required to prepare a national forest plan every 10 years. Certain mandatory elements of the plan must be reviewed by the competent minister and submitted to the Governor-in-Council for approval, after considering the advice of the Board. The Chief Forestry and Environment Officer is also obligated to demarcate protected forest areas and to manage such reserves according to the applicable management plan. (Caribbean Law Institute 1991).

Protected Areas Declaration

As a first step towards the declaration of protected areas, proposals for land use zoning regarding forest reserves, protected forests, conservation areas and national parks were drawn up (fig. 2) (Lang and Gray 1992). The proposals, the first of their kind for Montserrat, paved the way for the zoning of the whole island (Gray 1992).

Prior to the plan, there was one duly declared forest reserve. However, all land above 1,500 ft. and lands in critical watersheds received *de facto* protection. Land zoning was carried out through the consideration of land capability, present land use, land tenure, requirements of other bodies and conservation needs. The importance of forested areas to the island's water quality and supply is unquestionable. Over 95 percent of potable water is derived from springs located at the edge of the forest with their catchment areas within the forest. Therefore, the importance of catchments for water supply was of great relevance to the land zoning exercise.

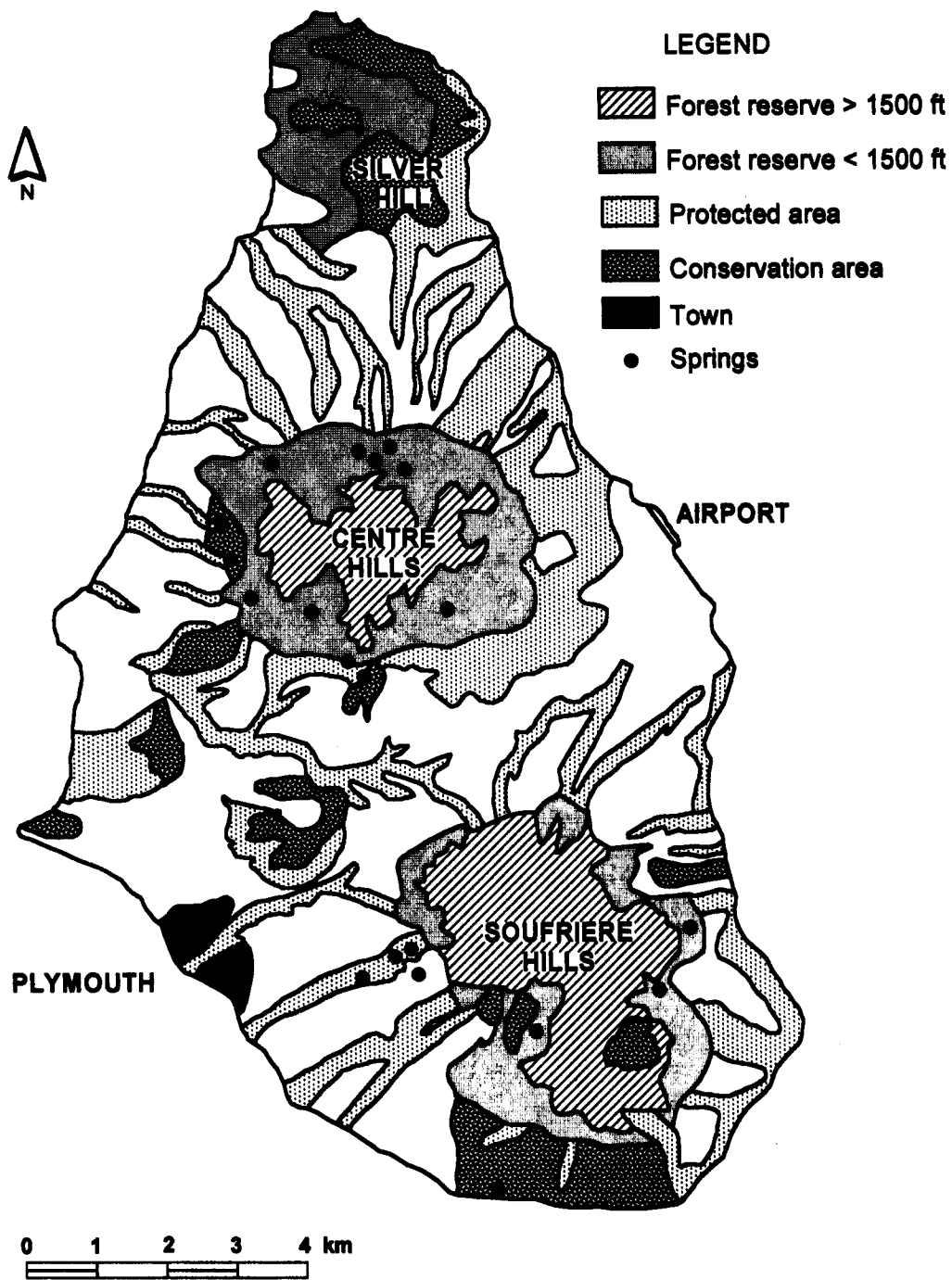


Figure 2. -Proposed land zoning scheme for reserves, protection, and conservation areas. (Map adapted by IITE, 1997).

The land use zoning proposal identified the following categories of protected areas as allowed for under the relevant legislation: forest reserve, protected forest, conservation area, wildlife reserve and national parks. Essentially, all areas of significance to forest resource development and management have been given protection via one of these classifications to facilitate appropriate action. There is provision for these areas to be expanded.

Forestry Sector Development and Management Programme

As a result of the CARICOM/FAO Tropical Forestry Action Programme (TFAP) process an immediate action programme was devised for forestry sector development and management. The purpose of the project is to improve management and utilization of national forest resources, via provision of core support to the National Forestry Action Plan (NFAP). The goal is to optimize the economic and environmental goods and services of these resources in support of national development. This will be achieved via four main outputs and supporting activities over a period of three years:

1. Strengthen the Forestry Division staff and facilities. This must occur so as to bring the Division's capacity to a level where its functions can be adequately fulfilled.
2. Protect and manage key watershed and catchments. This is necessary in order to safeguard future water supplies, minimize erosion, preserve biodiversity and support ecotourism.
3. Develop forestry and agroforestry management. This activity will improve the productive and protective potential of natural forest and plantations, and generate technical expertise and economic data for planning and implementing future programmes. The main beneficiaries will be communities living around the margins of the reserves, farmers, individuals needing forest products, and tourists.
4. Develop new water sources. This is necessary to ensure adequate water supplies in

the north to substitute for those made unavailable due to volcanic activity (Government of Montserrat 1996b).

Funding is assured from the Dependent Territories Regional Secretariat of the British Government and the Government of Montserrat.

CONCLUSION

The holistic and integrated planning of the development and management of the forestry, wildlife and national parks resources of Montserrat have led to a programme that is dominated by protected areas management. Provisions for the declaration of forest reserves, protected forest, conservation areas, wildlife reserves and national parks have allowed for the application of varying degrees of protection as appropriate. It must be emphasized, however, that such a plan materialized after due consideration was given to policy, legislative, administrative and resource development and management issues. The core support of the NFAP will effect the implementation of the development and management programme.

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ECOTOURISM IN ST. LUCIA: ALTERNATIVE USE OF THE FOREST

Brian James

INTRODUCTION

St. Lucia is not blessed with significant mineral and renewable natural resources. The forest in St. Lucia is extremely vital for the protection of our water, wildlife and soil resources. The use of the forest today is significantly different to what it was 15-20 years ago when it was believed to be a resource which could be utilized continuously to supply timber, wildmeat and virgin agricultural lands. With a rapid increase in population and a small forest base it soon became apparent that, if left unchecked, deforestation would result in serious degradation of the environment and standard of living. Over the past 15 years or more Government has demonstrated its concern for the natural environment by providing increased staff and finance to the Department of Forest and Lands to manage and protect the vital forest resources of this country. The government has in addition embarked on a programme of purchasing significant critical private lands for soil, water and wildlife conservation.

CENTRAL RAINFOREST TRAIL

Forest can be utilized for both tangible and intangible benefits. The tangible uses of items such as timber and wildmeat cannot be obtained from our forest in any significant quantity. Therefore, the Department has had to examine the nontangible uses which help maintain the resource. One of these nontangible uses is forest recreation. In 1979, the Department developed the first ever forest trail "The Rain Forest Walk" through the Central Rainforest Reserve starting at La Porte in Mahaut through Quillesse to Edmund Forest in Fond St. Jacques, Soufriere. The use and popularity of this trail grew over the years and it soon became the most popular natural area visited by both locals and foreign visitors. Because of the success of the rain forest trail, two more trails were

constructed: one at Union and one at Barre de Isle, respectively.

In the first year of operation more than 2000 overseas visitors visited the Central Rainforest Trail providing employment for two guides and a revenue of \$EC18,750.00. The tour at that time was only marketed by St. Lucia Representative Services and Barnards Travel. In the years following, the trail experienced a steady increase in usage from both local and foreign visitors. However, despite its early success, the trail was not without its problems. On August 4th 1980, Hurricane Allen struck St. Lucia causing serious damage to approximately 40% of the forest island-wide, homes, and other structures in excess of \$EC250 million. The heavy rains that followed resulted in many landslides that caused widespread damage to the trail and access roads leading to it. Visitation to the trail after Hurricane Allen remained relatively low mainly due to the poor condition of both the access road and the trail. By the mid 1980's visitation levels slowly began to rise with the Department recording over 10,000 visits by school children.

Approximately 10 years after Hurricane Allen, with the forest almost completely recovered, there was once again a renewed interest in the island's natural environment. Indeed the St. Lucia Tourist Board was marketing the country for its lush beauty with themes such as St. Lucia - "Where Wonders Never Cease" and St. Lucia - "Simply Beautiful". Tourist literature made reference to the island forest and to our national bird, the endemic and endangered St. Lucian parrot. This certainly translated to increased requests from visitors to visit the rain forest, and in order for the Department of Forestry to meet the increase in demand for tours the trail and roads leading to the trail had to be rehabilitated. The cost of rehabilitating the road was approximately \$EC1 million while the trail was \$EC287,000.



A Project was prepared and assistance was requested from CIDA, RARE Center for Tropical Conservation, Special Expeditions and the St. Lucia Tourist Board to jointly fund the rehabilitation of the trail. The rehabilitation work commenced in 1992 and continued to 1993 by which time visitation more than doubled. The contributions to the rehabilitation were as follows: CIDA \$EC1.15 million, RARE/Special Expeditions \$EC67,000, Government (Department of Forestry) \$EC95,000.00 and St. Lucia Tourist Board \$EC10,000. During the rehabilitation work more than 80 people were employed from the adjoining communities of Soufriere, Fond St. Jacques, Desruisseaux, Blanchard and Micoud. By the time the trail was fully rehabilitated in mid 1993, seven tour companies were selling the rain forest tour while the Department had to employ an additional four guides. The revenue generated by the Department reached a startling \$EC140,000 (1993/94), more than doubling the previous year's revenue. During the first two quarters of fiscal year 1994/95 we saw a doubling of the number of visitors and revenue generated for the corresponding period for the previous years.

This trend was expected to continue but Tropical Storm Debbie struck the island in September 1994 causing once again tremendous damage to the Central Rainforest Trail, making it inoperable and unsuitable for any ecotourism activity. Based on the magnitude of the damage suffered by the trail it was determined that rehabilitation would be too costly, and that the trail would not be able to offer much to nature lovers or ecotourists. Given the existing situation there was need to find or construct a new trail that would offer the same or even better attractions.

DES CARTIERS FOREST TRAIL

The Environmental Education Unit of the Department of Forestry was able to identify a track south of the original rain forest trail at Des Cartiers that could be developed into a worthwhile forest trail. Work commenced with limited government funding while a proposal was developed and submitted for funding to RARE. RARE agreed to assist on condition that the government would match their contribution. The trail was constructed in two phases

with RARE providing \$33,000 for Phase 1 and \$53,400 for Phase 2. The government's total contribution to the Des Cartiers Forest Trail amounts to \$EC106,614. Work on this trail commenced in mid October 1994 and was completed in March 1996. The new trail is a three kilometer loop that passes through a relatively undisturbed secondary to climax mountain rain forest. Along this trail there are several look-out points including two gazebos (viewing pavilions). The trail goes through areas of high parrot activity and bird life. One is almost always certain of seeing the St. Lucian parrot, one of the world's rarest birds, either perching on a branch or in flight along the trail. Although the trail was finally completed in March 1996, the Department has been conducting tours since November 1995.

CONCLUSION

There is once again a surge in increase in the request for forest tours. The government, through the Department of Forestry, is determined to provide top quality facilities and services to the users of this and other trails as you will witness today. The carrying capacity of this and other trails are closely monitored to reduce deterioration to a minimum. Similar to most products the trails operated by the Department of Forestry are also diverse. There are trails for hiking, bird watching, research, aesthetics, waterfall, riverbathing etc. for different age and fitness groups.

PROTECTED AREAS MANAGEMENT (ST. LUCIA)

David Lewis

INTRODUCTION

Within recent times there has been a growing realization among governmental and non-governmental institutions that the natural and cultural heritage of St. Lucia is subject to major and unprecedented threats. However, if properly managed, these resources could represent one of the country's principal assets in its quest for sustainable development and prosperity. Because of this realization a system for protected areas management was developed in 1992 by an advisory committee established under the auspices of the St. Lucia National Trust. The committee involved the participation of a wide range of governmental and non-governmental agencies including the Naturalist Society and the Caribbean Natural Resources Institute (CANARI). This system plan in essence was presented to the nation as a tool to help arrest the patterns of degradation and destruction, and as a guide toward more rational use of the country's rich patrimony. Protected areas are portions of the national territory of a country which are placed under special management status to ensure that the resources they contain are maintained and made accessible for sustainable uses compatible with conservation requirements. The first protected area established in St. Lucia was the Castries Waterworks Reserve, set up in 1916, which is now part of the St. Lucia Forest Reserve. Since then, a number of other protected areas have been established in the country under the auspices of the Ministry of Agriculture and the St. Lucia National Trust.

SYSTEM PLAN FOR PROTECTED AREAS

St. Lucia as a developing island is faced with a number of developmental and environmental problems. The plan for a system of protected areas is clearly and determinedly set against this background and seeks to respond in a modest but effective manner to some the challenges of

development which the country now faces. In this system plan there are basically nine broad management categories for protected areas in St. Lucia, as well as 27 species management areas within these categories. The nine broad management categories are as follows: forest reserve, wildlife reserve, marine reserve, nature reserve, national landmark, historic area/historic site, national park, protected landscape and national trail. Most of the 27 species management areas are merely proposals in the plan and have not yet materialized. However, there are a number of these which have already been established. These established management areas are under the control of the Forestry Department, Fisheries Department, and the St. Lucia National Trust in their respective areas. They are responsible for all management activities. When these areas were established the concept was basically for the protection and conservation of soil, water, flora and fauna and historic importance. However, within recent times, the ecotourism concept has introduced a new function for these areas- a significant function coming into focus. For example, the rain forest with all its lush vegetation and wildlife is becoming extremely attractive to tourists. As a small developing country with limited resources, this new concept was much appreciated affording us the opportunity to utilize the other natural resource available. This assists our overall quest for sustainable development.

Forest and Wildlife Reserves

The Forestry Department has risen to the ecotourism challenge and has embarked upon the establishment of a number of trails within its forest reserves. These trails are presently generating substantial revenue for the Department and the country as a whole. The first trail established was the Central Rainforest Trail in 1979. In its first year of operation more than two thousand overseas visitors visited the trail providing employment for tour guides and

annual revenue to the Forestry Department of approximately US\$7,500.00. The key attraction to this trail is the fact that it houses the 13th rarest bird in the world, the St. Lucia parrot. The number of visitors have grown steadily over the years to a total of 4,023 recorded in 1993. For 1993/1994 the revenue generated from forest tours reached an all time high at US\$42,500.00. Revenue received for the period between January to April 1994 doubled this figure indicating a revenue projection exceeding US\$92,600 for the year 1994-95. A few other trails have been commissioned since the development of the Central Rainforest Trail. They are the Barre De Lisle and Des Carties trails. These additional trails have contributed significantly to this increased revenue.

The establishment of a wildlife reserve within the Central Forest Reserve, basically for the protection and conservation of the St. Lucia parrot (*Amazona Versicolor*) also proved beneficial to the ecotourism effort by the Forestry Department in that, the parrot numbers have increased substantially making them more visible to visitors. The Wildlife Protection Act of 1980 also makes provision for the protection of the St. Lucian parrot as well as other of wildlife.

Most tours into the rain forest are sold by the Department through the local tour operators whose target group is primarily stay-over visitors from the hotel. The visitor may pay a fee of the US\$28.00 to US\$37.00 to the tour company who in turn provides the client with transport to and from the forest and a meal. The Forestry Department provides the guide for a fee of US\$10.00 per adult and US\$5.00 per child under 12 to the tour operation. Presently the Department has regularly scheduled tours with seven local operators where each tour operator is assigned a particular day(s) for the tour. At least two operators have a large enough clientele so as to warrant as many as three tours per week.

The forest and wildlife reserves are under the management of the range officer and forest

officers of their respective agencies. The officers are responsible for the overall protection of the resource which includes flora and fauna, soil and water, and are ably assisted by the Soil and Water Conservation Act of 1946 (1983 revision) and the Wildlife Protection Act (1980). Minimal activity in terms of timber sales is encouraged within the natural forest, where a system of selection cutting is carried out from time to time. As a matter of fact, the entire forest reserve has been characterized by various activities. The various classifications are self explanatory and as follows: protection forest, protection/production, and production.

Marine Reserves

Marine reserves are defined by the Fisheries Act No 19 of 1984 to be located within the exclusive zone, territorial sea and internal waters of St. Lucia. They include parts of the coastal zone and adjacent habitats (e.g. mangroves, coral reefs, coastal wetlands, estuaries, beaches and bays). The basic objectives of marine reserves are to (1) afford special protection to the plants and animals in such areas (particularly those in danger of extinction) as well as to the natural breeding grounds and habitats of aquatic life, (2) allow for the natural regeneration of aquatic life in areas where it has been depleted, (3) promote scientific research, and (4) preserve and enhance the natural beauty of such areas. There are 23 existing marine reserves, they are as follows:

Anse Mamin; Turtle Reef and reef from Anse Chastenet to Grande Calle Point; reef between Grande Calle and Rachette points; Malgretoute Reef; reef at Anse Des Piton (MAP); Anse L'lvrogne Reef; southern mangrove at Cas en Bas Bay; Esperance Harbour/Mangrove; Fond d'or Beach and Mangrove; Praslin Mangroves; reef from Anse Galet to Anse Cochon; Anse Cochon artificial reefs; Marigot Bay Mangrove; Bois D'orange Mangrove; Vigie Bay artificial reefs; Marquis Mangrove; Grande Anse Beach and Mangrove; Louvet Mangrove; Savannes Bay Mangrove; Man Kote Mangrove to Anse Sable; Maria Islands Reef; Moule a Chique

artificial reef; and reef from Caesar Point to Mathurin Point.

These marine reserves are located within the management areas, for example, the Savannes Bay Mangrove is situated within the Point Sable National Park.

Other Protected Areas

National Trust

The National Trust is basically a statutory body established by parliament which is run by a council of eleven members. The members of the Governing Council are appointed by the general membership. Its main function is for the protection and promotion of the natural and cultural heritage of St. Lucia. The trust is supported by additional funds obtained from entrance fees from areas under their management, e.g. the Pigeon Island National Park and the Maria Island Nature Reserve. The Trust is empowered by the St. Lucia National Trust Act of 1975.

Pigeon Island & Maria Island

The Pigeon Island National Park and the Maria Island Nature Reserve are the two main protected areas under the management of the

Trust. The Pigeon Island National Park was established mainly as a result of its historic importance. However, the Maria Islands have been designated under protection due to their endangered wildlife (ground lizard and couresse snake), which incidentally are endemic. These two areas play a significant role in the development of the tourism industry, for example the Pigeon Island National Park has been one attraction of the St. Lucia Jazz Festival from its inception.

CONCLUSION

The three agencies involved in the management of protected areas, the Forestry Department, Fisheries Department and the St. Lucia National Trust have all contributed significantly in the establishment and development of protected areas on the island. These agencies have tried their utmost in terms of the involvement of the general public to create an awareness which could only seek to enhance the effectiveness of managing our indigenous resources.

Protected areas management plays a significant role in terms of economic development especially for small developing countries, like ours. It is also essential for developing environmental stability.

PROTECTING OUR PROTECTED AREAS (ST. VINCENT)

FitzGerald Providence

INTRODUCTION

The establishment of the King's Hill Forest Reserve by the King's Hill Enclosure Act, proclaimed on April 2, 1791, was the beginning of the protection of natural resources in St. Vincent and the Grenadines. Since that important piece of environmental legislation, probably one of the first in the Caribbean, the government and people of this nation have recognized the importance of establishing forest reserves and protected areas for the protection of forest and other natural resources. Over these 200 plus years several additional reserves have been established. In this 32-island nation, with increasing population and increased and diverse demands for land, the protection of natural resources has become more complex. The forest reserves are constantly under pressure of encroachment, also upper watersheds, vital for the constant supply of water, are under threat of deforestation.

The forest resources are now being recognized for more than just timber, wildlife, and water. The recreational and aesthetic values along with the numerous minor products for crafts, horticulture, and medicines are being recognized. Thus, our approach to forest management must not be aimed at keeping the people out of the forest but must be geared to involving the people in its management and protection. Other resources such as coastal and marine must be protected for their ecological and economical importance.

HISTORY OF RESERVES

The first forest reserve established in St. Vincent was the King's Hill Forest Reserve, established by the enactment of the King's Hill Enclosure Ordinance No. 5 of 1791. The reserve is a 21.2 ha (55 acre) dry woodland climax forest situated on a 220 m high hill on the east coast of the island (fig. 1). On August 22, 1912 there

was a proclamation that reserved all crown lands situated 1,000 ft above sea level. Estimates of the size of this reserve was 13,600 ha, approximately 40 percent of the island's total land area. The 1946 Forest Ordinance declared the Central Reserve which encompassed all crown lands lying on the central ridge and mountainous interior of the island. This reserve encompassed all the forested areas south of the Wallibou and Rabacca rivers that form natural boundaries separating La Soufrière from the rest of the island.

In 1948 the crown lands forest reserve order established the following reserves: Soufrière Forest Reserve, Mesopotamia Forest Reserve, and Colnarie Forest Reserve. The Soufrière Reserve encompassed all crown lands on the volcanic mountain, its foothills and the mountainous interior north of the Wallibou and Rabacca Dry Rivers (fig. 1). The Mesopotamia Forest Reserve encompassed the crown lands lying upon the catchment area of the Yambou River, including the Petit St. Andrew and Grand Bonhomme peaks. This area is the upper watershed area of the Yambou watershed. The Colnarie Reserve encompassed the area of crown lands lying within the catchment area of the Colnarie watershed (fig. 1).

PRESENT STATUS OF RESERVES

The King's Hill Reserve still exists today, intact. The easy access for monitoring, and the community interest in this reserve have kept its boundaries intact. According to Trevin *et al.* (1993) the forest is expected to continue evolving naturally as long as disturbances continue to be both small and infrequent. The reserves established by the 1946 Proclamation have been affected by clearing for agriculture. The Colnarie and Mesopotamia Reserves have had most of their areas cleared, with only the upper watershed areas and steep slopes, and very highest areas remaining untouched. The

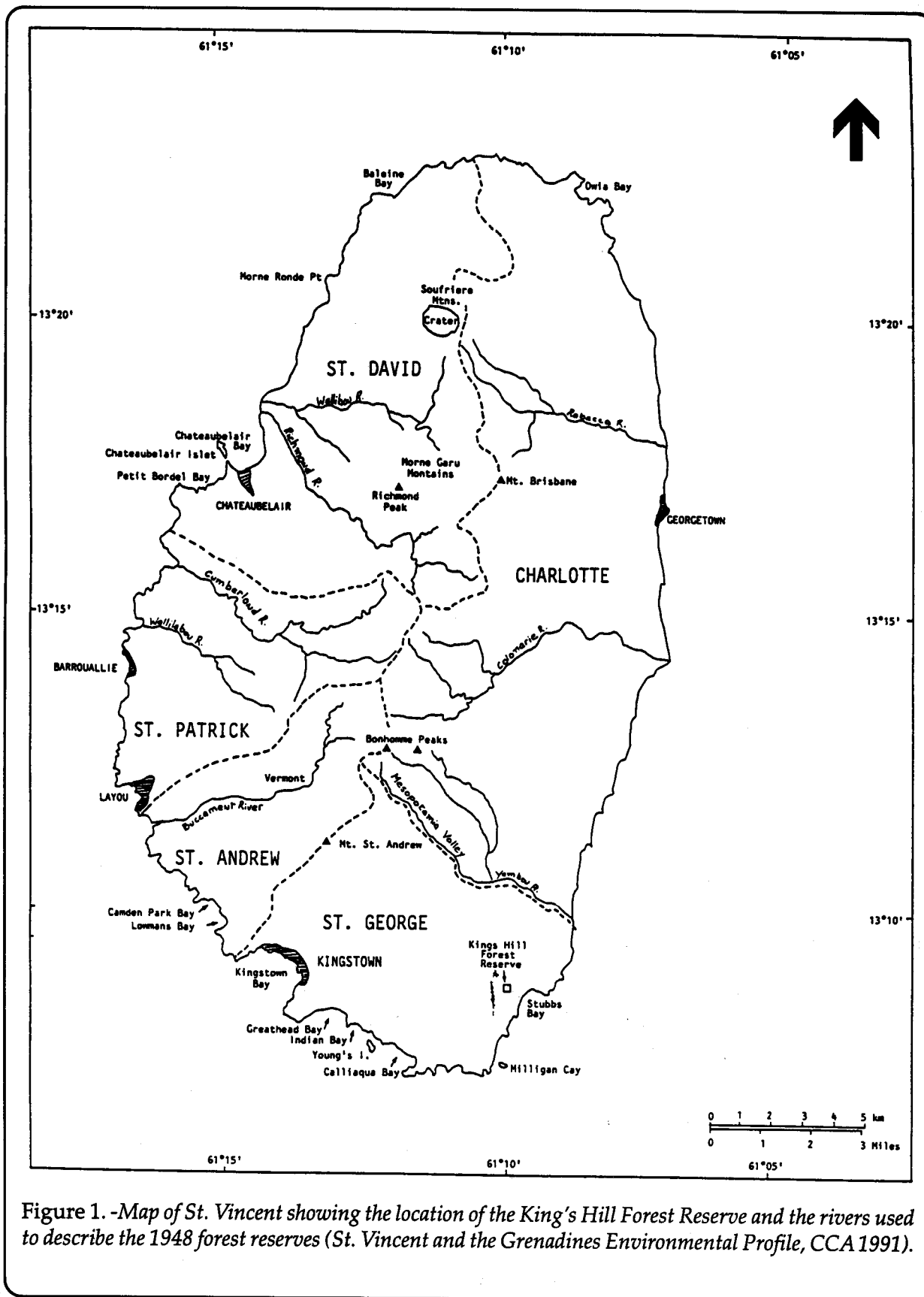


Figure 1. -Map of St. Vincent showing the location of the King's Hill Forest Reserve and the rivers used to describe the 1948 forest reserves (St. Vincent and the Grenadines Environmental Profile, CCA 1991).

upper part of the Soufrière Reserve has not been severely affected by humans. However, periodic volcanic eruption does affect the vegetation cover. This area has recovered from a recent eruption in 1979.

These forest reserves, with the exception of the King's Hill Forest Reserve, have been encompassed by the National Forest Boundary, which was surveyed and marked during the five year Forestry Development Project of 1989-1994. In addition to the National Forest Boundary, the Forest Resources Conservation Act (Act No. 47 of 1992) lists three forest reserves. The reserves listed are the King's Hill, Cumberland, and Tobago Cays Reserves. There are other reserves which include the Colonarie, Campden Park, Soufrière, Mt. Pleasant, Kingstown, Dalaway, and Richmond. However, these have been awaiting gazetting and enactment by law since 1994.

The Wildlife Protection Act (Chapter 55), first passed in 1987 (St. Vincent and the Grenadines Government 1992), established the St. Vincent Parrot Reserve which covers the interior of the island. The boundaries of this reserve are included in the National Forest Reserve surveyed and demarcated as part of the Forestry Development Project completed in 1994. This Act also listed several islands, cays, and islets found along the coast of St. Vincent and in the Grenadines as wildlife reserves, the total being 24 (fig. 2). The Tobago Cays, one of the wildlife reserves, had legislation passed in late 1995 to make it St. Vincent and the Grenadines' first national (marine) park. At present, the preparatory activities to develop and manage this park are being done, with major funding for this project provided by the French Government.

RECREATION SITES

The Forestry Division has developed and now maintains recreation sites. These include a nature trail (Vermont Nature Trails) in the St. Vincent Parrot Reserve, water falls, and historic site and a coastal tidal pool. These sites were

developed by the Forestry Division for education, recreation, and protection from uncontrolled use by the general public. Since their development, the Division has recorded increased use, and they have been included in the eco-tourist development and promotion of the island. However, these sites do not come under direct protection of the Forest Conservation Act, with the exception of those that fall within the boundaries of forest reserves or wildlife reserves.

CONCERNS OF PROTECTION

In the St. Vincent and the Grenadines Environmental Profile (Caribbean Conservation Association 1991), the following were listed as some of the factors contributing to a lack of enforcement and management of the forest reserves:

- outdated forestry legislation.
- lack of power of arrest for Forest Officers,
- lack of surveyed and demarcated forest boundaries,
- increasing population,
- shortage of man power,
- lack of transport for officers, and
- legal, political, and social problems associated with the eviction of squatters from crown lands.

Other concerns include the following:

- lack of an integrated approach to the management of natural resources and protected areas
- unclear responsibility for development and management of recreation sites, and
- improperly coordinated approach by NGO's interested in protecting protected areas.

PROTECTING THE PROTECTED AREAS

Legislation

The passing of the Forest Conservation Act in 1992 (St. Vincent and the Grenadines

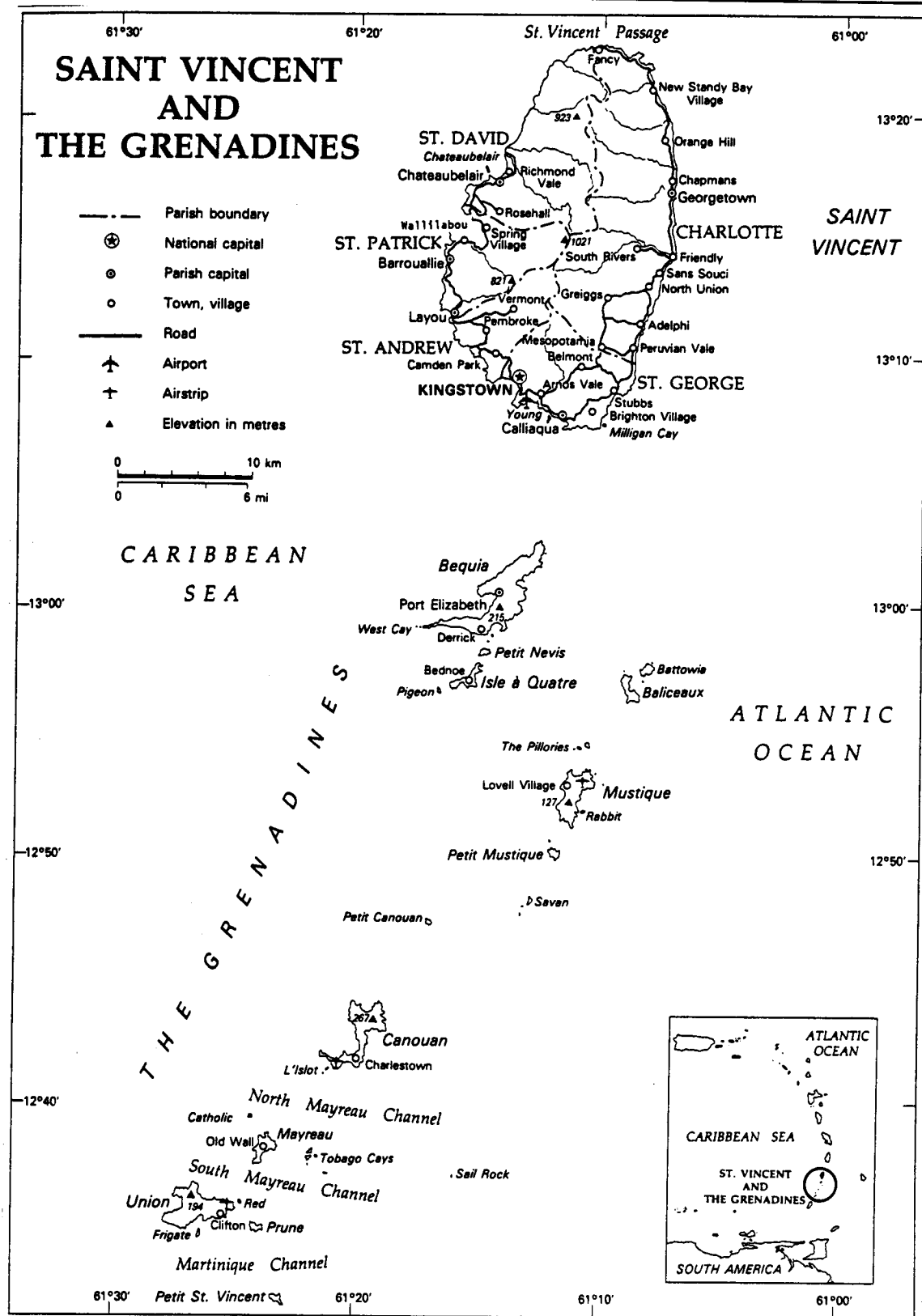


Figure 2. -Country location map, St. Vincent and the Grenadines (Source: GSVG, 1986b).

Government 1992) addressed some of these concerns, such as the powers of arrest for officers, and provided up to date legislation sensitive to the social and ecological problems. However, the Act is somewhat handicapped by the absence of accompanying regulations that have been written but are awaiting passage through, and acceptance by, Cabinet. In 1987, Barbara J. Lausche, legal drafter with the World Wildlife Fund, drafted the National Resource Conservation Act 1987 (Lausche 1987) that contained selected sections for forest, parks, wildlife, and watersheds. McHenry and Gane (1988) also produced draft legislation on forestry, wildlife, watersheds, and parks for the Government of St. Vincent and the Grenadines. The present legislation for forestry and wildlife do show some application of these drafts. However, legislation for parks and protected areas have not been developed.

National Forestry Policy

The National Forest Policy forms a part of the National Forest Resource Conservation Plan, and can be summarized as follows: The goal of the National Forest Policy is the conservation management, development, production, and enhancement of the country's resources in harmony with national programmes and development plans. These objectives are to be accomplished through

- increasing the contribution of the forestry sector to the country's social welfare and forest economy;
- establishing, measuring, and maintaining the Crown Forest Estate;
- managing the Crown Forest Estate;
- developing forest industries;
- providing areas and facilities for outdoor recreation, tourism, natural resource education and education, the conservation of genetic resources, and environmental protection;
- protecting, managing, and utilizing wild flora and fauna which occur naturally on Crown and private lands and have economic, scientific, aesthetic or cultural value, or have a site protection value;

- establishing and utilizing facilities for educating and training personnel to serve at different levels in the Forestry Division, in other Government agencies and in the private sector for the management, development, and use of the natural resources within the Forest Estate; and
- executing and promoting research to provide information and technology development which will permit better management and utilization of natural resources on Crown and private land.

This Forest Policy has been accepted by the administration of the Ministry of Agriculture, and up to this time the Division is unsure of its acceptance and enactment by Cabinet.

National Forest Resource Conservation Plan

The National Forest Resource Conservation Plan (St. Vincent and the Grenadines Government 1994) is the first for the country, and was prepared for the period 1994-2003 in accordance with the provisions outlined in Section 6 of the Forest Resource Conservation Act, Act. No. 47 of 1992. In the Plan, the nation's forest resources which consist of (1) timber and other forest produce; (2) water resources; and (3) soils, wildlife, recreation, and other natural resources, were assessed in terms of current amounts, condition and status and compared to the national demand for each resource. The Plan also addresses the threats to the sustainability of the forest resources and attempts to reverse the trend of resource loss occurring on Crown land in the sensitive upper river basins. The Plan also addresses the establishment of other forest reserves with accompanying management plans. Watersheds management plans are also to be developed for the 13 watersheds on St. Vincent and those in the Grenadines. These would be developed from the model Colonarie Watershed Management currently in its implementation and analysis stages.

The successful implementation of the Forest Resources Conservation Plan relies on the fundamental assumption that the required funding for proposed activities is available. To

maximize efficiency, the Plan also proposed changes to the organizational structure, and increased staffing. However, the fulfillment of these assumptions is slow in coming. The Plan's success also depends on incremental budget increases. However, as in most small developing countries with limited finances, the incremental increase has not materialized. The Division's activities produce limited revenue, but other revenue generating areas such as user fees and licensing are still to be addressed.

The Plan and Conservation Act also promote the integrated approach to management of the forest resource. This would be achieved through the submission of all management and development plans to Governmental Departments such as Central Planning, other organizations such as the utility companies and all organizations who directly use the resource, for their review and consultation.

Education

Education plays a pivotal role in the success of the Forest Resources Conservation Plan by promoting public recognition of the importance of the nation's forest in protecting the environment, in maintaining water quality and creating wildlife habitats. The recreational value and benefits to ecotourism will also be promoted. The Forestry Division has recently completed a successful information exchange session centered on the Vermont Nature Trails. This program involved the communities of the Valley, which are located close to the trails. The programme involved two sessions. The first informed the communities about the Division, the site history and its' development. The second session was used to gather information on attitudes, willingness to assist in managing the site, and willingness to do surveys with the community.

CONCLUSION

The passing of laws and establishment of reserves have always been done in St. Vincent and the Grenadines. These are, however, not

adequately enforced, protected, or managed due to restrictions of infrastructure, financing, and knowledge of their importance to the nation's development. Recent developments in Forestry and Parks have been greatly attributed to external funding. However, with the absence of external funding the process of development of natural resources becomes almost stagnant. For management and protection of the nation's forest resources and protected areas, the following must be achieved:

- full government recognition and participation in policy and finance of the Forest Resource Conservation Plans,
- integration of all the resource managers and exploiters for the sustainability of the resources,
- participation of the public management at all levels to attain sustainability,
- recognition and promotion of the Forestry Division as the lead agency in forest resource management,
- development of a protected areas plan including a park systems plan, and
- the development of appropriate revenue generating systems to reduce the dependence on government funds for protected areas management.

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MANAGEMENT OF PROTECTED AREAS IN SURINAME

Krishnerpersad Mohadin and Harryinderpersad Ganpat

HISTORY AND ESTABLISHMENT OF PROTECTED AREAS

Based on the Nature Protection Law of 1954, the Government of Surinam has so far established 13 nature reserves in order to preserve the most important components of the country's natural heritage. They vary in size from 100 ha to 220,000 ha, and cover approximately five percent of the total land area. The reserves are situated in several regions of the country: five in the coastal area, three in the savanna, and five in the sparsely populated hilly and mountainous regions farther south. In addition, there is one multiple-use management area of approximately 68,000 ha in the estuarine zone and one nature park of about 8,400 ha in the interior. This latter area has been given to the Foundation for Nature Preservation in Surinam (STINASU) on long-term lease basis to be used for recreational, educational, and scientific purposes.

Until 1976, the establishment of nature reserves was mainly based on the presence of important flora, fauna, geological, and cultural features rather than on a systematic and scientific inventory of the areas. During that period, nine nature reserves were created, and all are situated on uninhabited, public lands. After 1976, the selection for the establishment of nature reserves took place on the basis of a comprehensive inventory and mapping of ecosystems, and on previously established guidelines. One of the most important criteria for the selection of these areas was accessibility.

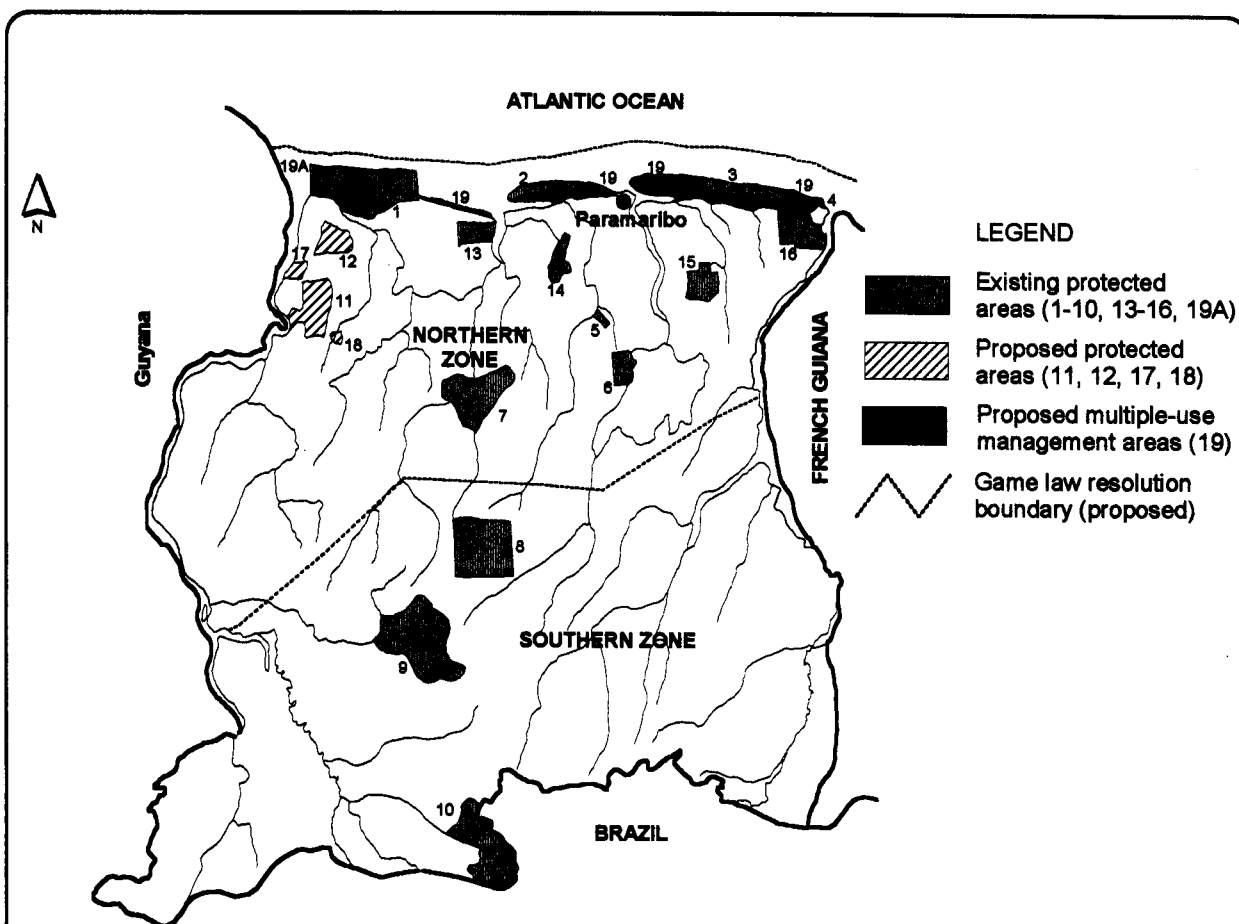
Development plans in adjacent areas were to be taken into account as much as possible to ensure that the activities, which now are taking place (or which can be expected to take place in the near future), do not have a detrimental effect on the protected areas. Based on these principles, an inventory and mapping exercise took place in the coastal and savanna regions

(in the lowlands of Surinam) where approximately 90 percent of the total population lives, and where most of the economic activities, such as mining (bauxite and gold), agriculture, crude oil drilling, industry, and urban development take place. As a result of this inventory and mapping project, six areas, varying in size from 27,000 ha to 45,000 ha, have been selected for establishment as nature reserves, and four areas for the status as forest reserve. The proposed nature reserves have been chosen as much as possible to be located on larger tracts of public lands, and include the upper reaches of creeks and rivers in order to safeguard them from pollution from development activities in surrounding areas. Furthermore, a small number of large areas was chosen instead of a large number of smaller surfaces. The areas chosen covered all important ecosystems.

The presence of important populations of animal and plant species (although not necessarily endangered species), has also contributed to the selection of protected areas. These include populations of manatees (*Trichechus manatus*), giant river otters (*Pteronura brasiliensis*), and spectacled caimans (*Caiman crocodilus*) in the Boven-Cusewijne Nature Reserve; spectacled caimans in the Copi Nature Reserve; large stands of possentri (*Hura crepitans*) in the Peruvia Nature Reserve; Gianot river otters and Guiana otters (*Lutra enudris*) and manatees in the proposed Nani Nature Reserve. In 1986, four of these six areas received the status of nature reserve. The other two are still awaiting legal status.

The current established protected areas are as follows (map 1):

1. Hertenrits Nature Reserve (approximately 100 ha). Created in 1972, is an archeological monument of pre-Columbian Amerindian culture.



Existing protected areas in Suriname (1990)*

1. Hertenrits NR (100 ha)
2. Coppename Monding NR (12,000 ha)
3. Wia Wia NR (36,000 ha)
4. Galibi NR (4,000 ha)
5. Brinckheuvel NR (6,000 ha)
6. Brownsberg NP (8,400 ha)
7. Raleighvallen/Voltzberg NR (78,170 ha)
8. Tafelberg NR (140,000 ha)
9. Eilerts de Haan Gebergte NR (220,000 ha)
10. Sipaliwini NR (100,000 ha)
13. Peruvia NR (31,000 ha)
14. Boven Cusewijn NR (27,000 ha)
15. Copi NR (28,000 ha)
16. Wane Kreek NR (45,000 ha)
- 19a. Bigi Pan MA (68,000 ha, excludes adjacent sea area)

Proposed protected areas in Suriname (1990)

11. Kaburi Kreek NR (68,000 ha)
12. Nani NR (54,000 ha)
17. Mac Clemens FR (6,000 ha)
18. Snake Kreek FR (4,000 ha)
19. Estuarine Zone MA (310,000 ha, of which 120,000 ha are already protected (see 1, 2, 3, 4, and 19a))

FR = Forest reserve

MA = Multiple-use management area

NP = Nature park

NR = Nature reserve

* = Hectares listed are estimates of land surface only

Map 1. -Existing and proposed protected areas in Suriname.

From: Mittermeier & al. 1990. Conservation Action Plan for Suriname. (Map adapted by IITF, 1997).

2. Coppenamemonding Nature Reserve (approximately 12,000 ha). Established in 1966. Comprised of mud flats, brackish-water grass swamps, and mangrove forests. It is primarily intended to protect nesting colonies and roosting places of herons, scarlet ibis and other waterfowl. This reserve is placed on the list of the Wetland Convention.
3. Wia Wia Nature Reserve (approximately 36,000 ha). Established in 1966, to protect sea turtle nesting beaches. Since the sandbeaches have moved westward, out of the reserve, no nesting of sea turtles takes place in the reserve at this time. The reserve contains mud flats and mangrove forests, which offer feeding, nesting, and roosting sites for numerous species of local as well as migratory birds.
4. Galibi Nature Reserve (approximately 4,000 ha). Created in 1969 to protect sea turtles nesting beaches. It includes three nesting beaches of international importance for the leatherback (*Dermochelys coriacea*), the green turtle (*Chelonia mydas*), and the olive ridley (*Lepidodchelys olivacea*).
5. Brinckheuvel Nature Reserve (approximately 6,000 ha). Established in 1966. The area holds the most characteristic part of the Subgraywacke landscape, formed by low, elongate, parallel, and gently sloping ridges. The residual and colluvial soils bear savanna vegetation while the alluvial soil bears xerophytic wood and mesophytic forest.
6. Brownsberg Nature Park. The park, approximately 8,400 ha in size and obtained by STINASU in 1969 on long-term lease, is the northern part of the Brownsberg Plateau and consists of mesophytic tropical rain forest. The park has been developed by STINASU for educational, ecotourism, and field research purposes.
7. Raleighvallen Nature Reserve (approximately 78,170 ha) established in 1966, and enlarged in 1986. The vegetation consists primarily of mixed mesophytic tropical rain forest, but unique vegetation is found in rapids and waterfalls, and on granite outcroppings (inselbergs), notably the impressive 240 m high dome shaped Voltzberg and the 360 m high Van Stockumberg. All eight species of primates occurring in Surinam live here. About 350 bird species are known to occur in the reserve, among these the Guianan Cock-of-the-Rock (*Rupicola rupicola*).
8. Tafelberg Nature Reserve (approximately 140,000 ha). Established 1966. It is part of the Roraima sandstone formation, and has the same physiography as the Kaieteur series in Guyana and the Tepuys in Venezuela. Primeval tropical rain forest and other pristine ecosystems occur here.
9. Eilerts de Haan Gebergte Nature Reserve (approximately 220,000 ha). Established in 1966, this largest nature reserve in Surinam is part of a mountain range with primeval tropical rain forest as well as ecosystems typical of the mountainous interior.
10. Sipaliwini Nature Reserve (approximately 100,000 ha). Established in 1972. It is situated along the border with Brazil. The savanna in this reserve is part of the extensive Paru savanna of Brazil. There are also gallery forests, freshwater swamps, isolated patches of forest, and granite outcroppings. At least one frog species (*Dendrobatus azureus*) is known to be endemic.
11. Peruvia Nature Reserve (approximately 31,000 ha). Established in 1986. It encompasses the last vast complexes of *Hura crepitans* forests (which serve as a foraging area for the blue-and-yellow macaw (*Ara ararauna*), and swamps alternating with *Maurita flexuosa* forests.
12. Boven-Cusewijn Nature Reserve (approximately 27,000 ha). Established in 1986. It represents unbleached brown-sand savannas, and mixed mesophytic and hydrophytic forests. The river in the reserve is excellent habitat for manatees, giant river otters, and spectacled caimans.
13. Copi Nature Reserve (approximately 28,000 ha). Established in 1986. The elevated clay flats of the Old Coastal Plain support different forest types. Wet and dry savannas are found on white sands and clays.

14. Wanekreek Nature Reserve (approximately 45,000 ha). Created in 1986. Savannas on several soil types are present, as well as marsh and ridge forest, and swamps. In addition to remnants of pre-Columbian habitation and agriculture on ridged fields, traces of settlements of the first runaway slaves are found here.
15. Bigi Pan Multiple-Use Management Area. This area is the western part of the Surinam estuarine zone and comprises 68,000 ha of land, and at least an equal area of marine waters. It consists of fresh and brackish water ecosystems, has a high productivity and serves as feeding and breeding grounds for large numbers of local and migratory bird species. It is also a nursery ground for fish and shrimp. In 1987, this area was placed under the jurisdiction of the Ministry of Natural Resources to be managed as a multiple use management area. This was done to safeguard its long-term ecological functions, its high biological productivity and its sustainable use by man.

The proposed protected areas are listed below:

1. Kaburikreek Nature Reserve (approximately 68,000 ha). The vegetation consists of e.g., western representatives of mesophytic and xerophytic forests. The creek is the habitat of a large population of giant river otters and the Guiana otter.
2. Nani Nature Reserve (approximately 54,000 ha). The area encompasses mesophytic, hydrophytic forests, and swaying swamps. This area is famous for its populations of spectacled caiman and manatees.
3. Mac Clemen Forest Reserve (approximately 6000 ha), with complexes of *Mora* and *Carapa* species.
4. Snake Creek Forest Reserve (4,000 ha), with "groenhart" (*Ocotea rodiaei*) complexes.
5. Estuarine Zone Multiple-Use Management Area, to protect the whole estuarine zone.

LEGAL REGULATIONS WITHIN NATURE RESERVES

The Nature Protection Law of 1954, which provides the Government with the means to designate wild lands of special importance as nature reserves, underlining the scientific, educational, and economic utilization, considers only one category of protected area, namely nature reserve. At the same time, provisions have been made in the Law with regard to activities within a nature reserve. The Law prohibits the undertaking of any kind of activity in a nature reserve which will affect the integrity of the reserves in a detrimental way. So it is prohibited in a nature reserve to camp, make fire, cut wood or make charcoal, and to hunt or fish unless written permission for this has been obtained from the Head of the Surinam Forest Service, and then only under the conditions stipulated in the permit. Nature reserves are established by Resolutions.

TRADITIONAL RIGHTS OF INDIGENOUS PEOPLE WITHIN NATURE RESERVES

The Resolution of 1986, by which the last four nature reserves have been established, includes a provision recognizing the traditional rights and interest of indigenous people living in tribal community in and around nature reserves.

MANAGEMENT OF PROTECTED AREAS

The management of nature reserves is delegated by law to the Head of the Surinam Forest Service within the Ministry of Natural Resources. In practice, the management is being done by the Nature Conservation Division of this Service. The management of protected areas is aimed at the following: implementation of a management plan for each of the protected areas; sustainable utilization of the resources without damaging the integrity of the area or its biodiversity; full participation and recognition of the knowledge and cultural aspects of local and indigenous people and

local non-government organizations (NGO's) in order to improve their standard of living; and enhancement of public awareness.

Management Plans Already Developed

Management plans have already been developed for the Galibi Nature Reserve, the Raleighvallen Nature Reserve, the Bigi Pan Multiple-Use Management Area, and the Brownsberg Nature Park. Development of these management plans have been made possible by funds made available by the Canadian Wildlife Service (for the Bigi Pan Multiple-Use Management Area), and the World Wildlife Fund-Netherlands (for the other three areas). The Canadian Wildlife Service has also made some funds available to start with the implementation of the Bigi Pan Multiple-Use Management Area. Implementation of the other management plan is being hampered by a serious lack of funds, means, and personnel.

Management Plans in Preparation

Funds have been made available for the development of a management plan for the Copie Nature Reserve by SURAPA (the Sub-Network of Protected Areas of the Amazon Region) within the framework of the Amazon Cooperation Treaty, and for the Coppenamemonding Nature Reserve by the French Government. The latter is being done within the framework of a Memorandum of Understanding that is currently in preparation between the Surinam Government and the French Government. The Copie Nature Reserve has the peculiarity that this reserve has always been inhabited by a small indigenous community, which has, and still is, using the area as their traditional land for hunting, fishing, plant collecting, and subsistence logging. We have little experience in negotiating with indigenous people for developing an integrated management plan—taking into account their traditional rights. Therefore, international support has been asked for this. SURAPA is therefore providing us with two experienced consultants for the development of such a management plan.

Present Situation of the Management of Protected Areas

The actual management of protected areas is the responsibility of the Nature Conservation Division of the Surinam Forest Service. The management of the Brownsberg Nature Park, however, is in hands of STINASU.

The activities of the Division are as follows: wildlife management and management of protected areas; enforcement of legislation related to nature conservation such as Nature Protection Law (1954), Game Law (1954), Fish Protection Law (1961); regulation and monitoring of wildlife export in accordance with national and international laws, and regulations applicable for Surinam; nature education and promoting of public awareness on nature conservation; facilitation or execution of nature conservation research; and liaison agency for international/regional conventions and institutions such as Convention on International Trade in Endangered Species (CITES), Wetlands Convention, Western Hemisphere Convention, Special Commission on Environment of the Amazonian Cooperation Treaty, United Nations Environmental Programme (UNEP), World Wildlife Fund (WWF), and Wetlands of the Americas.

According to the activities, the Division has been divided into the following Sections, each with a Coordinator as head: Wildlife Export Permits, Nature Conservation Education, Nature Conservation Research, and Wildlife Management and Management of Protected Areas. It should be emphasized that nature conservation education and the enhancement of public awareness have a high priority within the activities of the Division. At this moment, the Education Section is preparing a public awareness campaign which includes the use of a van equipped with audio-visual materials, leaflets, stuffed materials, posters, etc., to visit schools in Paramaribo and districts for the promotion of nature conservation.

It is also the intention to have a well staffed guard station in each of the protected areas to

provide information, and to enforce the nature conservation regulations. However, due to a serious lack of qualified personnel, necessary funds, transportation means, and the difficult accessibility of the protected areas in the interior, only two nature reserves in the coastal area have a guard post, each is staffed with only one person. There is also a mobile crew of a few game wardens which operates from Paramaribo. Funds have been solicited by the Government of the Netherlands for the rehabilitation of former guard stations which have been destroyed during a civil unrest in the interior, for the building of new guard posts and for the purchase of equipment, and hiring of personnel.

Involvement of Local Communities in the Management of Protected Areas

As said before, the management of protected areas is aimed at full participation of local communities in the management. So far, this participation has been limited to employment opportunities in the protected areas, as this is the case with the Galibi Nature Reserve, the Raleighvallen Nature Reserve and the Brownsberg Nature Park. It is our intention to establish local consultation structure comprising of representatives of local communities, local NGO's and government officials. For the Bigi Pan Multiple-Use Management Area, an Area Advisory Committee will be established comprising of all institutions, NGO's and government agencies that have interest in that area.

THREATS TO PROTECTED AREAS

It is anticipated that protected areas situated in the coastal and savanna area, where most of the economic and commercial activities are taking place, will be the ones most exposed to negative effects. The greatest threat comes from the ever increasing rice cultivation and associated use of pesticides. Especially the Bigi Pan Multiple-Use Management Area and the Coppenamemonding Nature Reserve are under great pressure. Logging will become a threat for the Copie Nature Reserve and the Boven

Cusewijne Nature Reserve, because of the traditional rights that the indigenous people have there. There are indications that their rights for logging are being sub-leased to multinational logging companies or they are logging themselves on a large scale on behalf of the multinationals. Bauxite mining may affect the Wane Creek Nature Reserve.

FOUNDATION FOR NATURE PRESERVATION IN SURINAM (STINASU)

In June 1996, STINASU was created as a semi-governmental organization with the intent to implement the goals aimed at with the designation of nature reserves as justified by the Nature Protection Law 1954.

STINASU intends to attain these goals as follows:

- stimulate, coordinate, and (jointly) finance scientific exploration in order to develop already existing nature reserves by
 - (1) initiating and maintaining contacts with international conservation organizations,
 - (2) obtaining financial and technical support from above-mentioned organizations, and
 - (3) programming and conducting scientific research in the reserves, and making the results of such research available through publications;
- develop the reserves for the recreational, educational, and economic purposes for which they have been established, namely by means of
 - (1) making the reserves accessible,
 - (2) providing and maintaining transport to (and in) the reserves,
 - (3) constructing and exploiting lodging facilities in the reserves,
 - (4) promoting in Surinam, as well as abroad, the possibility to visit the reserves under the guidance of trained personnel, and

- (5) printing publications and informational material on nature conservation in general, and the flora and fauna of the reserves in particular;
- attempt to protect and utilize areas not yet protected, or those areas insufficiently protected, on behalf of science, recreation, and public education.

FUND GENERATION

The establishment of a Nature Conservation Fund is being considered to ensure a constant flow of funding for the management of protected areas. Though it is not yet known how it will be structured, most of the funds will be derived from visitors visiting protected areas.

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PROTECTED AREAS MANAGEMENT IN TOBAGO

Raye A. Sandy

Tobago possesses a proud legacy of conservation activities and environmental concern. The main ridge of Tobago was made a forest reserve in 1765 and is said to be one of the first protected areas in the Western Hemisphere. This reserve was dedicated expressly for the 'protection of rains'. Protection of natural areas in Tobago is achieved primarily through the establishment of wildlife sanctuaries and through the management of the Main Ridge Forest Reserve. There are two wildlife sanctuaries in Tobago - both being offshore, uninhabited islands. These are the islands of Little Tobago and St. Giles.

WILDLIFE SANCTUARIES

Little Tobago

The need to afford special protection to the wildlife of Tobago was recognized as early as 1928 when the island's first game sanctuary was established (Thelen et al. 1980). Sir William Ingram, an estate owner and proprietor on the island, conceived the idea of colonizing Little Tobago with the greater bird of paradise (*Paralisea apoda*). After successfully introducing the birds on the island, Sir William died in 1927, and on May 28th, 1928 a deed was drawn up by his heirs conveying the land and the birds to the state (Guppy 1930).

Little Tobago is a small island of 101 ha and possesses considerable floral diversity. On large areas of the island, the ground is steep with difficult access. The hilly terrain which rises to a height of 143 m provides excellent cover for the wildlife (mainly birds) which inhabit the island (Guppy 1930). Sixty species of birds have been recorded on Little Tobago, with 33 of these observed breeding (ffrench 1972).

Geologically, Little Tobago was formed during the Cretaceous period and is clothed with a

mineral soil that is extremely shallow. The ecology of Little Tobago is much more fragile than that of mainland Tobago. Because of its small size, thin soils, and exposure to the elements of nature, depletion of flora and fauna are very noticeable and much more difficult to correct than on the larger mainland with its varied micro-climatic and edaphic conditions. Management's main goal on Little Tobago is the protection of the natural resource and the maintenance of the biodiversity that the island possesses.

With an annual rainfall of less than 250 mm and strong prevailing winds throughout the year, the island does not support permanent ponds or large bodies of water (ffrench 1972). Lack of water during the dry season (from January to June) is often a limiting factor for the survival of wildlife. Water is supplied to the island during this critical period. The availability of food is another critical need for the survival of the faunal wildlife on the island. Fruit gardens are established and maintained with the species of choice being those that occur naturally on the island. These interventions ensure that one of the factors that positively affect continued survival of the faunal wildlife on the island is in place, thereby assisting in the fulfillment of management's objective of the maintenance of biodiversity.

Little Tobago is a popular destination for the growing number of nature-conscious tourists that visit Tobago. Recreational use is limited to observation of animals in the wild, and hiking along the trails. This wildlife sanctuary is dissected by 12 trails that gives easy access to 40 percent of the island. Sixty percent of the island is left for the wildlife to inhabit unmolested by the casual and often well-meaning enviroconscious visitor. Rest spots are provided along the trails, usually in the vicinity of the fruit gardens, and lookouts are placed at

strategic points overlooking cliffs where the majority of avifauna can be observed either nesting or in flight.

Some tour guiding by locals is done and there is a limited and inadequate number of informational and interpretive signs posted at various points on the island. Regular visits to the island are made by forestry personnel who service the watering areas, maintain the trails, and generally offer protection to the wildlife from poachers who occasionally 'visit' the island. Illegal hunting is a major threat to the continued survival of the birds and other wildlife on the island. Even though hunting in any form is prohibited in the wildlife sanctuary, permits are not required for persons wishing to visit the island.

St. Giles Island

St. Giles is a small 29 ha island that lies 1 km off the northeast coast of Tobago. It is steep sloped and rises to 106 m at its highest elevation (ffRench 1972). For many years, St. Giles Island formed part of the Charlottesville estate of Mr. Charles Turpin. In April 1968, Mr. Turpin presented the island to the state on condition that it be maintained as a wildlife sanctuary with adequate protection. Accordingly, the island has been designated the St. Giles Wildlife Sanctuary and closed to landing without permission from the Forestry Division.

St. Giles supports one of the most important larger species seabird breeding colonies in the Southern Caribbean. It is the only location in Trinidad and Tobago where the magnificent frigate bird (*Fregata magnificens*) and the red-footed booby (*Sula sula*) breed (ffRench 1972). These colonies owe their existence mainly to the island's inaccessibility. During most of the year, the surrounding sea is quite rough, and this, combined with the absence of a suitable harbor, makes for hazardous landing. Only the very daring would attempt to land here.

Management of this protected area is limited to restricting access of visitors - usually

poachers. Only a few visitors would want - or are encouraged - to visit this wildlife sanctuary because of the difficulty of so doing and the exertion required to reach the ridge from the shore. Visitors are actively encouraged to journey around the island where the considerable scenic beauty can be enjoyed and where many of the large seabirds can quite adequately be seen on their nests from the sea. Forest officers frequently patrol around the island and these patrols are increased during the local 'harvest' season when there is an increase in poaching in the sanctuary. As with Little Tobago, anthropogenic activities are the greatest enemies to the continued survival of the colonies of birds on the island.

FOREST RESERVES

Main Ridge Forest Reserve

The dominant relief feature of Tobago is the Main Ridge. This is a central chain of mountains running northeast to southwest and extending two-thirds of the length of the island. The ridge slopes off steeply to the northeast and more gently to the southwest. The windward side is broader and more varied than the leeward side. On the higher elevation of the Main Ridge and occupying 10,000 ha is the well known Main Ridge Reserve. As stated earlier, this reserve is the oldest declared forest reserve in the Western Hemisphere and is the only protected area on mainland Tobago. Currently, access to the reserve is not restricted and hunting can be done within its boundaries.

On recommendations made by the Forestry Division, the sale of forest produce within the reserve has been curtailed. No logging or gathering of any type of forest products is allowed in the reserve. Recommendations to terminate all hunting activities within the reserve have been made and these are now under consideration.

The usefulness of the Main Ridge Forest Reserve as an ideal habitat for wildlife was seriously threatened after the destruction of

considerable areas of the island's forest by Hurricane Flora in 1963. Since then, there has been marked changes in the behavior of avifauna on the island. Habitat destruction as a result of the hurricane has left several species vulnerable as their food supply has been reduced and their shelter compromised. The Tobago deer (*Manzama americana*), and wild hog (*Tayassu tajuca*) are apparent casualties of this occurrence as they have disappeared from the list of wild animals frequently seen on the island. The cocrico (*Ortalis ruficanda*) and green parrot (*Amazona amazonica*), which previously inhabited the forested areas, have now become agricultural pests largely because of the destruction of their natural habitats. The cocrico also 'benefited' from its elevation in status to a national bird (therefore no hunting at anytime) when Trinidad and Tobago became independent in 1962.

Management of the reserve includes habitat rehabilitation through the reintroduction of wildlife feed-trees deep within the forest, and

the reforestation of areas degraded through previous logging operations and agricultural squatting. It is envisaged that these activities will lead to a reserve that is restored to its pre-Hurricane Flora condition when wildlife was abundant within the forest.

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DEVELOPMENT OF A SYSTEM OF NATIONAL PARKS AND PROTECTED AREAS: THE TRINIDAD AND TOBAGO EXPERIENCE

Kenny Singh and Raye Sandy

INTRODUCTION

The islands of Trinidad and Tobago lie between 10° and 11° 21' North latitude and 50° 30' and 61° 56' West longitude. Trinidad, the largest of the two islands, lies just some 18 kilometers east of Venezuela. The combined land area of Trinidad and Tobago is 512,800 ha with some 50 percent under forest cover. Geological features and floristic composition indicate that Trinidad can be regarded as a detached portion of the South American mainland, the flora being more South American than Caribbean. Tobago, some 48 kilometers northeast of Trinidad is more typically Caribbean. It is not surprising then, that the natural communities of this twin-island state are world renowned for their variety, uniqueness and beauty. Montane and lowland rain forests, savannas, mangroves, fresh and salt-water swamps, as well as beaches, bays, rocky coastlines and some of the world's finest coral reefs, provide habitats for an unusually diverse flora and fauna. Fourteen major vegetation types can be distinguished on the islands. There are some 2,200 species of flowering plants, over 100 species of mammals, more than 400 species of birds, 70 reptiles, 25 amphibians and over 600 species of butterflies. There is growing awareness of the importance of conserving this rich biodiversity and of the role of national parks and protected areas in achieving conservation objectives.

HISTORICAL PERSPECTIVE OF PROTECTED AREA MANAGEMENT

The identification and management of protected areas in Trinidad Tobago can be traced to as early as 1765 when the western Hemisphere's first forest reserve was established in Tobago's main ridge, as "woods for the protection of the rains". Demarcation of proposed reserves began in 1902 and continued to 1919, with the appointment of the first forest

officer in 1907. Proclamation of reserves began in 1922 when 11 reserves were proclaimed. The last proclamation took place during the 1960's. However, there are still proposed reserves which have not yet been proclaimed. Legally proclaimed forest reserves occupy some 121,259 ha, or approximately 25 percent of the total land area. These vary considerably in individual size, with the largest being the Victoria-Mayaro in southeast Trinidad occupying 51,915 ha, and the smallest being Galeota Point (58 ha.) The Forest Act, regulating the removal of timber from forest reserves and allowing for the designation of prohibited areas, was enacted in 1915.

With the enactment of legislation for the conservation of wildlife, a new category of protected areas - the wildlife sanctuary, within which no hunting is permitted - came into being. Between 1934 and 1968, a total of 13 areas were declared wildlife sanctuaries. Whilst several of these wildlife sanctuaries are located entirely within forest reserves, some extend into adjoining state lands.

During the 1940's, increasing timber exploitation within reserves, and the conversion of these reserves to teak and pine plantations, led to an interest in preserving the natural flora in specific areas within reserves. Thus, relatively small areas referred to as "nature reserves" were usually set aside along roadways close to forest plantations. Eleven areas were so designated. The Forest Act also allows for the designation of specified areas within forest reserves as "prohibited areas", which makes it an offense to enter such an area with a permit.

SYSTEM OF NATIONAL PARKS AND OTHER PROTECTED AREAS

During the 1970's, it was realized that increasing population density, industrialization

and rapid utilization of natural resources had led to a rather critical situation. Forests were being rapidly converted to other uses, land erosion and flooding had become serious problems, and habitat loss threatened the survival of several species of plants and animals. In addition, natural areas with the capability to support outdoor recreational activities were being degraded and lost.

In 1977, Cabinet established an Inter-Ministerial Committee to inter alia, "finalize proposals for the creation of a management structure for the development and control of National Parks and Beaches." The Committee recommended the establishment of a "Department of Parks, Beaches, Wildlife and Historic Sites" - with responsibility for the establishment and management of a national system of protected reserves, landscapes, marine and outdoor recreation areas and historic sites. The most significant effort towards this end began in 1978 when the Project for the Establishment of a System of National Parks and Other Protected Areas was undertaken with assistance from the Organization of American States. The National Park System Plan was completed in 1980.

Policy

The policy as drafted in the System Plan (1980) states the following: "The Policy of the Government of Trinidad and Tobago is to protect in perpetuity those areas of the country which represent significant examples of the natural heritage, and to promote public understanding, appreciation and enjoyment of this heritage in ways which will leave it unimpaired for present and future generations. The policy will be implemented through the establishment of a National Park System, which will include the significant natural, scenic and scientific heritage of Trinidad and Tobago. This policy dictates that the agency responsible for the development and management of the National Park System will systematically identify and evaluate all of the diverse types of areas in the country and then prepare a plan for their inclusion and management in a national system of parks

and other protected areas." However, new policy and legislation relating to natural heritage and biodiversity are currently being drafted. Some of the critical considerations currently being reviewed include the following:

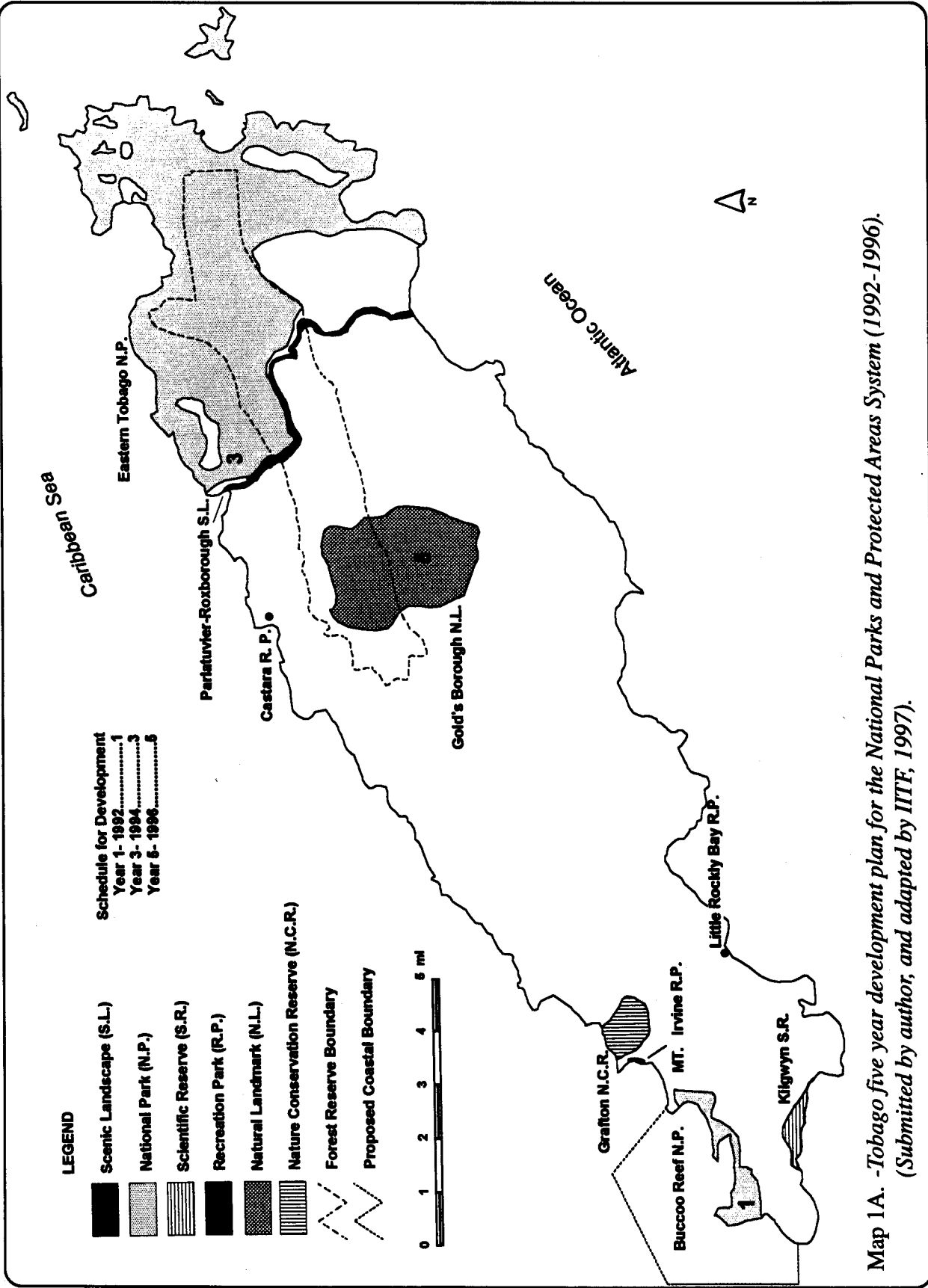
- the protection, conservation, enhancement and sustainable management, for their intrinsic values and for the benefit and enjoyment of present and future generations, of areas and species as fully representative as practicable of the biological diversity, terrestrial and marine wildlife, ecological communities and landscapes which gave Trinidad and Tobago its unique character;
- the integration in a holistic manner of the management of parks and protected areas with wildlife conservation so as to conserve effectively the nation's ecosystems and biodiversity;
- the coordination and harmonization of environmental functions of parks and protected areas with operating governmental entities and their legislation under the umbrella of the Environmental Management Act;
- the promotion of community involvement through partnerships in seeking to halt and reverse the deterioration of the nation's heritage and enhance the opportunity for coordinated relationships with local communities, landowners and the public including non-governmental organizations in the conservation field;
- cooperation between public and private sectors in harnessing the range of skills, scientific, technical and community knowledge, available in Trinidad and Tobago so as to maximize the use of available human and technical resources;
- the need for innovative approaches to conservation of biodiversity especially on private property, by encouraging the involvement of communities and individual landowners to conserve biodiversity wherever located inside or outside protected areas and whether in state ownership or not;

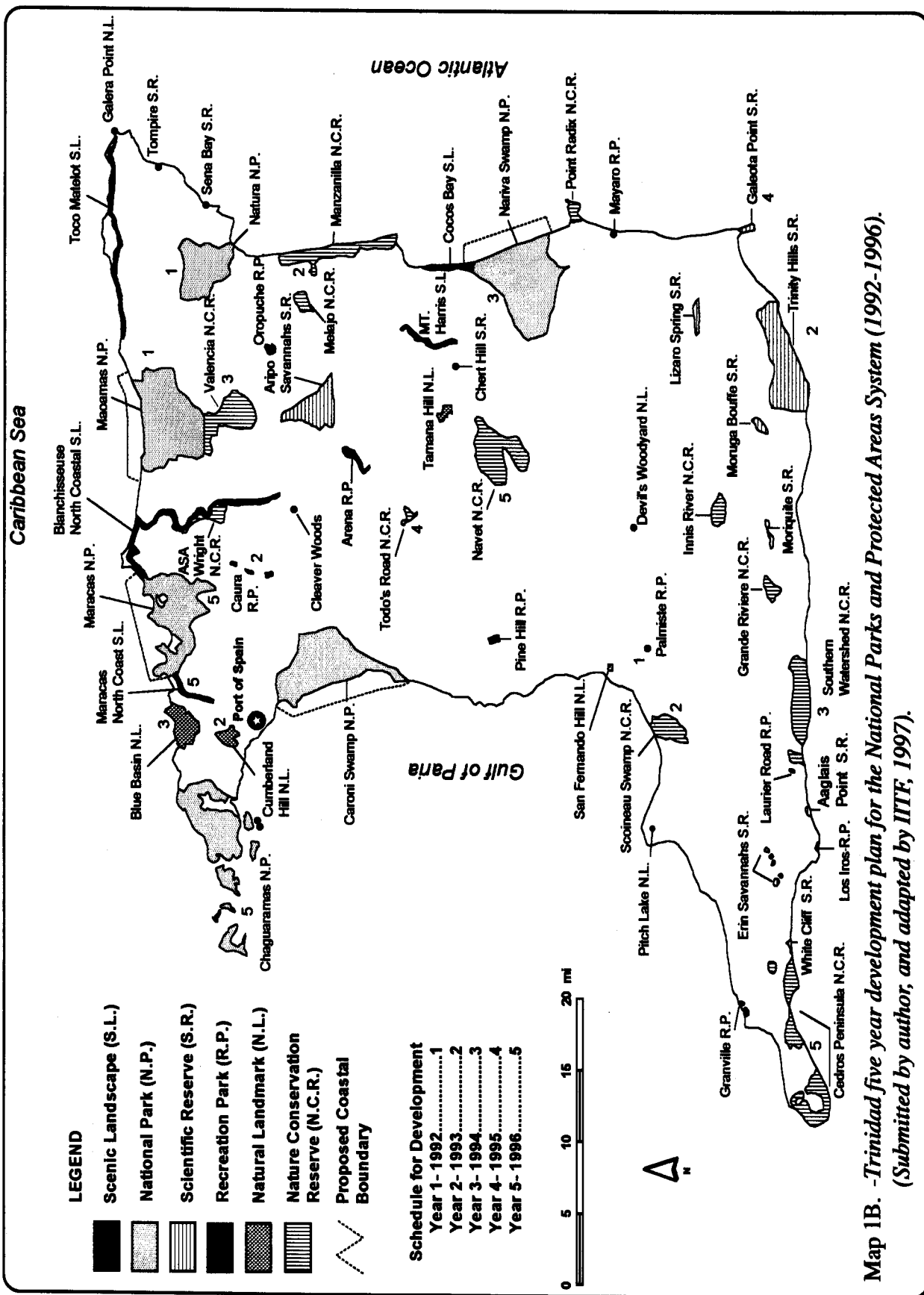
- the development of new or adaptive technologies and better understanding of local ecosystems and their biodiversity;
- the dissemination of information to the public, and the fostering of awareness and education programmes on nature and nature conservation.

The System

The National Park System Plan (maps 1 A and 1 B) includes only areas that meet the national significance criteria for the National Park System. It does not include the total range of areas which require special resource management practices to meet a variety of related conservation, watershed or land use management objectives which are also of critical environmental importance. A total of 61 units which occupy approximately 69,000 ha of terrestrial area, or about 14 percent of the total land surface of the country, have been included within the proposed National Park System. In addition, several marine areas are included in the system. These 61 units are distributed over six categories, as follows:

1. Scientific Reserves (13 units). These include relatively fragile ecosystems or natural features of importance to science.
Example: Aripo Savannas. This is the only relatively undisturbed savanna in the country. The vegetative associations are unique and many rare species of flora are found within the savanna.
2. National Parks (8 units). These are relatively large land or water areas containing a complex of ecosystems. They include the most outstanding natural areas of the country, are under strict national government control, and conform to international standards.
Example: The Caroni Swamp. This Swamp represents the most outstanding example of a mangrove swamp ecosystem in the country. It provides the only habitat in the country for the scarlet ibis, one of our national birds, as well as numerous other wildlife species. It is an important recreational and educational resource which is easily accessible.
3. Natural Landmarks (8 units). Generally, these are small areas rather than ecosystems, with distinctive features in a natural or near natural state.
Example: The San Fernando Hill. The Hill is the most prominent landscape feature of this southern city. It also represents outstanding examples of a variety of geological features. Most of the surface has been removed by quarrying activities.
4. Nature Conservation Reserves (13 units). These are areas incorporating representative habitats for plants and animal species or associations.
Example: Asa Wright. Located in the central portion of the Northern Range, this area consists of some 77 ha of essentially abandoned cocoa and coffee estates and is now managed by the Asa Wright Nature Centre. This area represents a valley ecosystem with a wide variety of bird-life and other wildlife species.
5. Scenic Landscapes. These areas typically adjoin roads, trails or waterways, and are designed to provide for the protection of the scenic integrity and related resources of the area, and recreational and educational opportunities.
Example: Blanchisseuse - North Coast. This area represents the best scenic landscape through a mountainous area as well as provide protection for a variety of wildlife species. The lofty peaks and steep gorges and cliffs are the best that can be viewed from a roadway.
6. Recreational Park (13 units). These are areas containing natural features which provide opportunities for swimming, hiking, picnicking and related resource-based recreational activities.
Example: Cleaver Woods. Located just one kilometer from Arima and along the Eastern Main Road, Cleaver Woods represent a typical example of a secondary tropical rain forest and affords opportunities in an urban setting for educational and recreational activities in a semi-natural area.





Approximately one-half of the total area is located within eight large national parks. Four of these parks are located in the mountains of the Northern Range of Trinidad; one in the main ridge of Tobago; two are swamps; and one is essentially a marine ecosystem. Approximately 24 percent, or some 17,000 ha of the total area proposed, is currently privately owned. The rest is located on forest reserves (31 percent), wildlife sanctuaries (12 percent), and state lands (33 percent.)

Because of funding and other constraints, development and management of the proposed national parks and protected areas has been significantly retarded. However, the Forestry Division does perform basic maintenance of resource and facilitates at several sites which therefore accommodates an appreciable level of visitor use. These sites include the Cleaver Woods Recreational Park, The Aripo Savannas Scientific Reserve, The Quinam Recreational Park, San Fernando Hill Landmark, The Matura National Park, The Caroni Swamp National Park and The Caura River Recreation Park. The Buccoo Reef Park is managed by the Tobago House of Assembly.

LEGAL FRAMEWORK

Legislation specifically addressing the subject of wildlife, national parks and protected areas is currently being drafted as part of an overall Watershed Management and National Parks project, to be funded by the World Bank. Current protected areas management is the refore carried out under the ambit of existing legislation - primarily the Forests Act and the Conservation of Wildlife Act. As stated earlier, the Forests Act does allow for the designation of forest reserve sites as prohibited areas, whilst wildlife sanctuaries have been declared under the Conservation of Wildlife Act. Declaring an area "prohibited" seeks to restrict and control access into such areas. Hunting is not allowed within wildlife sanctuaries.

There are deficiencies with such legislative arrangements which do not allow effective protection of forests and wildlife. For example, the

declaration of an area as a wildlife sanctuary does not offer any special protection to the habitat, as opposed the wildlife within that area. In addition, the extent of the area included within forest reserves in the western Northern Range - the area that is under the greatest human pressure within the country- is very limited.

In addition to specific legislations governing natural, resource management, Trinidad and Tobago is also party to a number of international conventions. Those of particular concern for protected areas management include the following:

1. Convention of Nature Protection and Wildlife Preservation in the Western Hemisphere (1940). This convention deals specifically with the establishment of national parks and the nature reserves.
2. Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar - 1971).
3. Protocol Concerning Specially Protected Areas and Wildlife in the Wider Caribbean Region (SAW - 1990).
4. Convention of the Conservation of Biological Diversity (1992).

INSTITUTIONAL ARRANGEMENTS

Given the history of the development of national parks and protected areas in Trinidad and Tobago, it is not surprising that the Forestry Division continues to be the head agency involved in the management of such areas. In Trinidad, the Forestry Division is within the Ministry of Agriculture, Lands and Marine Resources. In Tobago, the House of Assembly is responsible for the management of forests and related resources through the Department of Forestry, Environment and Parks.

In 1995, Cabinet agreed to the establishment of a National Parks Authority for the development and management of parks and protected areas. Current debate is focused on the administrative linkages for such an authority - includ-

ing whether the Authority should be part of the Ministry of Agriculture or an autonomous body.

The Chaguaramas Development Authority (a statutory body) has been vested with the responsibility of managing some 5,000 ha of the Chaguaramas peninsula including off-shore islands. The Authority is currently formulating plans for the Chaguaramas National Park. This shall of necessity include a heavy marine component - including yatching facilities. Non-governmental organizations and community groups are also involved in protected area management. These include the following:

1. Asa Wright Nature Centre. This is a non-profit organization which manages guest-house facilities on the Spring Hill estate in the Arima Valley. The centre also conducts a number of nature and bird-watching tours.
2. The Point-a Pierre Wildfowl Trust. This group manages a small wetland together with breeding population of wildfowl, within a refinery.
3. Nature-Seekers Inc. This is a community group established to protect the Mature Beach where leatherback turtles nest annually. The group also conducts guided tours. Their activities have been nurtured and sanctioned by the Forestry Division.

THREATS TO CONSERVATION

The main threats to tropical forest ecosystems in Trinidad and Tobago are from the agricultural sector and the exploitation of minerals.

Shifting cultivation has been the biggest offender in the agricultural sector with respect to encroachment and occupation of forested lands. Squatting is invariably associated with this activity. Problems are compounded as clearing often occurs on steep slopes and other marginal sites. Burning is usually the main means by which clearing is done. It should be emphasized that squatting poses the most serious threat of irreversible damage to forest ecosystems.

Quarrying operations - the extraction of limestone on the Northern Range and sand and gravel from eastern basins, pose a severe threat to several areas. Mineral exploitation also poses a major threat to the integrity of protected areas in south Trinidad. In this case, the problems arise from petroleum exploitation.

In Trinidad (and to a lesser extent in Tobago), logging activities have been a threat to the forest environment on both state and private lands. On state-owned forests, problems are caused by illicit timber removal and by ineffective regulation of timber felling and extraction. Driven by the shortage of local timber from accessible state forests, loggers have been targeting private timber stands. Invariably these stands are located on sensitive areas where intensive agriculture could not be started or had to be abandoned. The conversion of forested lands to other uses - housing and industrial development - are also cause for concern.

CONCLUSION

It may appear that progress toward the establishment of a System of National Parks and Protected Areas in Trinidad and Tobago has been quite slow. However given that (1) national parks and protected areas have the potential of playing a significant role in national development based upon ecotourism with attendant boosts to government revenue, employment operation and foreign exchange earnings; (2) several base-line studies and reports have already been completed; (3) the attention of the national and international communities is currently focused on this theme; and (4) the growing imperative for urgent action to be taken to stop further degradation and destruction of our rich biodiversity; it is clear that firm and decisive action cannot be postponed for much longer. The major impediment to the realization of both the System of National Parks and Protected Areas and its socio-economic benefits to date has been the lack of adequate resources for its implementation. In addition to inadequate funding, the absence of

an appropriate legal framework has also constrained progress. There is the very real possibility that both the above impediments will be removed via a project on National Parks and Watershed Management currently being finalized for World Bank funding.

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AN INTERIM REPORT ON THE GROWTH OF HYBRID MAHOGANY (*Swietenia mahagoni* x *S. macrophylla*) USING LINE PLANTING METHOD IN SECONDARY FOREST IN GRENADA

Rolax Frederick

SUMMARY

The mahogany hybrid of *Swietenia macrophylla* and *S. mahagoni* was introduced to Grenada to restock secondary forest using the line planting technique. A majority of seedlings (57 percent) was attacked by *H. grandella* during the first year. Despite this, the average heights for the first two years were 2.6 m and 4.1 m, respectively, and the survival rate was over 95 percent. Infested trees were scattered throughout the plot and showed no definite pattern. Regular weeding at the appropriate time was important to ensure growth. These interim studies show that line planting appears to be an alternative to clear felling secondary forests for establishing mahogany plantations. However, further studies are required to compare costs for site preparation and maintenance. This will give an overall picture of advantages and disadvantages of both systems.

INTRODUCTION

Grenada is the most southerly of the Windward Islands and occupies about 345 km² (34,830 ha). The island and its dependencies (Carriacou, Petit Martinique, and many other islands) extend between Trinidad and St. Vincent. These humid tropical islands are influenced by the northeast trade winds. Daily mean temperature is about 30° C and annual rainfall varies between 1000 mm in the coastal areas to over 4000 mm in the mountainous interior. The dry season is from January to May, and the rainy season for the remainder of the year.

Geologically, the island was developed in the Pliocene era with the southern part being mainly volcanic, and the northern part of sedimentary formations. The interior is dissected

with steep, narrow V-shaped valleys with torrential streams traversing its terrain. The highest point, Mt. St. Catherine (840 m), is situated along a ridge in the center of the island. Many ridges extend close to the coast, especially along the western side of the island. The soils are fertile, well drained and mainly clay loam. They are prone to erosion, and caution is advised during any land management activities.

About 23 percent of Grenada is covered with natural forest. A significant amount of agricultural activity is based on tree crops, hence trees are common throughout the mainland. Seven types of natural vegetation were recognized by Beard (1949): mangrove woodlands along sheltered coastal bays; cactus scrub, mainly on the dry peninsulas in the south; deciduous seasonal forests encircling the island near sea level; evergreen, semi-deciduous seasonal forest; lower montane rain forest on the central mountains and at high and intermediate altitudes; palm brake on steep slopes near mountain tops; and elfin woodlands on the highest windswept peaks.

Since the island's discovery, many crops have been introduced in Grenada where they thrive in its fertile soils and favorable climate. Initially, there were indigo and tobacco. Later sugar, cotton, and coffee became dominant. Finally, nutmeg, bananas, cocoa and others were grown. Much of the natural vegetation was cleared to grow these crops, especially during the sugarcane era, leaving very little of the original forest remaining. As the importance of sugar decreased, natural vegetation recolonized some areas. Hence, some of the "natural forests" observed today are actually secondary forests from these former sugar plantations.

BACKGROUND

The International Union of Forest Research Organization (IUFRO) and United Nations Development Program (UNDP) held a research planning workshop for the Caribbean islands in Trinidad and Tobago in May 1990. It was agreed that research was required in the areas of watershed degradation, agroforestry, secondary forest management, conservation of forest ecosystems (e.g., mangroves), and improvement of the establishment, tending and management of industrial plantations. Grenada, Barbados, Montserrat, and Guyana were selected to participate in this initial phase of research in secondary forest management.

In Grenada, areas for secondary forest management include marginal lands, model farms, and non-productive lands on large estates. Once an area of secondary forest is selected for management, an inventory of the trees should be done. Where sufficient stocking exists, appropriate management techniques may be implemented. If stocking is insufficient, then new plantations may be established. Line planting was justified because the existing secondary forest had limited timber production potential. The objectives were to (1) improve species composition and growth in secondary forest, and (2) derive sustained yields of timber and other forest products from managed secondary forest stands.

After assessing the secondary forest at Grand Bras, it was decided that mahogany (*Swietenia macrophylla* and *S. mahagoni* hybrid) would be used to plant in the area. The purpose of this research is to evaluate the growth of mahogany trees which were planted using the line planting technique.

HISTORY OF MAHOGANY PLANTING IN GRENADA

The Forestry Department planted mahogany in Grenada for many years, especially after Hurricane Janet in 1955. The trees were planted on forest reserves or privately

owned lands, especially estates. Numerous plantings were damaged by the shoot borer *H. grandella*, and the Forestry Department discontinued planting in the late 1970's. Trees grew successfully in some areas, however, notably on the estates (e.g., Springs). Today, most of the local mahogany is harvested from these areas. The demand for mahogany as a furniture wood has increased significantly and this trend is expected to continue in the future. A considerable amount is harvested locally, mainly from private sources, and some is imported. Most private people who harvest the trees do not replant.

The Department is concerned that if no trees are planted soon there will be no available stocks, either locally or imported. Blue mahoe (*Hibiscus elatus*) is currently being used as an alternative, but mahogany is sold at a higher price. Furthermore, the blue mahoe is a favored host of the pink mealybug, while there is no evidence that mahogany is one of the mealybug's favored hosts.

The Forest Department resumed its mahogany planting program in 1985, but the shoot borer destroyed the plantations after a few years. Observations of previously established stands indicated that, if mahogany is planted in mixtures with blue mahoe, it will not be severely destroyed by *H. grandella*. The initial growth is slow, but normal growth resumes after the blue mahoe trees are cut.

There are very few remaining areas within the forest reserve for establishing plantations. The Department is now concentrating its efforts on plantings in the other areas of the island. The intention is to plant, mainly mahogany, on private lands (through extension programs) and on government lands made available for that purpose. A section of Grand Bras estate was made available to the Department to plant the mahogany, hence the beginning of this project. The Department is using the experiences from this project, together with previous plantings, to expand mahogany into areas that are too dry for blue mahoe. An analysis of available data

will provide interim results which the Department can use as it increases its effort to grow more mahogany for future use in Grenada.

LINE PLANTING AT GRAND BRAS

Site Information

The Ministry of Agriculture's Forestry Department, with the support of the USDA Forest Service through the International Institute of Tropical Forestry in Puerto Rico and the US Peace Corps, introduced the line planting technique in Grenada's secondary forest. The planting site at Grand Bras consists of sedimentary formations of alluvial and superficial deposits which are found close to rivers. Volcanic formations associated with the Pleistocene era are common. Two types of soils are identified in the area: sandy loam and clay loam. The sandy loam is mainly found close to rivers. It is a coarse sub-angular blocky structured soil. It is of good fertility and weakly acidic to neutral. The clay loam, also known as the red earth, developed from the weathering of basaltic and andesitic lava. The brick-red appearance is due to lateritic alteration of the parent material. It is found mainly on the steeper slopes and in areas of low permeability. The soil (acidic in nature) is not very fertile. The land is gently sloping with small patches of steeper slopes (8 percent) scattered throughout the area.

Grand Bras is an agricultural estate that produces nutmeg, cocoa, and fruits. Agricultural crops were not maintained in large sections of the estate, so bush and shrubs are the main vegetation. The site is a tract of marginal land on which the dominant species, white cedar (*Tabebuia pallida*), maruba (*Simaruba amara*), and lowland gommier (*Bursera simaruba*), are of little commercial value.

METHODS

Species Selection and Nursery Treatment

A hybrid mahogany (*Swietenia macrophylla* x *S. mahagoni*) was chosen as the species to con-

vert this secondary forest into a valuable plantation. The mahogany seeds (source: Puerto Rico) were sown directly into 3 lb polythene potting bags in January 1991. Germination began 13 days after sowing. The potting mixture consisted of forest soil taken from a pine stand and riverbed material. Fertilizer was added in the following proportions: 20 wheelbarrows of forest soil, 22 wheelbarrows of riverbed material, and 2 paint tins (1.1 gal or 5 liters container) of fertilizers. The plants were watered and weeded as required.

Site Preparation

Line planting was the technique selected because the protective and productive functions of the forest are maintained as the site is prepared for planting. Lines were cleared within the natural forest to facilitate growth of planted mahogany trees. These lines were regularly spaced 36-ft (11 m) apart and were oriented in an east to west direction using a compass. This spacing allows for between-line competition and reduces planting costs. The orientation allows for optimum utilization of the overhead sunlight by the plants. Each line was cleared 9-ft (2.7 m) wide using a cutlass to cut the smaller vegetation. Larger trees were cut by chainsaw. All overhead branches were cleared. Merchantable trees were marked with flagging tape and their bases cleared for easy cutting. These trees were then felled and cut into 9-ft sections for conversion into boards. A few trees were girdled and allowed to dry. The remaining small trees (between the lines) in the forest were left to protect the young plants from wind.

Planting

Planting commenced in September 1992 and was completed in December. It was a slow process because clearing and planting were done at the same time. The plants were about 2-ft (0.6 m) tall at planting time which was less than the recommended 1 m in height. This was probably due to restriction of root growth by the small potting bags. Visual checks were made for shoot borer (*H. grandella*) attack when trans-

porting the seedlings to the field. Where they were planted 8-ft (2.4 m) apart within the lines.

Maintenance

The plants were weeded four times per year mainly to remove climbers and grasses which were competing with them. These weeds, especially the climbers, covered the tops of the plants causing them to lean. They were staked, and with the regular weeding there was remarkable improvement in the performance of the plants. No other maintenance work was required, but regular checks were made to monitor their performance.

Data Collection and Analysis

In April 1994, height measurements of all the trees and visual checks for evidence of shoot borer attack were done. The heights were measured using a tall stick graduated in meters.

In 1995, the heights of all trees were measured. The results are summarized in table 1, and compared with those of 1994. No checks

for *H. grandella* were made in 1995 because visual observations can cause stems to break when bent.

RESULTS

Out of the 496 seedlings planted, only 5 died as of March 1993. The first sign of borer infestation was observed in June 1993.

I found the following:

- During the first year of growth the results show a strong relationship between tree height and shoot borer attack. The relationship shows a steady increase of attack (up to 92.9 percent) at a height at 4.5 m, then a subsequent decline (table 1).
- There was significant increase in height of the plants during 1994-1995 (table 2). The average increase in height was about 1.5 m with a range of -1.8 to 4.9 m (table 3). The negative growth may be due to attack by *H. grandella*.
- The results also show that the trees which were attacked by *H. grandella* in 1994 were

Table 1. -Distribution of height classes (1994 and 1995) of line planted mahogany and shoot borer infestation by height class in 1994.

Height class	No. of trees		Infestation of 1994 seedlings		
	1994	1995	Trees attacked	Trees not attacked	Percent attacked
0-0.9	2	-	0	2	0.0
1-1.9	120	7	34	86	28.3
2-2.9	201	48	113	88	56.2
3-3.9	133	140	101	32	75.9
4-4.9	28	195	26	2	92.9
5-5.9	7	85	6	1	85.7
6-6.9	-	12	—	—	—
7-7.9	-	2	—	—	—
Total	491	489	280	211	57.0

Table 2. –*Comparison of height. There was significant differences in height between both readings ($r = 0.46$). Analysis of data collected in 1995 show significant differences in height among the trees.*

	1994	1995
Mean height (m)	2.5948	4.1060
Minimum height (m)	0.5000	1.1000
Maximum height (m)	5.9000	7.4000
Standard deviation	0.8677	0.9795
Standard error	0.0392	0.0444

Table 3. –*Analysis of height increment (1994-1995). Negative increment may be due to infestation by shoot borer.*

Mean (m)	Minimum (m)	Maximum (m)	Standard deviation	Standard error
1.5	-1.8	4.9	0.9651	0.0437

generally taller in 1995 but those which were not attacked grew faster (table 4). Since no investigation was made to identify trees which were attacked in 1995, no definite conclusions can be drawn. However, this topic can be investigated further.

- In 1994, when observing growth by lines, 12 of the 13 trees (92 percent) with significantly different height were taller than the mean height for that year (table 5). In 1995, 60 percent of trees with significantly different height (15 of 25) were taller than the mean height for that year. There were twice as many trees of significantly different height in 1995 as there were in 1994.
- Trees showing unusual heights in 1995 were different to those in 1994, except numbers 208 and 209.
- Unusual observations refer to those which are greater or less than the confidence limits.

- Trees with significantly different height were scattered throughout the plot (table 5).
- In 1994, 84 percent of the trees which showed unusual heights (11 of 13) were attacked by shoot borer. Fifty six percent of the trees which showed significantly different height in 1995 (14 of 25) were attacked in 1994.
- An increase of 4.9 m in height by some trees is very significant. In the early stages of growth this is desirable to enable the trees to compete with the weeds and surrounding vegetation.
- In 1994, some trees were repeatedly attacked by the shoot borer. The affected shoots died back, and growth was suspended but resumed later.
- Observations also indicated that when weeding was done regularly, the trees grew very well.

Table 4. –Comparison of growth of infected trees (1994) and those not infected.

Status in 1994	Mean height	Standard deviation height	Increment mean	Increment standard deviation
	----- 1995 -----			
Attacked	4.318	0.05624	1.419	0.05697
Not attacked	3.809	0.06651	1.635	0.06739

Table 5. –Distribution of trees with significantly different heights.

Line no.	No. of trees	Compared with mean height	No. of trees	Compared with mean height
	----- 1994 -----		----- 1995 -----	
1	0		1	shorter
2	0		1	shorter
3	0		2	taller
4	2	taller	3	taller
5	1	taller	1	shorter
6	3	taller	3	2 taller
				1 shorter
7	3	2 taller	3	2 taller
		1 shorter		1 shorter
8	3	taller	1	taller
9	1	taller	2	taller
10	0		4	3 taller
				1 shorter
11	0		4	shorter
Total	13		25	

DISCUSSION AND RECOMMENDATIONS

The available evidence indicates that the trees grew quickly for 2.5 years following planting despite the high level of infestation by the shoot borer, *H. grandella*. This is shown by the mean heights, incremental heights, and the in-

crease in the number of trees which were taller than their mean in 1995 as compared to 1994. This interim information also shows that height increases, at an average of 1.5 m, meet a very important requirement for species used in line planting (Lamb 1968). Based on the observations made in this study, the following is recommended:

- Mahogany growth rates are satisfactory using the line planting technique to be considered for further use on similar sites in Grenada.
- The tallest trees should be considered as candidates from which further research can be performed using vegetative cuttings. These were exposed to the shoot borer but had good growth rates.
- Stem form and height at which a definite branching system develops on the trees should be monitored. A minimum of 8 ft (2.4 m) knot-free bole is ideal wood for the furniture industry.
- More research is needed to ascertain whether it is cheaper to establish plantations using line planting technique or traditional clear felling.

- Similar experiments must be carried out on other sites to ascertain the suitability of the line planting as a technique to be adopted on appropriate sites.

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INTRODUCTION AND ESTABLISHMENT OF PINK MEALYBUG, *MACONELLICOCCUS HIRSUTUS*, IN THE CARIBBEAN SUB-REGION AND IMPLICATIONS FOR THE AGRICULTURE AND FORESTRY SUB-SECTORS

G.V. Pollard

INTRODUCTION

Maconellicoccus hirsutus (Green [Pseudococcidae: Hemiptera]) is commonly known as the pink mealybug (PMB) because of the reddish-pink egg mass carried by the gravid females, or the hibiscus mealybug because of its preference for *Hibiscus* species. This pest was reported to FAO by Grenada in November 1994 after specimens were identified in October 1994 by the Centre for Agriculture and Biosciences International Institute of Entomology. This was the first report of the PMB in the western hemisphere. However, for an 18 to 24 month period prior to this, there had been increasing reports of mealybug infestation in Grenada, especially in the parish of St. George in the southwest of the island. The species concerned were unclear at this time until *M. hirsutus* was identified. From initial reports in St. George, shortly thereafter, PMB infestations were reported in the adjoining parishes of St. David and St. John. Currently the pest is now distributed throughout the island. Following this initial introduction, PMB then spread to the countries of Trinidad and Tobago (reported on August 1995) and to St. Kitts and Nevis (reported on October 1995) (Tobago and Nevis are so far reportedly free of PMB). There are also unconfirmed reports from some other countries.

BRIEF REVIEW OF LITERATURE ON

M. hirsutus

Taxonomy and Distribution

Maconellicoccus hirsutus was originally described from India. It was introduced into Egypt in 1908 and in the next few years became a serious pest of many plants. Initially there was some confusion with regard to its taxonomy, having been previously labeled as both *Pseudococcus hibisci* and *Pheanococcus*

hirsutus. However, it was finally re-described as a new genus by Ezzat (1958).

According to Mani (1989) the distribution of *M. hirsutus* includes much of tropical Africa, throughout the oriental region and northern parts of Australia. The recent reports of this pest in the Caribbean region are the first for PMB in the Americas. The life cycle of PMB has been studied by many workers, particularly in India. Biological data of this pest are summarized in table 1. Variation in periods for development are probably related to temperature differences (Mani 1989). The life cycle may take as little as 23 days, so that given the right conditions, there could be as many as 15 generations a year, with each female capable of producing a maximum of more than 600 eggs. With unsuitable climatic conditions there may be seasonal incidence of the pest. Over wintering has been reported on both the host plant and in the soil, either in the egg stage or in some other. Upon hatching, the young larvae or crawlers are highly mobile and so are able to distribute themselves to new host plants. Both males and females are produced, the males being winged (one pair). According to the review of Mani (1989), different authors have reported either sexual or parthenogenetic reproduction or both.

Host Plants

PMB is an extremely polyphagous species, reportedly attacking more than 125 plant species. Mani (1989) has listed 35 genera representing 23 major families of plants as hosts. These include a number of plants of major agricultural, horticultural, and forestry importance; for example, citrus, coffee, sugar cane, annonas, plums, guava, mango, okra, sorrel, teak, mora, pigeon peas, peanut, grapevine, etc. Some other host plants listed for Egypt include maize, asparagus, chrysanthemum, phaseolus beans, etc.

Table 1. -Summary of biological data on *Maconellicoccus hirsutus*.

Particulars	Misra (1919b)	Hall (1921a)	Dutt <i>et al.</i> (1951)	Singh and Ghosh (1970)	Ghose (1972a)	Mani (1986)	Reddy and Lakshmi Narayana (1986)
Egg size (mm)							
length	0.36-0.39	-	0.29-0.32	-	0.357-0.398	0.34-0.38	-
width	0.15-0.21	-	0.17	-	0.178-0.206	0.17-0.20	-
Incubation (days)	5-8	6-9	7	6-7	3-8	4-7	3-4
Nymph (days)	-	-	-	22	10-19	19-22	20-25
Egg to adult (days)	24-29	35	-	-	23-29	24-27	30
Adult length (mm)	2.52	-	3	-	-	2.65-2.80	-
Preoviposition (days)	-	-	-	3-5	0.5-6	4-5	-
Oviposition (days)	-	-	5-8	4-5	-	6-8	-
Fecundity (no. eggs/ female)	232	150-300	194	-	84-654	386-540	500

Source: Mani (1989).

(Ezzat 1958). Cotton and soybean have been recorded as hosts in Africa and Australia, plants rarely attacked by mealybugs, according to Williams (1986). Cocoa has also been recorded as a host plant in Africa. In the Caribbean PMB has shown itself to be even more catholic in taste. Over 200 plant species are reportedly attacked in Trinidad, for example.

Economic Impact

Despite its wide distribution, Mani (1989) reports that PMB has only achieved pest status in India and Egypt. Manjunath (1985) and Mani (1989) report that PMB has become the major pest of grapevine in India, with losses from 50 to 100 percent. Also in India, yield in roselle or sorrel (*Hibiscus sabdariffa*) could be reduced by up to 75 percent and severe losses were reported

in various fibre crops like jute, mesta, and roselle.

According to Hill (1983), *M. hirsutus* is the only mealybug species reported to have a toxic saliva. Injection of saliva into plant tissue during feeding results in stunting and even death to young shoots; leaves show a characteristic curling, similar to damage caused by viral pathogens. Heavy infestations lead to a rosetting or bunched top appearance due to shortened internodes, also heavy sooty mold infection results.

Control

Mani (1989) described various measures attempted in the control of PMB, including sticky traps, insecticide use, and biological

control. Of these, biocontrol is the most feasible option. A number of natural enemies have been reported for this pest. Mani has listed 16 hymenopterous parasitoid species belonging to six families, and 30 predators belonging to 11 families representing five insect orders. Successful control utilizing the parasitoid *Anagyrus kamali* and the predator *Cryptolaemus montrouzieri* has been reported in Egypt and in India respectively. Other coccinellid predators, *Scymnus coccivora* and *S. gratusus*, have also been recommended for PMB control in India.

PINK MEALYBUG IN THE CARIBBEAN

Grenada

Grenada had been reporting increased activity of various hemipteran pests since 1993. On September 1994 the Government of Grenada requested technical assistance from the FAO to deal with this as yet unidentified problem. However, when *M. hirsutus* was identified and officially reported to FAO in November 1994, the request for technical assistance was changed to reflect the threat of this new pest introduction. As a result, the Director General of FAO, in January 1995, approved a project –TCP/GRN/4553: Control of Pink Mealybug– to provide technical assistance to Grenada under the Technical Cooperation Programme (TCP) of FAO.

As indicated above, PMB has an extremely wide host range. In Grenada, a systematic listing of host plants would include many which are reported in the literature. A range of vegetables, fruit and tree crops, ornamentals, and forest species are all attacked; as well as numerous weed and other species. There has been devastating effect on a large number of different crop species. For example, major losses have been reported in the annonas, malvaceous species (ornamental hibiscus, sorrel, okra), and *Spondias* spp. Saman trees (*Samanea saman*), which dot the Grenadian landscape and which are commonly used for landscaping purposes at hotels, have been severely affected, with many having been killed outright. Last July,

one hotel owner had complained that he had spent over US\$1500 in control costs to save one tree and he was pessimistic of its chances of survival; six months later it had to be cut right back. Other hoteliers have complained of having to remove many of the various ornamentals (hibiscus, oleander, allamanda, croton, etc.) from their gardens as a direct result of PMB attack. This has detracted from the aesthetics of their properties. The Grenada Cocoa Association was predicating losses for the present cocoa crop of 220,000 lbs (100,000 kg). Cocoa is a major foreign earner for the country. There is also the threat to the forestry sector as PMB has infested blue mahoe (*Hibiscus elatus*) plantations and small stands of teak (*Tectona grandis*).

Unquantified losses have also resulted from restrictions in trade of agricultural produce with Trinidad and Tobago. This huckster trade, (small entrepreneurs dealing mainly with fruits and vegetables, importing into Tobago on schooner craft) with three or four boats making weekly trips between Grenada and Trinidad, has come to a virtual stand-still following quarantine restrictions placed on the importation of fruits and vegetables from Grenada into Trinidad.

One preliminary study of the economic, environmental and social impact of PMB in Grenada was recently completed (Francois 1996). One-time losses were estimated at EC\$9.7 million (US\$3.5 million) but with the recognition that "... losses to the Grenadian economy are expected to be substantially higher". Table 2 summarizes these losses.

From field observation, many host plants show symptoms of mealybug attack –crinkling of leaves and rosetting or a bunchy top of stems, but no mealybug colonies could be found on these plants. It appears that such secondary hosts act as feeding plants for dispersing nymphs but these nymphs cannot develop on these hosts. Other host plants are primary hosts which allow for development of the pest, e.g. saman, hibiscus. If this proves to be true, then the incidence of damage on many of these

Table 2.—*Summary of economic and environmental impact of pink mealybug in Grenada (after Francois 1996).*

	Costs(EC\$)	
	One time	Annual
Economic impact		
Reduced crop yield	-	4,750,000
Increased production cost	-	493,000
Increased forestry replanting	8,265,840	-
Reduced timber production	-	342,000
Subtotal	8,265,840	5,585,000
Environmental impact		
Siltation of reservoirs	-	26,675
Decreased water quality	-	551,152
Lower dry season stream flow	-	3,142,800
Loss of aesthetics	1,410,075	3,719,627
Subtotal	1,410,075	3,719,627
Total costs	9,675,915	9,304,627

secondary host plants should decrease, if not disappear, once the pest is brought under control.

Trinidad and St. Kitts

The situation in Trinidad and in St. Kitts is not as devastating as in Grenada. While spreading in both of these countries, the pest has not as yet gotten into the major agricultural regions nor forested areas. However, like in Grenada, a wide range of host plants has been identified. Both countries are still hoping to be able to eradicate PMB, although this now appears to be unlikely. Both Trinidad and St. Kitts comprise twin island states, but neither the sister islands of Tobago nor Nevis is infested at this time. Quarantine measures have been put in place in each island to maintain their pest free status.

Of particular concern to authorities in Trinidad and Tobago is the potential effect of PMB on teak. Trinidad has the largest holdings of teak in the hemisphere and potential losses could be staggering. In agriculture and forestry in Trinidad potential losses to PMB have been estimated at US\$125 million (Programme Management Committee 1996).

FAO Project - TCP/GRN/4453

This project was initiated in March 1995. It consists of three main thrusts: (1) chemical spray programme to reduce high populations of PMB; (2) biological control using the parasitoid wasp, *A. kamali*; and (3) public awareness campaign.

Chemical Spray Programme

Applaud (buprofezin) Tracfection (dimethoate) and spray oil were supplied under the project in order to bring the pest populations down to low levels in as short a time period as possible and to attempt to eradicate from those areas where the pest had not fully established. Applaud is an insect growth regulator aimed at immature stages or crawlers, while Tracfection is a systemic organophosphate insecticide targeting both adults and crawlers. Sevin was used to control the ants which are associated with the pest. In addition, paraquat was supplied for weed control, as many weeds are important hosts of PMB. Spray teams were organized by the Ministry of Agriculture which was responsible for the programme. Tracfection was used mainly on farms and on cocoa plantations while Applaud / spray oil was applied to residential areas.

Tracfection has been the more successful of the insecticides sprayed compared with Applaud, essentially because it acts against all stages of the pest. It has been estimated that Tracfection resulted in 90 to 95 percent control while Applaud / spray oil some 60 to 75 percent. Control of ants using Sevin was 90 to 95 percent (Francis-Ellis 1995). However, despite the efficacy of the pesticides, there has been little overall impact on PMB populations. Effectiveness of the programme required a spray cycle of three weeks and various factors militated against this. According to Francis-Ellis (1995) these included the following: lack of manpower; rapid spread of the pest into new areas; the great demand for spraying services island-wide; involvement of spray teams in other control activities, e.g., cutting and burning of infested vegetation, which slowed down the spray programme; and interruption of the spray programme due to frequency of rain showers.

Biological Control

The main thrust of this project is biological control of PMB utilizing the encyrtid parasitoid wasp, *A. kamali*. This has been successfully uti-

lized in India and Egypt. Consultants to this project are the CAB International Institute of Biological Control (IIBC).

Field observations in Grenada have not revealed any significant natural enemies, hence the strategy of an applied biological approach. This lack of indigenous natural enemies is not unexpected given the fact that this pest is a newly introduced species. However, successful establishment and action of *A. kamali* was expected given the success of this parasitoid elsewhere. Also, successful biocontrol of other mealybug species, for example, cassava mealybug in Africa as well as mango mealybug, offered hope for similar success in Grenada.

Anagyrus kamali was introduced from China into quarantine laboratories of IIBC, in the United Kingdom, for rearing and study in order to ensure that introduction into Grenada was in accordance with the FAO international standard on phytosanitary measures –Code of Conduct for the Import and Release of Biological Control Agents. Up to the end of February 1996, three lots of these parasitoids have either been hand carried or shipped to Grenada from the IIBC laboratories in England for both field releases and to initiate laboratory cultures. Originally, three field sites were selected for parasitoid release in November 1995: on teak trees at the Governor General's garden in St. Georges, on hibiscus at Carriere, and on teak in Mt. Moritz. At all these sites it appeared that there was establishment of *Anagyrus*. In February 1996 releases were made at additional sites: Bailles Bacolet on broom weed; on blue mahoe at Les Avocat, an important watershed area; at La Sargesse on mixed vegetation and saman, and on soursop trees. These sites are being monitored to determine establishment and control levels. A final mission of the consultant is scheduled for mid-June 1996.

Public Awareness Programme

A public awareness programme is the third component of the FAO project. To date, this has involved the preparation and distribution of

two fact sheets by the Ministry of Agriculture. In addition, billboards have been posted at strategic areas in the country. For example, before the pest had spread to the Mirabeau region where the government propagation station is located, there was one such billboard informing people of the threat of introducing PMB to that district. Other activities are planned.

In addition to the above, member countries of the Caribbean Plant Protection Commission (CPPC) have been kept updated of this new threat to the region through the distribution of three Circular Letters from the office of the Technical Secretary to the CPPC. These Circular Letters (No. 5/94 of December 1, 1994, No. 3/95 of September 1, 1995, No. 4/95 of December 1, 1995) served to provide information to all CPPC members on this new pest to the region.

Regional Threat of Pink Mealybug

Since the first reports of PMB introduction and establishment in Grenada in October 1994, this pest has now been confirmed in two other countries with unconfirmed reports for others. A more worrisome threat is that of the pest moving from Trinidad into Venezuela which is only about 24 km distant at the nearest point and then, from here, the potential for further spread to the rest of South America. Should this occur the potential for crop loss is enormous. Of course, no one can predict how a newly introduced organisms will behave in a new country or environment. But given the extremely polyphagous nature of PMB, the apparent lack of natural enemies and favorable environmental conditions it will encounter, it is not difficult to imagine PMB achieving major pest status wherever it is introduced in the neotropics. Also, given the experience in Grenada, PMB seems to have the ability to spread rapidly once introduced. The relatively high fecundity and short life cycle facilitate rapid spread. In recognition of this threat the Inter-American Board of Agriculture, at its Eighth Meeting in Costa Rica on September 1995, declared PMB a pest of major economic and quarantine importance to the region. This

position has recently been confirmed by a pest risk analysis conducted by USDA/APHIS (Jorge and Castleton 1996).

A Proposed Regional Response

Regional Action Programme. -To deal with the regional threat of PMB, a comprehensive Regional Action Programme (RAP) was developed to deal with this threat by a committee comprising PMB-affected and other non-affected countries, together with several regional and international development and technical assistance agencies. This RAP was immediately endorsed by the Minister of Agriculture of Grenada and St. Kitts at a meeting of the Programme Management Committee in St. Kitts on February 26, 1996 and also by other Ministers of Agriculture who were not present at that meeting. Donor support is being solicited at present for this regional programme.

FAO's Proposal for a Regional TCP Project. -With the continuing spread of PMB in the Caribbean sub-region, FAO received requests for technical assistance from St. Kitts and Trinidad, at present chairing the Standing Committee of Ministers of Agriculture of the Caribbean Community. Anticipating additional requests for assistance as the pest is expected to inexorably continue its spread, FAO agreed to consider a regional project for the biocontrol of PMB under its Technical Cooperation Programme (TCP). General objectives of this project include (1) establish a permanent breeding colony of *A. kamali* at the IIBC station in Trinidad, affected countries to be supplied with *A. kamali* as and when needed, (2) develop dossiers on three other candidate biological agents, and (3) train personnel of affected countries in biological control and how to make informed decisions in the control of PMB. This project proposal is yet to be endorsed by sub-regional governments before it is formally approved.

CONCLUSIONS

Maconellicoccus hirsutus, the hibiscus or pink mealy bug, is the latest pest introduction to this

region. Given its impact in Grenada where it was first reported, this pest has the potential to be one of the most damaging to be introduced into the hemisphere. Its extremely wide host range is one of the major factors militating against effective control. The continuing spread of this pest in the Caribbean region is cause of concern, and with the potential for spread into South America now even more real since establishment in Trinidad. Pink mealybug must therefore be considered a pest of extreme quarantine importance for the region.

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EASTERN CARIBBEAN INSTITUTE OF AGRICULTURE AND FORESTRY: THE FORESTRY SCHOOL

Carlton Sambury

GENERAL

The Eastern Caribbean Institute of Agriculture and Forestry (ECIAF), Division of the Ministry of Agriculture, Land and Marine Resources is a post secondary educational institute which grants diplomas in Agriculture, Forestry, and Agriculture Teacher Education, and certificates in Forest Ranger Training and Wildlife Conservation for Game Wardens. The Institute is located at Centeno, on the Caroni North Bank Road. It is approximately 2 km east of Piarco International Airport, 32 km east of the city of Port of Spain, and 8 km west of the Borough of Arima. The Forestry School was established in 1966. Two years later, the Government of Trinidad and Tobago with the assistance from the United Nations Development Program (UNDP) and the Food and Agriculture Organization (FAO) also of the United Nations, amalgamated the Forestry School with the previously existing agriculture school - the Eastern Caribbean Farm Institute (ECFI), thus forming ECIAF. Today ECIAF remains a division within the Ministry of Agriculture, Land and Marine Resources.

From 1966 to 1975 the School of Forestry provided in-service training for sub-professional forest officers from Trinidad and Tobago and a number of regional territories. Two programmes were then offered, the diploma programme which extended over a two year period, and the certificate programme for a one year period. In 1975, when all the local field officers had been trained, the school began pre-service training for the two year diploma. Trainees from Trinidad and Tobago attended the programme on Government Scholarship, while those from other Caribbean islands, mostly practicing forest officers, continued to participate in the programme. In 1984, responding to the needs of the Wildlife Section of the Trinidad and Tobago Forestry Division, a new curricu-

lum for a one-year certificate programme in Wildlife Conservation was developed and initiated. The full complement of game wardens in Trinidad and Tobago were trained in two years, following which, the programme was discontinued.

In 1986, the next priority identified was the training of the largest group of sub-professional officers in Trinidad and Tobago, (and perhaps the entire region) - the forest rangers. A curriculum was developed for a one-year certificate course and the first forest rangers were enrolled. Approval was granted by the Government of Trinidad and Tobago for the courses to be programmed for five years, 1986-1990. The student body was enriched by the inclusion of many trainees from many of the Eastern Caribbean territories.

MISSION

The mission of ECIAF is to provide of sub-professional training in tropical forestry which is constantly updated so as to keep abreast with relevant socio-economic, technological, and other scientific developments in the world of Forestry.

THE FORESTRY DIPLOMA COURSE

General Description and Prime Objective

The diploma course is a residential one taught over thirty weeks per year. During the July to September vacation the trainees are exposed to field training in order to broaden their outlook and to provide them with on-the-job experience. All programmes are administered by staff of the School of Forestry, and supplemented by Agriculture's staff and external lecturers from the Forestry Division. A major goal of the School has been to constantly revise the programmes in order to

maintain relevance to the present and future needs of all participating states. The major objective of this programme is to train the students in the necessary disciplines that will enable them to appreciate and to perform the role and functions of a sub-professional forest officer.

Major Areas of Emphasis

Once dominated by silviculture, mensuration, geology and soils, and forest management, the present curriculum reflects the current and imminent forestry programmes in the region, and therefore is better able to equip the forest officer to undertake the now wide spectrum of duties required. The major emphases in the diploma programme are forest biology, silviculture, and soils; forest mensuration; forest management (plantations and natural forests); policy, administration, and economics; wildlife and recreation (including aquaculture); watershed management; wood technology, utilization, and engineering; protection (entomology, pathology, fire); extension, agroforestry, and environmental conservation; surveying, photogrammetry/remote sensing, and GIS; and general supportive courses such as technical communication and research practices.

Protected Areas Training

Students are exposed to two detailed courses: Introduction to Parks and Recreation (in year one), and Recreation Management (in year two) which incorporates a variety of aspects of protected areas management. The range of topics include the following:

- introduction to (and history of) national parks - Trinidad and Caribbean overviews;
- categories and concepts of protected areas (consideration of systems plans and other "protected areas" documents from various regional territories);
- definition and history of recreation;
- misuse, non use, and abuse of natural resources;

- national planning;
- site analysis and planning;
- principles and problems of maintenance;
- users classification;
- landscaping, finances, and budgets; and
- accountability and levels of liability.

This year the following topics have been introduced within the subject matter of Economics and Recreation: cost and investment considerations, pricing and paying for facilities, community co-management - accommodating the need and interests of local people, and nature based tourism/ecotourism. It is important that the students at least appreciate the need for determining the economic values of protected areas. This information will assist in the variety of management decisions which they will eventually be required to make, especially in respect to the determination of fees, or related prices for forest products and services. We are therefore proposing a range of student projects to begin in the new school year which will consider topics such the analysis of visitor related data on protected areas; the introduction of fees at specific sites (economics and social, and other ramifications); and estimating recreation demand.

Practical Training

Equal emphasis is placed on theoretical and practical work. Practical training includes experiences at the Forestry School's Enterprises. These include an arboretum (2.3 ha, table 1), a pine stand (4.7 ha), a meteorological station, a forestry laboratory, forest nursery, herbarium, and an entomological collection. Practical exercises commence at 0630 hours on the Institute's compound. Students also obtain practical experience at the national forests and related facilities of the Forestry Division of Trinidad and Tobago. Exercises are arranged in collaboration with Divisional Staff and the specific lecturer, and will often coincide with ongoing operations. These are excellent opportunities for students to "do it themselves", and are regarded as an essential component of the course.

Table 1. –List of some species in the School of Forestry's Arboretum.

<i>Tabebuia rosea</i>	<i>Eugenia malaccensis</i>
<i>Anacardium occidentale</i>	<i>Mammea americana</i>
<i>Casuarina equisetifolia</i>	<i>Swietenia macrophylla</i>
<i>Ficus benjaminii</i>	<i>Manilkara bidentata</i>
<i>Delonix regia</i>	<i>Tabebuia serratifolia</i>
<i>Acacia mangium</i>	<i>Pinus caribaea</i>
<i>Cupressus lusitanica</i>	<i>Hibiscus elatus</i>
<i>Rollinia mucosa</i>	<i>Diospyros</i>
<i>Albizia lebbek</i>	<i>Eucalyptus deglupta</i>
<i>Leucaena leucocephala</i>	<i>Brysonima coriacea</i>
<i>Tectona grandis</i>	<i>Gmelina arborea</i>

Field Training

For five weeks of the vacation period, immediately following the first year programme, trainees are assigned to various sections of the Forestry Division and/or other natural resource agencies for “full time” hands-on-training. Objectives of this specific training include the following:

- to gain experience by actual practical involvement, and to apply the theoretical and practical knowledge gained during the first year, into real work situations;
- to develop a repertoire of knowledge and practical experiences to be used as a frame of reference for the course work to be undertaken in the second year;
- to discover as well as gain insight into the role and functions of a forester; and
- to observe and practice methods and techniques used by foresters in the performance of their duties and tasks, and to see how they would attempt to solve problems and surmount constraints.

The Research Project

Students are assisted in choosing research projects to be completed over the three terms of the second year. The topic selected must be researched, documented, analyzed and submitted in manuscript form, and be defended at an

oral inquiry. Consultation of, and reference to, pertinent literature is a continuous process throughout the project, and must be reflected in their final report/paper.

Some selected research projects completed by past students include the following:

- management plans for the ECIAF pine forests,
- interpretative plan for the Arboretum,
- comparative study of three provenances of *Pinus caribaea* at ECIAF,
- wildlife farming with *Dasyprocta*,
- the potential for recreation on ECIAF forests,
- an investigative study of the edge habitat of ECIAF's swamp lands,
- a study of three methods of bamboo regeneration,
- development of the herbal plot at ECIAF,
- the reproductive behavior of *Dasyprocta agouti* in captivity, and
- the propagation of *Azadirachta indica* seeds under local nursery conditions.

Entrance Requirements and Attendance

The academic requirements for admission to the Diploma programme are as follows: five GCE “O” level subjects or five CXC passes (or the equivalent), including English language, mathematics, and one science subject (except

Health Science). Previous experience in forestry is an asset, but is not a requirement for entry to the programme. Table 2 shows admissions (to the diploma program) for the period 1969 to 1996. During this period, approximately 20 women have graduated, this Institute constantly encourages women to apply. Many of our graduates now command very senior positions in natural resources agencies throughout the region. Additionally, others are pursuing degrees in various natural resources related fields, since the diploma is recognized by universities - here and abroad.

CERTIFICATE: FOREST RANGER AND GAME WARDEN

These certificate courses have been both one year programmes, and as indicated above, are not being offered this year. The Forest Ranger programme has been geared to provide technical and vocational skills at an intermediate level to the Forestry field staff who work under the direct supervision of sub-professional officers. Their duties are less managerial in nature, and they generally function within relatively narrow and fixed set of operational procedures and methods. As a consequence, training at this level has been geared to develop such skills and procedures through emphasis on practice and drills, with sufficient scientific theory to rationalize the meaning and purpose of the operations.

Entrance Requirements

The minimum entrance requirements to the Forest Ranger Certificate have been a primary school leaving certificate (or its equivalent) and three years of field experience in forestry or agriculture. Requirements for the wildlife course have merely stipulated experience in an appropriate wildlife unit. This level of academic attainment is usually adequate to ensure that the trainee is able to communicate effectively so as to conceptualize the scientific bases of forestry, and understand and follow the regulations and operational procedures that are encountered both in their training and, subsequently, on their job.

REFRESHER TRAINING

The School has, in the past (1988), scheduled one six-week refresher course for senior sub-professionals (Forester II and III's) from Trinidad and Tobago. This course emphasized Administration and Personnel Management, and Policy and Law, and various other activities involving these officers' daily responsibilities. Due to the success of this course, a request has been made to schedule another toward the end of 1996. Additionally, certain regional territories have expressed a desire for "short-term Certificate Courses" - of perhaps one to three months, and we are currently in the planning phase. Other activities contemplated include seminars and workshops on a range of topics in collaboration with the Caribbean Natural Resources Institute (CANARI) and the USDA Forest Service International Institute of Tropical Forestry (IITF) with whom we hope to maintain a fruitful relationship.

GENERAL ADMINISTRATION INFORMATION

Evaluation of Student Transcripts

The evaluation system prior to 1986 employed a "subject and paper structure". Transcripts were subsequently reported on an absolute percentage mark system with a number of subjects comprising a paper. Since September 1986, the Institute has adopted the Grade Point System of "evaluation with effect". This system evaluates on the following Letter Grade/Grade Point System (4.0 scale):

Letter grade	Numerical grade	Mark ratings
A	4.0	>80
B+	3.5	75-79
B	3.0	65-74
C+	2.5	60-64
C	2.0	50-59
F	0	<50

Table 2. –Forestry School (ECIAF) admissions (Diploma) 1969-1996.

Year	T+T	Jamaica	St. Lucia	Grenada	St. Vincent	Dominica	Antigua	Guyana	Belize	Total
1969-71	6				1					7
1970-72	11		1							12
1971-73	12	1		1						14
1972-74	10									10
1973-75	14									14
1974-76	9	1				1			1	12
1975-77	10					3				13
1976-78	14	4			1					19
1977-79	13	1								14
1978-80	14						1			15
1979-81	13		1							14
1980-82	9					1		2		12
1981-83	8		2							10
1982-84	7									7
1983-85										0
1984-86										0
1985-87										0
1986-88	2		1	1	1	1				6
1987-89	3		2			1				6
1988-90	3		2		1		1			7
1989-91										0
1990-92	2			3	2	1				8
1991-93	4				1					5
1992-94	11			1						12
1993-95	8	1	2							11
1994-96	3	3								6
1995-97	8	5								13
Total	194	16	11	6	7	8	2	2	1	247

Space Capacity

The limitation of classroom space dictates a limit of three classes, each with a maximum of 20 students attending at any one time. These facilities are normally utilized only during the Institute's academic year which runs from late September to early July. The vacation period of approximately two and one half months could be utilized for short courses.

Tuition Fees

Two year fee structure (fees are in TT dollars, TT\$5.9 = EC\$1.97, or US\$1).

Board, Lodging, and Tuition

Local students and students sponsored by

organizations in which
Trinidad and Tobago
participate (e.g., Carib
bean Community) \$8,100/year

British Common-
wealth students not
sponsored directly by
their governments,
and for all other
foreign students \$13,500/year

Subscription to
students' Guild 20

Subscription to Sports 40
Purchase of stationery 450

Contingency fees
(caution money)
(refundable, and paid
by students) 200

Immigration 100

Field training 600

Final year project
(approximate cost) 1,350

Insurance 24

Special equipment/
clothing (for field
work) 620

THE FUTURE

The publication An assessment of forestry and related environmental matters in the English - speaking Caribbean (Lackhan 1992) has identified the need for approximately 900 technical staff by the year 2000. This finding justifies the continued existence of training institutions like ECIAF. However, ECIAF recognizes the importance of graduating "quality products" - forestry sub-professionals who can function effectively in an increasingly challenging and dynamic environment. Forest managers must now balance and satisfy on one

hand, an increasing population with its associated impact on the finite resource base, and on the other, the ever more expanding list of commodities and services which people want from our forests (Brooks and Grant 1992). Graduates of the Diploma programme have often been placed in managerial posts, where they are required to identify suitable projects, and prepare a simple proposal, especially with community involvement. To cope with these additional training needs, it is proposed to introduce a variety of new subject areas as follows:

- project planning - identification, preparation and analysis, implementation, and evaluation of simple projects;
- co-management - to meet the changing cultural, social, and economic needs of our peoples; and
- social/ community urban forestry.

Areas to be strengthened will include Geographic Information Systems (GIS). Acquisition of laboratory equipment will be pursued, and additional training for staff. As can be seen from tables 3 and 4, the present curriculum is a "heavy" one, so that rationalization is necessary. Existing courses will be strengthened or expanded, or replaced to include these new areas of emphasis. However, great care will be taken to maintain core areas of training, such as silviculture, mensuration, and forest management, since these are some of the basic tools of the forest manager.

Keeping up with new knowledge presents a challenge, even to us at ECIAF, whom you have trusted with the important responsibility to train your students. For the natural resources based institutions, industries, and agencies, the problems of technical change are compounded by rapidly changing social, political, and economic values. The forest resources, for example, must be managed to produce a reasonable return on investments, provide a reliable source of raw materials, and at the same time provide a range of other services for an increasing list of "publics", who are now demanding a greater say in its management.

Finally, the Institute recognizes the following priority areas, which are included among specific goals and targets for the next seven years:

- increase in student admissions;
- upkeep of the physical plant;
- dormitory improvement - improve the present dormitory facilities to provide a better environment for learning;

- classrooms improvement - improve classroom conditions and provide modern teaching aids;
- increased library services - improve the present collection by providing texts and the required journals in forestry;
- support services, infrastructure, maintenance - improvement of buildings, offices, transport for field trips, kitchen and dining room facilities, etc.;

Table 3. -Year 1 Forestry Diploma course structure.

Course number	Course name	Credit rating (hours)		
		Theory	Practical	Total
104*	Botany I	2	3	3.5
105*	Botany II	2	3	3.5
106*	Farm Power Engineering	2	.5	2.5
107*	Genetics	2	0	2.0
108*	Geology and General Soils	2	0	2.0
118*	Sociology	2	0	2.0
119*	Soil Fertility and Plant Nutrition	2	1	2.5
150	General Forestry	2	0	2.0
151	Silviculture I	2	3	3.5
152	Mensuration I	2	3	3.5
153	Forest Machinery and Equipment	2	3	3.5
161	Silviculture II	2	3	3.5
162	Mensuration II	2	3	3.5
163	Dendrology	2	3	3.5
164	Wood Technology	2	3	3.5
171	Silviculture III	2	3	3.5
172	Photogrammetry	2	3	3.5
173	Forest Surveying	2	3	3.5
174	Introduction to Wildlife Conservation	2	3	3.5
175	Introduction to Parks and Recreation	2	3	3.5
176	Herbarium	1	1	1.5
177	Agroforestry	2	0	2.0
178	Report Writing	1	0	1.0
179	Forest Economics	2	0	2.0
286	Disaster Preparedness	1	0	1.0
Total		47	44.5	

*Common courses with agriculture.

Table 4. –Year 2 Forestry Diploma course structure.

Course number	Course name	Credit rating (hours)		
		Theory	Practical	Total
250	Field Training			4.0
251	Silviculture Systems	2	3	3.5
252	Forest Management I	2	3	3.5
253	Forest Policy and Law	2	0	2.0
254	Wildlife Management	2	3	3.5
256	Watershed Management I	2	3	3.5
257	Research Practices	2	0	2.0
260	Research Project	5	6	8.0
262	Forest Management II	2	3	3.5
263	Administration and Personnel Management I	2	0	2.0
266	Watershed Management II	2	3	3.5
268	Forest Engineering I	2	3	3.5
269	Fire Protection	2	3	3.5
270	Forest Influences	2	0	2.0
273	Administration and Personnel Management II	2	0	2.0
274	Forest Utilization	2	3	3.5
275	Recreation Management	2	3	3.5
277	Introduction to Computer Sciences	2	3	3.5
278	Forest Engineering III	2	3	3.5
279	Forest Entomology and Pathology	2	3	3.5
280	Environmental Conservation	3	0	3.0
281	Library Sciences	1	0	1.0
282	Aquaculture	2	1	2.5
283	Geographical Inventory Systems/ Remote Sensing	2	1	2.5
284	Natural Forest Management	2	3	3.5
285	Trends and Development of Forestry in the Caribbean	1	0	1.0
286	Disaster Preparedness	1	0	1.0
287	Technical Reporting	1	0	1.0
Total		54	50	

- computerization - the provision of up-to-date technology for the teaching programme, etc.; and
- staff training and recruitment.

ACKNOWLEDGMENTS

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254	Wildlife Management	2	3	3.5
256	Watershed Management I	2	3	3.5
257	Research Practices	2	0	2.0
260	Research Project	5	6	8.0
262	Forest Management II	2	3	3.5
263	Administration and Personnel Management I	2	0	2.0
266	Watershed Management II	2	3	3.5
268	Forest Engineering I	2	3	3.5
269	Fire Protection	2	3	3.5
270	Forest Influences	2	0	2.0
273	Administration and Personnel Management II	2	0	2.0
274	Forest Utilization	2	3	3.5
275	Recreation Management	2	3	3.5
277	Introduction to Computer Sciences	2	3	3.5
278	Forest Engineering III	2	3	3.5
279	Forest Entomology and Pathology	2	3	3.5
280	Environmental Conservation	3	0	3.0
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282	Aquaculture	2	1	2.5
283	Geographical Inventory Systems/ Remote Sensing	2	1	2.5
284	Natural Forest Management	2	3	3.5
285	Trends and Development of Forestry in the Caribbean	1	0	1.0
286	Disaster Preparedness	1	0	1.0
287	Technical Reporting	<u>1</u>	<u>0</u>	1.0
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ACKNOWLEDGMENTS

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(10 years as Assistant Director) has helped to lay a solid foundation for the School's progress and initiatives. Additionally, Ms. Marva Carter, the Secretary from the inception of the School, has continued to contribute invaluable services. Finally, acknowledgment is given to the Director, Mr. Aldwyn Bart, who provides unstinting direction and support so essential to our present and future successes.

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FORESTRY ACTIVITIES IN THE CARIBBEAN BASIN WITH EMPHASIS ON GRENADA

Peter L. Weaver

INTRODUCTION

The Caribbean islands, with their small land masses, high population densities, and continual pressures on existing forest resources, face similar challenges. Since 1982, the US Department of Agriculture, International Institute of Tropical Forestry has sponsored biennial Caribbean Foresters meetings to discuss critical issues relating to the conservation of natural resources and forest management. These events have been attended by forestry officials, environmental groups, guest speakers, and observers from the Caribbean Basin and mainland areas.

The purpose of this report is to highlight the success of recent regional projects that were developed in conjunction with several Forest Departments, local non-government agencies, Peace Corps volunteers, the Island Resources Foundation, and the IITF. These projects, supported with limited funds, were conceived and designed to conserve existing forest resources and develop new ones.

FORESTRY ACTIVITIES IN GRENADA

Grenada, the spice island, noted for its export of nutmeg, mace, cloves, and cinnamon, was discovered by Columbus on August 15, 1498. The country, located at the southerly end of the Windward Island archipelago, occupies 345 km², 90 percent of which is the main island. The remainder consists of offshore islands and the Grenadines which extend northward towards St. Vincent. Grenada's mountainous interior is rugged, rising to 840 m at Morne St. Catherine in the north-central mountains (fig. 1). In the south-central mountains, several peaks such as Mt. Qua Qua, Mt. Sinai, and Southeast Mountain, all over 700 m, surround old crater basins, one of which, Grand Etang, contains a lake.

Grenada's climate is tropical and is strongly influenced by the northeast trade winds. Rainfall increases and temperature declines with elevation forming a series of concentric zones ranging from hot, humid shorelines to cool, wet interior mountains. Annual rainfall varies from 1000 mm at Point Saline on the island's southwestern tip to nearly 4000 mm at Grand Etang in the south-central mountains. Grenada, lying south of the Caribbean hurricane belt, experienced only one hurricane during modern times - Janet in 1955. Gale force winds and heavy rain, however, were felt seven times between 1768 and 1921.

At the time of discovery, Grenada was covered by numerous vegetation types (fig. 1): (1) mangrove woodlands along sheltered coastal bays; (2) cactus scrub, mainly on dry peninsulas along the south coast; and (3) deciduous seasonal forest encircling the island near sea level. Ascending the mountains, several other forest types grow in a concentric arrangement (4) evergreen and semi-deciduous seasonal forests at relatively low elevations; (5) lower montane rain forest and montane rain forest occupying the central mountains at intermediate to high elevations; (6) palm forest on steep slopes near the mountain summits; and (7) elfin woodland on the highest, wind-swept peaks.

Like many other islands in the West Indies, Grenada's history has been quite eventful. French colonization began in 1650 and soon extirpated the Carib occupants. The last of these Indians perished by jumping off a cliff into the sea rather than submit to the foreign domination. The incident is commemorated by the town name "Sauteurs" (French for jumper) located on the north coast. During the 18th century, continuous skirmishes between the French and English resulted in numerous political changes.

FOREST TYPES

-  Elfin
-  Palm
-  Lower montane rain
-  Semi - evergreen
-  Deciduous
-  Cactus
-  Mangrove

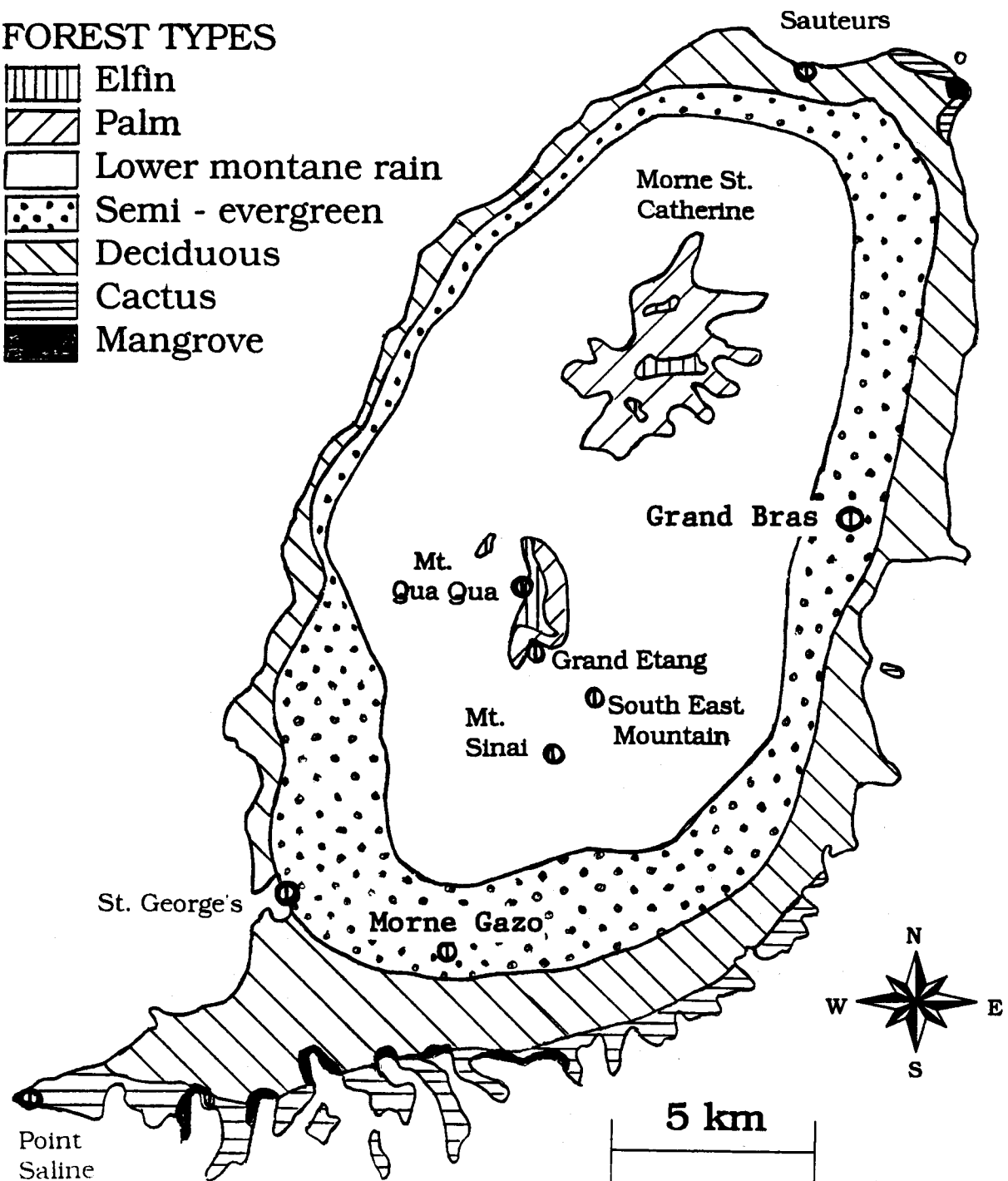


Figure 1. -Map of Grenada's original vegetation and location of places mentioned in text.

Population growth and agriculture have greatly altered all of Grenada's natural vegetation below 300 m in elevation. The first introduced crops, tobacco and indigo, were later supplemented by sugar, cotton, and coffee, and finally by cacao and nutmeg. Today, nutmeg and cacao predominate, but bananas, coconuts, citrus, mango and other fruits, sugar, and vegetables are grown throughout the island. Only 3 percent of Grenada's original forests remain intact, mainly at high elevations in the central mountains.

In 1957, two years after Hurricane Janet, major efforts were initiated to reforest upland watersheds (Weaver 1989). During the next 30 years, five timber species were planted on 166 ha at six main locations. The principal species used were *Hibiscus elatus* Sw. (blue mahoe) and *Pinus caribaea* Morelet (Caribbean pine).

Grenada, with slightly more than 100,000 inhabitants (nearly 300/km²), faces problems typical of the region—high costs for imported products including wood, and underemployment. Greater emphasis on forestry with its linkages to rural areas and unskilled labor is viewed as one means to alleviate these problems. Three major forestry projects were implemented in Grenada during the 1990's. These activities, conceived and developed in cooperation with the staff of the local Forestry Department, have been coordinated through US Peace Corps volunteers working on the island.

Forest Conservation

Grenada's landscape is dominated by subsistence agriculture comprised mainly of exotics such as nutmeg, cacao, coconut, mango, and other introduced fruit trees. Lowland remnants of the island's pre-Columbian vegetation are few and highly degraded. However, 50 years ago on one of his many excursions, Beard (1949) encountered an area with "scrub woodland" that contained more than 30 native tree species, among them: *Tabebuia pallida* (Lindl.) Miers (white cedar), a tree prized locally for boat building; *Cedrela odorata* L. (Spanish cedar) and

Buchenavia capitata (Vahl.) Eichl. (yellow sanders), valuable cabinet woods; *Manilkara bidentata* (A. DC.) Chev. (bullet), an important construction wood; *Pimenta racemosa* (Mill.) J.W. Moore (bay-rum-tree), a species whose leaves and twigs provide an essential oil; *Ormosia menosperma* (Sw.) Urb. (locally, L'angelin), a species whose seeds are strung and worn as necklaces; and *Rapaula montana* Aubl. (locally, bois bonde), highly regarded as an aphrodisiac.

The area, Morne Gazo (also called Delice Hill), is only 15 minutes from the capitol city of St. George's. Occupying a steep, exposed hilltop ranging from 240 to 335 m in elevation, this 10 ha parcel of government land escaped cultivation. Encroachment, however, remains a constant threat. Today, the largest trees on Morne Gazo approach 25 m tall and form the only extensive mature stand of semi-deciduous forest known in Grenada (fig. 2). The area provides a rare glimpse into the island's past before the arrival of settlers. The relatively small hilltop also supports a diverse avifauna containing at least 11 bird species (Wunderle 1985). Recently, the area was set aside for recreation and environmental education thus protecting Morne Gazo's relict forest and wildlife.

The development of the Morne Gazo Nature Trail involved numerous activities such as (1) explaining the project to local residents; (2) designing and building a trail covered with nutmeg shells; and (3) installing interpretative signs highlighting the reserve's important tree species, wildlife, and attractive vistas. Regular monitoring of the reserve and the production of a visitor's brochure are scheduled once the trail is opened to the public.

Mahogany Line Planting

On a worldwide basis, secondary forests now cover an area 1.1 times the size of Brazil and 1.2 times the size of Argentina within the American tropics (Weaver 1995). Enrichment planting—the introduction of timber species into degraded woodlands—is one management alternative available to make these lands more



Figure 2. -Alan Joseph, Forestry Department Head, in a clump of large white cedar along the Morne Gazo nature trail.

productive. About 25 tree species have proved suitable using this method (Weaver 1986). In Puerto Rico, a mahogany hybrid was successfully tested in conversion line plantings on more than 600 ha in the Caribbean National Forest (Weaver and Bauer 1986).

In Grenada, secondary forests, many temporarily abandoned as fallow, are found scattered throughout the island. On portions of Grenada's model farms, however, some parcels have been abandoned for many years. One such area was located at Gran Bras Estate in the east-central part of the island.

Seed collection, nursery production, site selection, and removal of large, poorly formed trees, all preceded line clearing and planting. At the beginning of the rainy season, planting was carried out on 1.2 ha using spacings of 11 m between the lines and 2 m between the seedlings within the lines. Weeding in the lines and vine cutting was done once every 3 months for 1.5 years when the first assessment was made.

The results were very encouraging (fig. 3). Saplings averaged 2.7 m tall and ranged between 0.5 and 5.8 m tall (Frederick 1994). When partitioned by height class, 40 percent were between 2.0 and 2.9 m tall, and 35 percent exceeded 3.0 m in height. Slightly more than half of the stems were infested by *Hipsiphylla grandella* (mahogany shoot borer) but most recovered well.

Tending, it appears, is no longer required for most of the area. With future thinnings in 5 years or so, the growth of these mahoganies may equal or exceed those in Puerto Rico where nearly 300 m³/ha of total standing volume were produced in 20 years (Weaver and Bauer 1986). A planting program designed to reforest with commercial timbers could substantially reduce Grenada's imports and provide much needed rural employment.

Grand Etang Demonstration Plots

The wind swept and rain drenched slopes and summits of Grand Etang near the Crater



Figure 3. -*Quentin Holden, Peace Corps volunteer, and line planted mahogany 18 months after planting on the Grand Bras model farm.*

Lake offer spectacular vistas and contain the best examples of lower montane forest, montane forest, and elfin woodland in Grenada. The visitor information center, initiated in 1985 as part of a United States Agency for International Development (USAID) project, provides a panorama of these vegetation types from its patio. The center highlights several of Grenada's important natural areas but offers little information on composition, structure, or dynamics of the forests that it overlooks.

To facilitate a greater understanding of the vegetation at Grand Etang, two plots were established, a 0.4 ha plot in lower montane and a 0.1 ha plot in montane forest. The heights and diameters of all trees more than 4 cm in dbh were measured, and each tree was identified to species and permanently tagged. These data may be used to describe stand structure and species composition; future measurements will provide information on growth rates and stand changes as well as response to major climatic

events. The newly established plots have already been instrumental in the Forestry Department's management program. Several biologists interested in the foraging behavior of the area's wildlife find the labeled trees useful in their studies.

ELSEWHERE IN THE CARIBBEAN BASIN

The conservation and reforestation projects in Grenada were components of a regional program. Natural forest conservation projects were also developed in Antigua and Montserrat and reforestation projects in the Dominican Republic, Montserrat, and Venezuela.

Forest Conservation

Antigua

Antigua is relatively flat and dry but has scenic viewpoints and patches of moist forest along the south coast. The Wallings dam and spillway, excellent examples of Victorian industrial architecture constructed around 1890, highlight some of the island's earlier history. Surrounded by advanced secondary forest, the reservoir site contrasts with the remainder of the island which is characterized by agriculture and human settlement (Mackler and Hannah 1988). Numerous trails permeate the area, one descending along a scenic route to Rendezvous Bay on the south coast.

Conservation of the Walling's Reservoir area and the development of a nature trail are projects that were conceived by an advisory committee comprised of several local entities including the Forestry Department, the Environmental Awareness group, the Historical and Archeological Society, National Parks and Recreation, and the Tourism Department. All of these groups worked in conjunction with the Island Resources Foundation on St. Thomas, US Virgin Islands. The aim of the project is to protect and manage the Wallings forest and its wildlife resources through environmental education and ecotourism. The management plan contains maps of vegetation, wildlife habitats, property boundaries, scenic viewpoints, and trails. Interpretative signs and a nature trail

brochure will be prepared when the area is opened to the public.

Montserrat

Montserrat, the emerald isle of the Caribbean, was named by Columbus in 1493 and settled in the 1600's by the Irish, an event reflected in many of the island's place names. The Montserrat Forestry Department, the National Trust, and the Tourism Board, working in conjunction with Island Resources Foundation, implemented two projects on Montserrat. The first was the reopening of Galway's Nature Trail which stretches for 5 km along the south coast between Mefraimie ghaut and the fumaroles at Galway's soufriere. A spectacular view of the rugged east coast from the abandoned mill at Roche's Estate make the hike along this trail a memorable experience. The project included trail clearing and improvement, benches at rest stops, interpretative signs, modest fees for trail maintenance, and brochures outlining the cultural, historic, and scenic resources found along the trail. The second project involved the planting of multiple use tree species on three government estates: Galway's, Broderick, and Hermitage.

Line Planting

Dominican Republic

Local residents working along with the Peace Corps reforested 15 ha of recently abandoned farmland in the area around Cotui in the Dominican Republic. The main species planted were *Acacia mangium* Willd. (mangium), *Eucalyptus deglupta* Blume (bagras), *Swietenia macrophylla* King (big leaf mahogany), *Swietenia mahagoni* Jacq. (West Indian mahogany), *Simaruba glauca* DC. (locally, Juan Primero), and *Guarea guidonia* (l.) Sleumer (American muskwood). A preliminary survey of the plantations after one year showed satisfactory results (Escaño 1994).

Venezuela

In the Tipocoro Forest Reserve, Venezuela, 20 ha of degraded secondary forest were line

planted in a cooperative program with the Venezuelan Forest Service (SEFORVEN). *Swietenia macrophylla* and *Cordia alliodora* (Ruiz & Pav.) Oken (local name, pardillo) were planted in 20 x 2 m spacings. Because of the prevalence of the mahogany shoot borer in Tipocoro, each mahogany seedling was separated by 14 pardillo seedlings. A preliminary field check indicated satisfactory survival in most areas.

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