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**COUNTRY  
ENVIRONMENTAL  
PROFILE**

Prepared Under the Aegis Of:

**THE CARIBBEAN CONSERVATION ASSOCIATION**  
St. Michael, Barbados

On Behalf Of:

**THE GOVERNMENT OF ANTIGUA AND BARBUDA**  
Historical, Conservation, and  
Environmental Commission

With the Technical Support Of:

**THE ISLAND RESOURCES FOUNDATION**  
St. Thomas, U.S. Virgin Islands

And

**THE ENVIRONMENTAL AWARENESS GROUP**  
St. John's, Antigua

Funding Provided By:

**THE U.S. AGENCY FOR INTERNATIONAL DEVELOPMENT**  
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Bridgetown, Barbados

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## Abbreviations Used In The Country Environmental Profile

ac	acre	kW	kilowatt
AF	acre-feet	kWh	kilowatt-hour
BOD	biochemical oxygen demand	lb	pound
cm	centimeter	m	meter
COD	chemical oxygen demand	MG	million gallons
EC\$	Eastern Caribbean Dollar	MG/A	million gallons per acre
ft	foot	MG/D	million gallons per day
g	gram	MG/M	million galls per month
gpd	gallons per day	mi	mile
ha	hectare	ML	millions of liters
in	inch	ml	milliliter
kg	kilogram	mm	millimeter
km	kilometer	MW	megawatt
kn	knot	US\$	American Dollar
kV	kilovolt		(US\$1.00 = EC\$2.67)

## Conversion Coefficients Between Imperial Measures and Weights And The Metric System

	<u>Imperial</u>	<u>Metric System</u>
LENGTH	1 inch	2.540 centimetres
	0.39370 inch	1 centimetre
	1 yard	0.91440 metre
	1.094 yards	1 metre
	1 mile	1.609 kilometres
	0.6214 mile	1 kilometre
	1 fathom (6 feet)	1.829 metres
AREA	1 square foot	0.093 square metre
	10.6 square feet	1 square metre
	1 acre	0.405 hectare
	2.471 acres	1 hectare
	1 square mile	2.59 square kilometres
	0.386 square mile	1 square kilometre
VOLUME	1 pint	0.568 litre
	1.76 pints	1 litre
	1 gallon	4.546 litres
	0.220 gallon	1 litre
	1 cubic foot	0.028 cubic metre
	35.31 cubic feet	1 cubic metre
WEIGHT	1 pound	0.4536 kilogram
	2.205 pounds	1 kilogram
	1 long ton	1016 kilograms
	1 short ton	907.185 kilograms
	0.9842 long ton	1 tonne (1,000 kilograms)
	1.102322 short ton	1 tonne (1,000 kilograms)
	TEMPERATURE	Conversion F to C: subtract 32 and divide by 1.8

**ACRONYMS USED IN  
THE ANTIGUA and BARBUDA COUNTRY ENVIRONMENTAL PROFILE**

<b>AHTA</b>	Antigua Hotel and Tourism Association
<b>ALICS</b>	Antigua Livestock Improvement Cooperative Society
<b>APUA</b>	Antigua-Barbuda Public Utilities Authority
<b>BDD</b>	British Development Division
<b>CANARI</b>	Caribbean Natural Resources Institute (formerly ECNAMP)
<b>CAPS</b>	Caribbean Advisory and Professional Services
<b>CARDATS</b>	Caribbean Agricultural Rural Development Advisory and Training Service
<b>CARDI</b>	Caribbean Agricultural Research and Development Institute
<b>CARICOM</b>	Caribbean Community
<b>CBH</b>	Central Board of Health
<b>CCA</b>	Caribbean Conservation Association
<b>CDB</b>	Caribbean Development Bank
<b>CEHI</b>	Caribbean Environmental Health Institute
<b>CEP</b>	Country Environmental Profile
<b>CERMES</b>	Center for Resource Management and Environmental Studies (UWI)
<b>CFA</b>	Cooperative Farmers Association
<b>CHAPA</b>	Central Housing and Planning Authority
<b>CIDA</b>	Canadian International Development Agency
<b>CIDE</b>	Center for International Development and Environment
<b>CITES</b>	Convention on International Trade of Endangered Species of Wild Flora and Fauna
<b>CMC</b>	Central Marketing Corporation
<b>CTO</b>	Caribbean Tourism Organization (formerly Caribbean Tourism Research and Development Center)
<b>CXC</b>	Caribbean Examinations Council
<b>CZM</b>	Coastal Zone Management
<b>DCA</b>	Development Control Authority
<b>DFS</b>	Deutsche Forstinventur Service
<b>EAG</b>	Environmental Awareness Group
<b>ECCB</b>	Eastern Caribbean Central Bank
<b>ECLAC</b>	Economic Commission for Latin America and the Caribbean (United Nations)
<b>ECNAMP</b>	Eastern Caribbean Natural Area Management Program (renamed 1989 as Caribbean Natural Resources Institute, CANARI)
<b>EEC</b>	European Economic Community
<b>EEZ</b>	Exclusive Economic Zone
<b>EDF</b>	European Development Fund
<b>EIA</b>	Environmental Impact Assessment
<b>EPU</b>	Economic Planning Unit
<b>FAO</b>	Food and Agriculture Organization of the United Nations
<b>GDP</b>	Gross Domestic Product
<b>GIS</b>	Geographic Information System
<b>GOAB</b>	Government of Antigua and Barbuda (found in the Bibliography under Antigua and Barbuda Government)
<b>GTZ</b>	German Agency for Technical Co-operation (Deutsches Gessellschaft fur Technische Zusammenarbeit)
<b>HAS</b>	Historical and Archaeological Society of Antigua and Barbuda
<b>HCEC</b>	Historical, Conservation and Environmental Commission
<b>IDB</b>	Industrial Development Board

IICA	Inter-American Institute for Cooperation on Agriculture
IMF	International Monetary Fund
IRF	Island Resources Foundation
IUCN	International Union for Conservation of Nature and Natural Resources
LAC	Latin America and the Caribbean
MAB	Museum of Antigua and Barbuda
NDNP	Nelson's Dockyard National Park
NGO	Non-Government Organization
NPA	National Park Authority
NRAD	Natural Resources Assessment for Agricultural Development (OAS)
OAD	Organization for Agricultural Development
OAS	Organization of American States
ODA	Organization for Agricultural Development
OECS	Organization of Eastern Caribbean States
OECS-NRMP	Organization of Eastern Caribbean States-Natural Resources Management Project
PAHO	Pan American Health Organization
PCB	Pesticide Control Board
PPO	Physical Planning Office
PWD	Public Works Department
RAMSAR	Convention on Wetlands of International Importance Especially as Waterfowl Habitat
REMS	Regional Environmental Management Specialist (USAID)
SFA	Small Farmers Association
SJDC	St. John's Development Corporation
TFR	Total Fertility Rate
VSO	Voluntary Service Overseas
UK	United Kingdom
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
US	United States
USAID	U.S. Agency for International Development
USAID/RDO/C	U.S. Agency for International Development/ Regional Development Office/Caribbean
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USMAB	U.S. Man and the Biosphere Program
UWI	University of the West Indies
WHO	World Health Organization
WWF	World Wide Fund for Nature (International)
WWF-IJS	World Wildlife Fund (U.S.)

## INTRODUCTION

Preparation of Country Environmental Profiles (CEPs) has proven to be an effective means to help ensure that environmental issues are addressed in the development process. Since 1979, the U.S. Agency for International Development (USAID) has supported Environmental Profiles in USAID-assisted countries. Those completed to date have provided:

(1) a description of each country's natural resource base, including a review of the extent and economic importance of natural resources and changes in the quality or productivity of those resources;

(2) a review of the institutions, legislation, policies and programs for environmental planning, economic development and natural resource management;

(3) identification of the major issues, conflicts or problems in natural resource management and opportunities for effective responses.

Profiles have highlighted gaps in the existing information base, suggested new guidelines for the design and funding of development programs, pinpointed weaknesses in regulatory or planning mechanisms, and illustrated the need for changes in policies. Most importantly, the process of carrying out a profile project has in many cases helped establish new working relationships and even consensus among government and non-government bodies concerned with environmental issues and has also served to strengthen local institutions and to improve their capacity for incorporating environmental information into development planning.

### PROFILES FOR THE EASTERN CARIBBEAN

Country Environmental Profiles have been prepared for several countries in the Wider

Caribbean Region, including Panama, Belize, the Dominican Republic, Haiti, and Jamaica. The potential utility of CEPs in the Eastern Caribbean sub-region (essentially the OECS countries) has been a subject of discussion since the early 1980's. The need for the profiling process to begin in those countries was reaffirmed during a seminar on Industry, Environment and Development sponsored by the Caribbean Conservation Association (CCA) and the University of the West Indies in August 1986.

Shortly thereafter, USAID entered into a Cooperative Agreement with CCA for preparation of a series of CEPs for the Eastern Caribbean. It was decided to begin the profile process in the country of St. Lucia as a pilot project, to be followed by profiles for Grenada, Antigua-Barbuda, Dominica, St. Kitts-Nevis, and St. Vincent and the Grenadines.

Early in 1987, CCA and the Island Resources Foundation (IRF), of St. Thomas, U.S. Virgin Islands, entered into an agreement whereby it was determined that IRF would provide technical assistance and support to CCA in the execution of the profile project in the Eastern Caribbean. The Executive Director of the Caribbean Conservation Association is the CEP Project Director, while the President of the Island Resources Foundation serves as CEP Project Manager/Team Leader.

### THE ANTIGUA-BARBUDA COUNTRY ENVIRONMENTAL PROFILE

Early in 1990 a Memorandum of Understanding (MOU) was signed by CCA and the Government of Antigua and Barbuda (GOAB) for the purpose of executing a Country Environmental Profile, with the Historical, Conservation and Environmental Commission (HCEC) selected as the counterpart agency for Government. The members of the Commission were designated to serve as the CEP National Committee for the Antigua-Barbuda Profile Project. At the same time, the Antigua Environmental Awareness Group (EAG), a local non-govern-

mental organization, was designated by CCA and GOAB as the local implementing and coordinating group for the CEP project in Antigua-Barbuda.

The CEP National Committee was called on to support the project in a variety of ways, most importantly in helping to identify environmental issues, to obtain reference materials, and to coordinate and assist with the in-country review of materials prepared by the CEP technical writing team. A broad spectrum of individuals was selected locally to participate in the review of the Profile, on a chapter-by-chapter basis.

The headquarters of the Environmental Awareness Group at the National Museum of Antigua and Barbuda in St. John's also served as the headquarters of the CEP Project. The staff and members of EAG were most supportive of the project and greatly facilitated completion of the report within what was a very demanding time frame. During the course of the CEP project, a significant collection of environmental reference materials on Antigua-Barbuda and the Eastern Caribbean was made available at the offices of EAG. This collection will remain in the country and can form the nucleus of an important environmental library or information center to serve the community long after the completion of the Profile Project.

The draft Profile Report was prepared during a three month period, June - August, 1990, with draft chapters circulated to in-country reviewers for comments and input as each was readied by the CEP technical team. The full CEP document, in "draft final" format, was completed in September and disseminated for final review both in Antigua-Barbuda and to other reviewers in the Caribbean region.

## **ORGANIZATION OF THE ANTIGUA-BARBUDA CEP REPORT**

As determined by the Antigua-Barbuda CEP National Committee and the IRF technical writing team, the Country Environmental Profile has been organized in ten primary sections. Each sector-specific section provides the reader with an overview summary of the

sector, reviews key environmental problems and issues within the sector, and concludes with recommendations specific to that sector.

A SYNTHESIS OF POLICY ISSUES AND RECOMMENDATIONS precedes the sector-specific sections and provides a summary and synthesis of critical environmental issues, conclusions, and recommendations.

SECTION ONE provides background information on the general environmental setting of the country and briefly reviews historical, economic and demographic features.

SECTION TWO is a review of the country's land resource base, including a discussion of primary environmental issues within three key resource sectors: agriculture and forestry, freshwater and watersheds, and biodiversity and wildlife. SECTION THREE turns to a discussion of the coastal and marine environment.

The Profile moves away from an examination of the physical environment to consider first energy and industry issues in SECTION FOUR, while focusing more specifically on the tourism industry in SECTION FIVE. Pollution and environmental health are the subjects of SECTION SIX.

The related topics of land use, physical planning, and development control are examined in SECTION SEVEN. SECTION EIGHT considers issues related to park planning and protected areas management, while SECTION NINE focuses specifically on the management of historical and cultural resources.

The subject of SECTION TEN is the institutional framework for environmental management in Antigua-Barbuda, including an overview of key agencies and organizations with resource management responsibilities.

A comprehensive bibliography of source materials dealing with natural resource development and environmental management is found at the end of the Profile. Most references cited deal specifically with Antigua-Barbuda or with the Eastern Caribbean sub-region. It is the most thorough assemblage of

such reference material on Antigua-Barbuda to be published to date.

The objective of the Country Environmental Profile project in Antigua-Barbuda has not been to prevent or obstruct development but rather to provide another kind of comprehensive planning tool for the country, one which stands as an updated addendum to economic planning documents. At the same time, the CEP seeks to inform and guide local discussion and debate about development priorities and to encourage identification of more sustainable development strategies for the

long term. The Environmental Profile attempts to draw attention to gaps in the country's information base, to identify critical problem areas and to suggest options for addressing these problems. An important related objective is to improve the country's capacity for incorporating environmental concerns in the development planning process early enough to avoid the risks and eventual costs associated with growth strategies which ignore or pay little attention to such considerations.

## SYNTHESIS OF POLICY ISSUES AND RECOMMENDATIONS

The critical environmental issues identified in this Country Environmental Profile will not surprise those who know Antigua and Barbuda well -- at the same time, there is little room for complacency. There is in fact cause for concern, which has been articulated in various forums long before the current CEP project began. Ironically, one of the most serious reasons for concern is that quite a bit is known about existing and/or potential environmental problems in the country, but the telling harbingers or early warning signs have not generally received the attention they deserve; nor have resources been systematically applied to develop either preventive or remedial strategies.

This synthesis does not attempt to fully summarize an almost 200-page Profile because the sector-specific sections of the CEP (sections two through ten) already provide concise "Overview", "Problems and Issues", and "Policy Recommendations" subsections for each resource or management sector. Rather, a smaller group of critical environmental issues and recommendations -- more national and less sectorial in scope -- have been singled out and presented in this synthesis. There is a risk in doing this, for any issue (or cluster of issues) should not be considered in isolation. There are important linkages between sectors, and the interrelatedness of both natural and human elements within ecosystems constitutes an important concept and challenge for the Antiguan-Barbudan resource manager.

Solutions generally require inter-disciplinary and inter-ministerial/departmental cooperation and coordination; they are seldom as neat and orderly as their presentation in list form would suggest. Furthermore, a complex problem will appear, and in fact will prove, intractable until it is attacked creatively, aggressively and simultaneously by both government and private sector entities working together more or less as partners. One of the purposes of the Country Environmental Profile Project in Antigua-Barbuda has been to open up such avenues of dialogue in the search for workable solutions.

Under the best of circumstances, this first Antigua-Barbuda Environmental Profile could be seen as an immediately useable agenda for the Government's Historical, Conservation, and Environmental Commission, from which it could develop an action program of its own for presentation to Cabinet.

Additionally, the Profile could also be seen strategically, i.e., as a comprehensive planning document and a first step leading to the design and implementation of a *national conservation strategy* or its equivalent. At the very least, the document stands as an updated addendum to the country's national planning documents and provides new environmental guidelines for its ongoing public sector investment program. What is most needed at this juncture is a policy framework and a schedule of implementation.

(1) **DEVELOPMENT PLANNING  
AND CONTROL**

Inadequate development planning and control represent the greatest environmental threats, and arguably also the greatest socio-economic threat, to the country. Currently, there is no requirement -- and limited opportunity -- for systematic coordination across departmental lines in the physical planning and developmental control process.

The problems arising from inadequate development planning and control are exacerbated because of the magnitude and rate of change affecting the country. Within the course of one generation the economic and social underpinnings of Antigua and Barbuda have changed dramatically, transforming the country from a rural-based/agricultural society to a tourism-dominated modern society. An important similarity is that the economy has moved from a reliance on one export crop (sugar) to an equally risky overdependency on one economic sector (tourism). The tourist sector supplies some 60 percent of GDP and, despite attempts to diversify the economy, this percentage can be expected to increase in the next decade. Government is aware of the risks associated with this new "monoculture", but it has not yet taken the steps to safeguard the natural resource base upon which the tourism sector depends. Sand mining continues at an unsustainable pace, human and industrial wastes threaten the quality and safety of marine recreational areas, and hotels and condominiums multiply in coastal areas without careful consideration of infrastructural requirements or the potential environmental implications of such development.

Many countries in the world, irrespective of their size or economic status, have recognized the necessity of good land use planning. It could be argued that the importance of planning is inversely related to a country's size and GDP, i.e., in smaller, less wealthy countries like Antigua-Barbuda, there is little margin for error and fewer funds available to remedy the mistakes of ill-planned schemes and strategies. For example, the resort developments underway and proposed for Barbuda would, over the next five

years, alter a significant percentage of the island's wetlands and coastal environment; and, at full occupancy, these resorts would increase the number of people on the island by nearly 40 percent. It is difficult, perhaps impossible, to imagine a proportionately comparable level of change in a larger continental country such as Canada or the United States for a comparable time-frame. Yet, no real assessment has been done to examine potential environmental or social impacts of resort development on the environmental well-being of the island or the quality of life of its residents.

The dangers are compounded by Antigua and Barbuda's stressed economy, which limits the country's options to address social or environmental problems that might arise from development activities. It cannot easily reallocate from within the national budget the millions of dollars that could be needed to alleviate development-related crises. Antigua and Barbuda, like most small islands, is less able to afford the consequences and costs associated with poor planning decisions.

**\* Recommendation.** Government needs to establish a *process* for development planning that will ensure that appropriate agencies are informed of, and can provide technical input into, proposed development activities at the very earliest stages of project planning and evaluation, particularly for major development activities. The Board of the Development Control Authority (DCA) -- Government's intended "clearinghouse" for the review of development proposals -- needs to be strengthened by providing better inter-agency representation in the application review and development control process. The Physical Planning Office, which provides staff for the Development Control Authority, needs to be upgraded and its staff enlarged. Consideration should be given to providing the PPO with more substantive environmental planning and environmental protection functions.

**\* Recommendation.** One means for more effective and regular coordination among resource management, development control and land use planning agencies rests

with the newly-established Historical, Conservation and Environmental Commission. The Commission has not yet been given an official mandate or terms of reference. At the very least, the Commission should be vested with sufficient authority and provided with a staff to vet critical development/environment issues, to bring into that process a broad cross-section of appropriate government and non-government technical persons, and to make recommendations to appropriate decision-making authorities on its findings.

Consideration should also be given to providing the Commission with substantive coordination/integration responsibilities, both for recommending environmental policy across departmental lines and for establishing procedures for monitoring the environmental impacts of development activities, particularly when these responsibilities are shared by more than one GOAB agency or are not clearly defined in existing legislation. Improved coordination is one of the most critical institutional issues confronting Antigua-Barbuda in the resource management sector, and the HCEC has the potential for establishing more effective and regular coordination by Government agencies with resource management, environmental protection, physical planning and development control responsibilities.

**\* Recommendation.** Legislation is needed to require the preparation of Environmental Impact Assessments for all major development projects (public or private sector), especially those within the coastal zone, within the boundaries of designated protected areas, or affecting other critical areas. An institutional capability for interpreting, and later carrying out, the technical aspects of impact assessment needs to be created within the Physical Planning Office and other appropriate GOAB agencies. Private developers of large projects or projects affecting environmentally sensitive areas should be required to bear the costs of preparing impact assessments.

**\* Recommendation.** A national land use plan needs to be prepared, focussing on the achievement of sustainable development over the long term. The plan should guide

future development into areas which are best suited for particular kinds and densities of land use -- based on physical and ecological constraints as well as national social and economic priorities. Preparation of land use maps should be the initial step in the process of designing a land use and growth management plan for the country.

## (2) *PARKS AND PROTECTED AREAS*

Currently, there is only one officially designated, actively managed park in the country -- Nelson's Dockyard National Park in Antigua. However, management efforts are principally directed at the regulation and support of business activities within the Park. The Park's permanent staff lack adequate training in resource or park management, and therefore the Park's biological, historical and cultural components are not being properly preserved, protected, or managed at the present time. Two marine parks have been established under existing legislation, but they are not managed or protected except on paper; activities within these parks are not controlled or regulated in any way. Several sites in Antigua and Barbuda have been identified as being worthy of protection, but there is no plan for development of a full parks and protected areas system for the country.

Heritage sites -- broadly defined to include areas of biological and geological importance and pre-historical, historical and cultural sites -- represent valuable resources that Antigua and Barbuda can ill-afford to squander. They are essential to the nation's cultural identity; furthermore, in many cases they can be linked to the country's key economic sector -- tourism -- and thus have potential for enhancing Antigua-Barbuda's marketability in an ever-more competitive tourism market. Antigua and Barbuda still has the opportunity to preserve and enhance its unique cultural identity and to foster and encourage sustainable economic development of so-called "heritage resources" -- but timely action is required.

**\* Recommendation.** A Parks and Protected Areas System for Antigua and Barbuda should be developed immediately. Development assistance agencies are paying more attention to and allocating more funding for both biodiversity and parks and protected area programs, suggesting that GOAB might attract donor interest in such endeavors. Special consideration should be given to:

- Critical habitats for endangered or threatened species;
- Protection of areas of high biodiversity;
- Forest reserves and other areas of special vegetational concern;
- Multiple-use management areas such as coastal wetlands, watersheds, and offshore islands;
- Protection and appropriate development of archaeological, historical and cultural sites;
- The value of "non-productive" land uses, such as wildlife conservation and recreation; ideally, marginal lands not suitable for agricultural use should be evaluated to determine their potential contribution to the country in a non-developed state, e.g., as ecotourism amenities, for watershed protection, as "green space", for wildlife habitat, or as public recreational sites.

Four lists of prime areas which should be considered for some degree of protected area status are included within the Profile in Sections 2.2, 3, 8 and 9. It would be timely for the Historical, Conservation and Environmental Commission to prepare a short list for presentation to Cabinet as a first step in the development of a representative National Park and Protected Areas System.

**\* Recommendation.** A National Parks and Protected Areas Plan is needed to ensure that all critical natural and cultural resources receive adequate protection and that

management is carried out in an integrated fashion. The Plan must include a phase-in schedule of park management responsibilities to be increasingly assumed by the National Parks Authority, in cooperation and coordination with other GOAB departments and agencies which might share or collaborate with NPA in the execution of park management tasks. Resource management and park management training for NPA staff (and other appropriate GOAB agency staffs) are considered essential to the successful implementation of a fully-implemented Parks and Protected Areas System for Antigua-Barbuda.

**\* Recommendation.** Amended, updated, or new legislation may be required. The current National Parks Act does not provide a working framework for a full parks and protected area system (indeed, it does not even provide a legal definition for what constitutes a "national park"). Furthermore, both the National Parks Act and the Fisheries Act (under which marine reserves may be established) lack supporting regulations; therefore, specific management procedures as well as prohibited activities for protected areas are not defined or controlled.

### (3) *NATURAL RESOURCE PRODUCTIVITY*

The state of Antigua and Barbuda has adequate natural resources to be far more productive than is currently the case. Rainfall is low, but improved management of water supplies and watersheds could significantly increase the reliability and availability of this resource. Imports of food, especially vegetables, fruits and meat, could be greatly reduced by a concerted effort to improve productivity of these commodities. It is remarkable that Antigua and Barbuda imports such large quantities of meat, while grazing pressure from large numbers of unmanaged cattle, goats and sheep constitute one of the prime factors in deforestation and water and soil runoff.

Sufficient background analysis has been completed and a suitable framework has been laid to provide for more efficient use and

greater protection of the country's natural resources. A draft Forestry and Wildlife Act has been vetted with a wide group of governmental and non-governmental individuals. Separate acts to deal with each of these sectors are now being finalized. A draft Water Resources Act draws on a decade of analysis of issues and opportunities relating to water and watersheds in the country.

**\* Recommendation.** Government should facilitate completion and passage of the aforementioned legislation for forestry, wildlife and water resources. Two issues in this regard are important: (1) the need to ensure the harmonization of policies and legislation for these natural resource sectors and (2) the need to ensure that input from the agricultural sector informs national resource decisions, especially for water allocation.

**\* Recommendation.** Support is needed to enable the institutions involved to monitor and enforce proper management of these resources. Government should pursue discussions concerning the proposed CIDA Natural Resource Management Project, which represents an excellent opportunity to begin an integrated approach to management of the country's lands, forests, and watersheds. The fact that legal or historical control of the various sectors is dispersed among many Ministries and governmental bodies is a serious obstacle but not an acceptable justification for allowing the country's resources to be mismanaged. The necessary coordination is possible, and Government has an excellent opportunity for leadership by demonstrating its commitment to an integrated response for addressing these critical issues.

**\* Recommendation.** Government could support more environmentally appropriate agricultural practices and use of forests. In particular, there are opportunities to promote agroforestry as a means to improve economic viability while conserving the natural resource base. Agroforestry is a major component of FAO's Tropical Forestry Action Plan, which could serve as an umbrella for various ongoing and proposed agroforestry initiatives (e.g., Pan American Development Foundation's current project). The Ministry

of Agriculture has expressed interest in the Plan and should be encouraged to take advantage of this opportunity.

#### (4) *POLLUTION AND PUBLIC HEALTH*

Waste disposal and pollution control problems associated with solid wastes, sewage and other liquid domestic wastes, agrochemicals, and hazardous and toxic wastes collectively represent one of the most difficult problems facing the country. These problems have potentially injurious environmental implications for both public health and the natural environment. There are also potential economic impacts in neglecting these related pollution issues, particularly as Antigua-Barbuda focuses its economic future on selling the country as a pristine, well-managed tropical paradise.

The technical actions required to address these problems are well known and understood by local resource managers, but the solution has not been as well understood or appreciated by decision-makers. Increasing the country's resources for addressing pollution-related problems is a clear priority, justified on economic and social grounds.

**\* Recommendation.** Government should develop a National Waste Management Plan and Strategy to focus on: (1) the need to update and harmonize pollution control legislation and regulations and to provide a framework for follow-up actions; (2) the need to raise public awareness about pollution issues and their costs to the country; and (3) the need to identify new sources of funding transferring some of the costs of collection and disposal site management to waste generators, including commercial, industrial and development enterprises as well as new and expanding residential communities.

**\* Recommendation.** Public health legislation is seriously outdated, lacks standards, and is based on colonial legal concepts which are inadequate to deal with modern pollution control problems. This legislation

needs to be updated and strengthened by inclusion of national standards and criteria for water quality, pollution control and waste management. The institutions given oversight/regulatory responsibilities -- in particular the Central Board of Health -- must be allocated sufficient technical and fiscal resources to take advantage of improved legislative authority.

**\* Recommendation.** The need for controlling and regulating the sale and use of agrochemicals and for promoting their safe and economical use warrants special attention by GOAB at the present time. The Pesticide Control Board (PCB) should be reactivated immediately as an operational body, and supporting regulations to the Pesticide Control Act need to be vetted and gazetted as soon as possible in order to give the PCB authority for monitoring and regulating pesticide use in the country. Among other activities, the Board should develop a list of approved pesticides, require pesticide distributors to report quantities sold, and require major users to report quantities applied to their crops.

#### (5) COASTAL ZONE MANAGEMENT

The coastal zone is the most heavily populated area of Antigua-Barbuda and figures prominently in the recreational pursuits of its citizens. Almost all industrial activities in the country are sited in the coastal zone, while the country's critical tourism sector is dependent upon development of infrastructure in the coastal zone. Much of Antigua's coast is experiencing significant alterations due to intensive development, primarily for tourism. Major concerns continue to be raised about the consequences of this explosive development including the degradation or destruction of critical coastal resources, especially in the absence of an effective policy for coastal zone management (CZM).

The interactive linkage of CZM issues with other environment/development issues -- tourism and industrial expansion, port/marina development, environmental monitoring, and pollution control, to name a few -- means that management and develop-

ment of the coastal environment cannot be viewed in isolation by Antigua-Barbuda policy planners.

Adverse impacts associated with *ad hoc*, unregulated development in the country's coastal zone have been well documented. While the tendency has been to focus upon such problems selectively, their increasing, cumulative visibility reflects the absence of comprehensive development control guidelines and policies committed to maintaining the quality of coastal resources. This is a situation which needs to be addressed immediately by the Government of Antigua-Barbuda, given the heavy use, loading, density, traffic, and habitation levels in the coastal zone.

**\* Recommendation.** A comprehensive coastal zone management program should be implemented to provide overall guidance for specific development and management activities. A useful island model with over a decade and a half of adaptive testing is provided by the U.S. Virgin Islands, a neighboring insular area which has had to face similar coastal-intensive development issues.

Oversight authority for a CZM program should reside in one agency, although responsibility for specific components almost certainly will have to be an inter-ministerial undertaking and better coordination of multi-agency responsibilities for the nation's coastal resources and wetlands will have to be provided. Emphasis should be placed upon development planning, adherence to a policy of review of all development proposals by the Development Control Authority, and requirements for Environmental Impact Assessments for all major developments in the coastal zone.

**\* Recommendation.** A program of management of the country's sand resources needs to be put in place. An evaluation should be made of the overall impact of sand mining on the rate of beach loss, and GOAB resource managers need to make judgments as to where continued sand removal will have the least detrimental impacts and is most compatible with current site utilization. Priority areas where sand removal will be abso-

lutely prohibited need to be designated, and areas of lesser concern also need to be identified where regulated sand removal will be carried out at some determined and managed level. Best management practices (e.g., setbacks, pedestrian walkways, vegetation protection) should be required and enforced for all beachfront facilities.

A review and possible revision of the Beach Control and Beach Protection Ordinances should be carried out; it needs to be recognized that beach management requires more involvement by public sector authorities than the mere letting of sand mining permits.

The transfer of legal responsibility for beach management from the Public Works Department to a more appropriate agency should be considered.

**\* Recommendation.** Immediate protection should be extended to mangroves, which are rapidly disappearing. Destruction of mangroves and degradation of their associated habitats should be absolutely prohibited.

**\* Recommendation.** Procedures to control sediment loading into coastal waters should be required for all dredging and all construction activities in the coastal zone.

## SECTION 1 BACKGROUND

### 1.1 LANDSCAPE AND A CHANGING ENVIRONMENT

Antigua, with its sister islands of Barbuda and uninhabited Redonda, lies about 250 miles southeast of Puerto Rico in the southern sector of the Leeward Islands (Figures 1.1(1) and (2)). The absence of a mountainous landscape and lush green vegetation distinguishes Antigua from many of its neighboring islands in the Lesser Antilles archipelago, that chain of Caribbean islands which descends in a graceful arc from Puerto Rico in the north to Trinidad in the south. In Antigua, flat dry plains give rise to gently rolling hills in the north and to higher volcanic hills in the south. Its intricate coastline is deeply indented and fringed by reefs and shoals except for areas of the central western coast and Falmouth and English Harbor in the south. Antigua's sister island, Barbuda, is a low limestone island with no marked indentation in the coastline.

Typical of many former colonies, Antigua's economic and land use history reflects a pattern of extensive resource exploitation organized around an economic system designed to produce a limited number of export crops. In Antigua's case, until very recently, virtually the entire island was affected by the monoculture economy -- if not to grow the monocrop, then to provide the fuelwood needed to process it. Shortly after colonization, tobacco, cotton and indigo were the chief crops. Later, the Plantation Act of 1673 established sugar as the island's principal crop, and by 1700 most land was under cane. Sugar dominated for over 300 years, and it was only in the mid-1960's that this industry was officially closed. Attempts were made to revive it in the early 1980's, but these were not successful.

Cotton was re-introduced around the turn of the century in an effort to diversify agriculture in the face of an already failing sugar industry. However, the unreliability of adequate water makes production of cotton problematic. If it was not for the unique, high

quality of sea island cotton, the crop probably would have been allowed to disappear long ago. The most recent effort to revive the cotton industry ended with Hurricane Hugo in September of 1989 (Cater, 1944; Hill, 1966; OAS, 1990).

The abandonment of sugar and cotton production has led to a large increase in livestock production, especially of cattle. Much of this land is unimproved pasture used by landless cattle owners. Owners of small ruminants -- sheep and goats -- typically allow their animals to range freely regardless of land ownership. On several of the dry sloped hillsides of the island, goats are the main agents of devegetation, leading to soil erosion and run-off (OAS, 1990).

Table 1.1(1) provides an interesting comparison of land use in Antigua over the past 24 years. Although the data are not directly comparable between years because each study used slightly different land use categories and land totals, the data do illustrate that crop production has declined dramatically, complemented by an increase in acreage used for livestock production. It also is evident that vegetable and food crops have become more important, presumably because of increased local markets associated with rising per capita income and demand generated by growth in the tourist industry.

Although Antigua was once sustained economically by export agricultural production, tourism has now emerged as its major industry. The country is undergoing intense tourism-related development, which like the agrarian-based economy which preceded it, has resulted in major alterations of terrestrial landscapes and, more recently, of the coastal and marine environments.

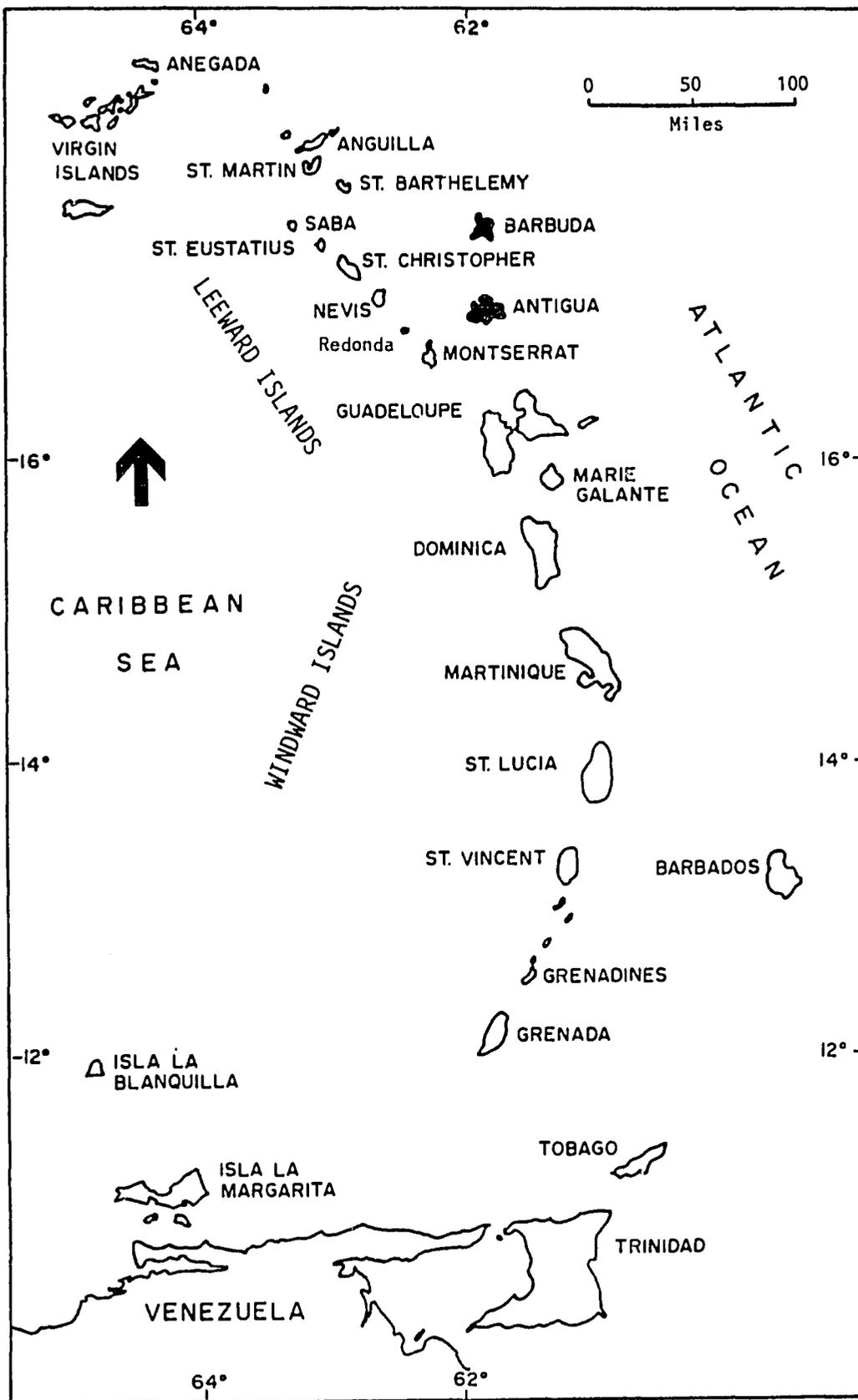


Figure 1.1(1). General map of the Eastern Caribbean, showing the location of Antigua-Barbuda.

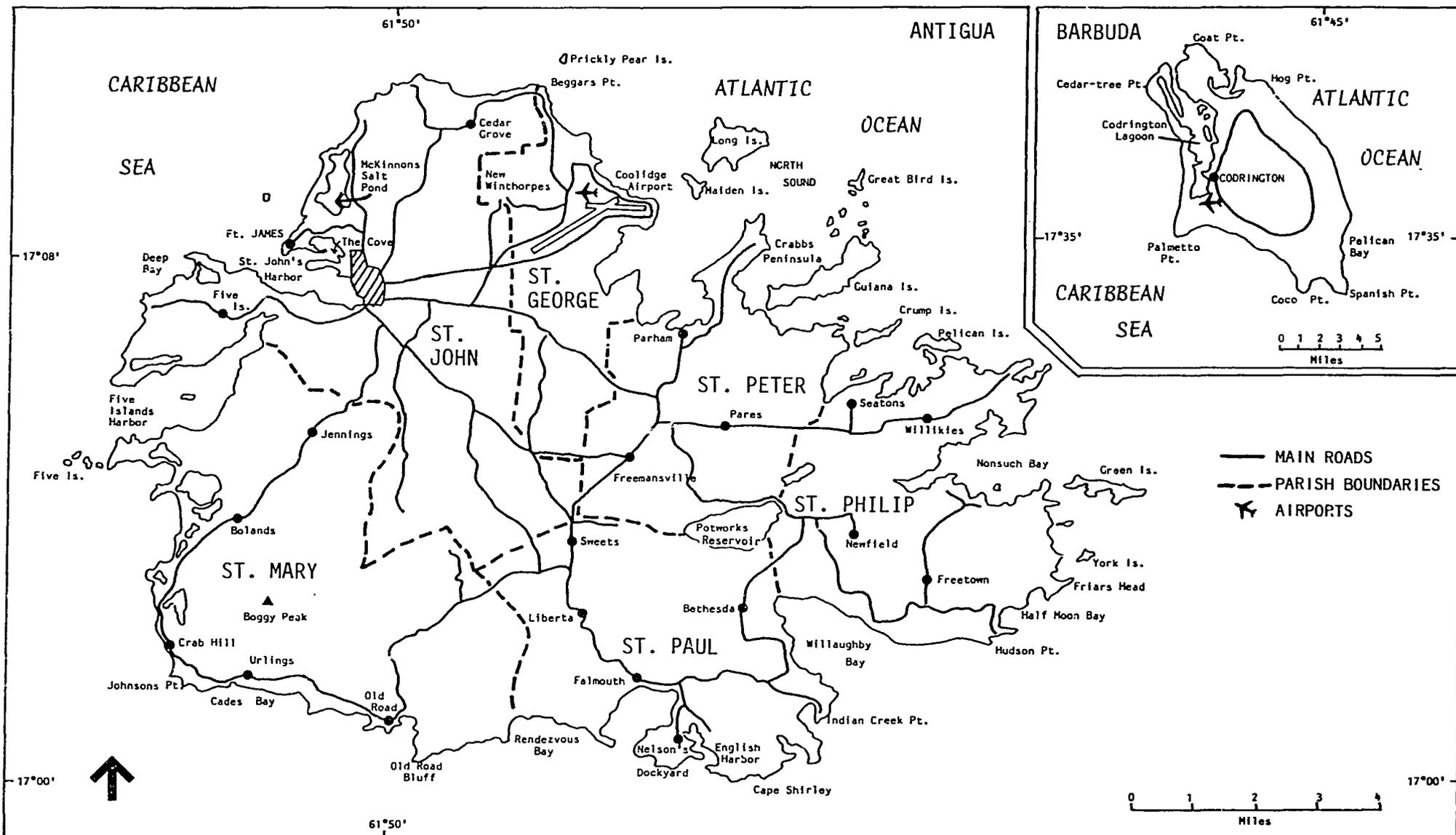


Figure 1.1(2). General location map for the islands of Antigua and Barbuda.

Table 1.1(1) Comparative land use in acres in Antigua for selected years.

Land Use Categories	1961	1964	1975	1985
<b>Agricultural - Crop</b>				
Sugar Cane	12,552	22,371	45	554
Cotton	1,690	606	440	117
Coconut	54	312	NG	119
Fruit Trees	NG	NG	755	486
Pineapple	NG	NG	604	131
Banana	88	172	NG	246
Corn	-	-	1,260	-
Sorghum	-	-	115	-
Food Crops	1,440	1,108	6,040	2,026
Vegetable Crops	-	-	-	1,479
Citronella Grass	-	222	NG	343
Arrowroot	30	100	-	-
<b>Agricultural - Livestock</b>				
Improved Pasture	725	1,008	9,210	2,364
Rough Grazing	5,496	4,450	9,210	2,364
Mixed Scrub/Rough Grazing	NG	14,588	NG	6,981
<b>Agricultural - Unused</b>				
Arable	-	-	13,290	-
"Unproductive" Land	-	-	4,985	-
<b>Woodland</b>				
Volcanic Areas	4,697	12,890	11,220	15,190
Limestone Hills	4,697	12,890	11,220	8,455
<b>Other Uses</b>				
Rural Areas	NG	NG	2,390	1,819
Urban Areas	NG	NG	2,130	4,808
Industrial Areas	NG	NG	300	381
Tourism - Hotels, Golf Courses	NG	NG	NG	1,133
Recreational/Historical Areas	NG	NG	NG	714
Airports/Military Installations	NG	NG	NG	935
Dams and Reservoirs	NG	NG	435	635
Swamps, Mangrove, Beach Sand	NG	NG	1,125	2,164

Notes: (a) NG means "not given".

(b) 1961 and 1964 data from Hill, 1966.

(c) 1975 data from Land Use Map, 1975.

(d) 1985 data compiled using the GIS from Wirtshafter, *et al.*, 1987.

(e) Food crops for 1961-1975 include vegetables.

(f) Data between years are not directly comparable (see text).

Source: OAS, 1990.

## THE ANTIGUA AND BARBUDA CEP: A LOCAL PERSPECTIVE

The environmental resource base of any insular state is notoriously fragile and complex. To some extent, the environmental issues confronting an island are a microcosm of those experienced on larger, more diverse continental land masses. At the same time, smaller oceanic islands are sufficiently different from continental areas to require customized, carefully adapted, and more participatory kinds of resource assessment, planning, development and management strategies (Towle, 1985). Furthermore, whereas a continental area might be able to afford an environmental mistake or two and can even absorb, albeit at significant costs, a disaster of the magnitude of the recent *Valdez* oil spill in Alaskan waters, similar disasters in insular ecosystems could lead to significant weakening if not total destruction of a small island economy.

The economic growth of Antigua and Barbuda is almost totally dependent on its natural resources for important development sectors such as agriculture and fisheries and for the economy's current mainstay -- tourism. Antigua and Barbuda has substituted a dependency on sugar cane for a dependency on tourism, and this new "monoculture" is just as risk-prone as its predecessor. For example, Antigua and Barbuda is extremely susceptible to natural disasters. Hurricane Hugo in 1989 is the latest -- but not likely to be the last -- large-scale disaster to affect the dual-island state. Typically, hurricanes occur every 10-15 years; drought every five years, with the 1983-84 drought the most severe in recent history; and heavy fires every 25 years (Morello 1983). Major earthquakes occurred in 1843 and 1974 (Montgomery, 1983).

The country is made even more susceptible to natural disasters when its infrastructure and natural resource base are severely strained, as is currently the case. Improved planning -- in particular, strong developmental planning that merges environmental concerns with economic growth issues in the decision-making process -- can better prepare the country for the inevitable natural disasters and help to mitigate their long-term detri-

mental impact on the environment and the economy.

During the past five years, a number of events have increased local awareness about the need for strengthened and more environmentally-sensitive planning and development control policies; without such commitment on the part of the Government and people of Antigua-Barbuda, the environmental health and general quality of life for the state and its citizens will continue to be at risk. Some of the indicators that all is not well include the following:

- (1) The ongoing destruction of major mangrove ecosystems has been more recently accelerated by large-scale hotel and marine recreational developments and, in other instances, by the use of these habitats as garbage dumps. Jolly Beach, McKinnons Salt Pond and Deep Bay are primary examples of areas where extensive mangrove wetlands have been damaged and in some cases destroyed. These areas also are of considerable archaeological interest, Deep Bay, in particular, since it is one of the earliest known sites of man's presence in Antigua. Other sizeable areas of mangrove forests, notably Cooks (the Flashes) and Fitches Creek, are used as garbage dumps.
- (2) The clearing of hillside trees and scrub for the construction of roads and building sites has resulted in severe soil erosion, notably in the Cooks and Union areas. Far less damage to the landscape would have occurred if simple soil and water conservation measures such as contouring and drainage ditches had been employed. Some have pointed out that more suitable alternatives for arable soil for hotel landscaping are available than the present removal of such materials from Betty's Hope Estate, site of one of the country's major historic restoration projects.
- (3) Uncontrolled and illegal beach sand mining along the coastal perimeter of

Antigua and Barbuda, in conjunction with uncontrolled sewage disposal from beach front hotels into the marine environment, calls attention to the need for stringent resource regulation and resource conservation measures -- if the country's hotel/tourism industry is to continue to prosper.

The extent to which the nation's infrastructure is overtaxed, and the vulnerability of its natural as well as its built environments, was well demonstrated in September of 1989 when Hurricane Hugo hit Antigua and Barbuda. Even though the full force of the storm was not felt in these islands, winds of 125 miles per hour were recorded; fifteen percent of the country's houses were damaged, and electricity supplies were disrupted. Beaches and coastal areas suffered varying degrees of erosion. Antigua and Barbuda had not experienced a hurricane in almost four decades, the last occurring in August 1950 when two hurricanes passed over the islands, approximately 10 days apart. Prior to the 1950 storms, it had been twenty-two years (1928) since a hurricane was felt in Antigua-Barbuda. Interestingly, Hurricane Hugo, which covered a greater diameter and was

more devastating than all preceding hurricanes to strike Antigua-Barbuda, followed the same route as the 1928 storm.

Because of the considerable hiatus in the occurrence of these hurricane disasters (a time lapse of 22 years followed by another of 39 years), the country's population was inclined towards complacency. This attitude was encouraged by repeated assurances that adequate storm warning coverage was available from regional weather bureaus such as Miami and San Juan, which supplied information to Antigua's Meteorological Station.

Thus, the adequacy of the country's disaster preparedness plans and its ability to cope with a major hurricane disaster were not sufficiently addressed prior to Hurricane Hugo. The hurricane highlighted many planning deficiencies and pointed clearly to the need for improvements in a wide range of issues, e.g., the need for reinforced, adequately equipped, properly identified disaster shelters, as well as the necessity for building design and construction guidelines which ensure a built environment better capable of withstanding hurricane-force winds.

#### FISH-KILL AT MCKINNONS

McKinnons swamp, in the north of Antigua, again experienced considerable loss of fish life in late July, 1990. The die-off is similar to, but not as disastrous as, the one last year at about the same time when millions of small fish perished in the swamp. It is believed that this recurring event is attributable to a combination of factors. Effluent from a nearby hotel with a malfunctioning sewage treatment plant is pumped into the swamp. The higher summer temperatures increase biological activity of almost all organisms, including those that thrive on the "nutrient soup" represented by the raw sewage, and therefore there is an increase in oxygen demand and consumption. Yet warmer waters cannot maintain as high a dissolved oxygen concentration. The result is that many fish die, unable to get enough oxygen to sustain themselves.

In order to reduce the highly unpleasant odor of the sewage and rotting fish, sea water is being pumped back into the swamps. If the pumping had begun earlier in the season, some of the annual problem might be eliminated. However, it should be remembered that this "solution" will simply dilute the concentration of the sewage which, as it continues to flow untreated into the swamp, will also continue to pollute the swamp.

It is worthy of note that in the aftermath of this hurricane, it was discovered that many of the older houses with gabled roofs and outside hurricane shelters were found to have withstood the fury and onslaught of the storm far better than many of the more modern structures with nearly flat roofs. In this case, there are important lessons to be derived from an examination of the techniques used in traditional West Indian architecture (see also White, 1989).

Problems with basic infrastructure were also highlighted following Hugo. The lengthy delay in getting electrical services back on stream stands in strong contrast to one neighboring island, St Kitts, which suffered more severe damage but had its electricity restored within two weeks of the catastrophe.

Another kind of natural disaster occurred in October of 1974 when an earthquake measuring 6.7 on the Richter scale was felt in Antigua, causing extensive damage islandwide and millions of dollars in damage. It was the most destructive earthquake on the island since the catastrophic Leeward Island earthquake of February 1843. (Robson, 1964). In most cases, severe damage was ascribed to buildings without concrete reinforcement and steel beams. The risk of disease was present, but fortunately no lives were lost.

Clearly, Antigua-Barbuda, like the rest of the Caribbean, is an extremely disaster-prone place -- exposed as it is to hurricanes and their associated storm surges and wave action, to earthquakes and earthquake-generated ocean waves (tsunamis), to landslides and rockslides, to flooding and also to droughts. The islands of the Caribbean are particularly vulnerable because of their small size and because of their dependency on foreign revenues, whether earned from agriculture or tourism. Therefore, it is incumbent on island countries such as Antigua and Barbuda to include precautionary measures -- which focus on the likelihood of natural disaster occurrences -- as a part of all development planning and to give more attention to the environmental implications of major modifications to the natural landscape. In this effort,

the preparation of the present Environmental Profile should be of assistance.

#### **LOCAL IMPLICATIONS OF GLOBAL ENVIRONMENTAL CHANGE**

It is becoming increasingly obvious that multiple feedback interactions are taking place between human activities and the state of the environment everywhere (Clark, 1989). For example, there is growing concern that human-induced changes in concentrations of carbon dioxide and other so-called "greenhouse gases" are causing significant warming of the atmosphere, with consequent climatic changes. This fear is based on a belief shared by many if not most experts; there is, however, less agreement on the rate and magnitude of warming. Resulting changes in temperature and precipitation distribution could threaten natural ecosystems as well as agricultural production and could trigger a worldwide rise in sea level. Although there is considerable uncertainty surrounding these projections, the possible consequences warrant contingency planning.

Such changes would pose particularly severe challenges for developing nations like Antigua and Barbuda. In the Caribbean region, critical ecosystems such as coral reefs and mangrove swamps would be seriously damaged if the sea level rises so fast they cannot compensate. Global warming would increase sea-surface water temperatures and may cause changes in the strength, frequency, and paths of hurricanes as well as an extension of the hurricane season. Beaches vital to the tourism industry are also at risk.

Conservative estimates suggest that the sea level rise due only to climatic effects will be on the order of 2-3 cm per decade in the Caribbean region (Maul, 1988), but others indicate that it may be larger and not necessarily linear (see Figure 1.1(3)). This may seem like a trivial change, but one rule of thumb states that a one centimeter sea level rise will generally result in a one meter shoreline retreat (Gable 1987/1988). In that scenario, Antigua and Barbuda could expect to lose some 8-12 meters (26-40 feet) of beach

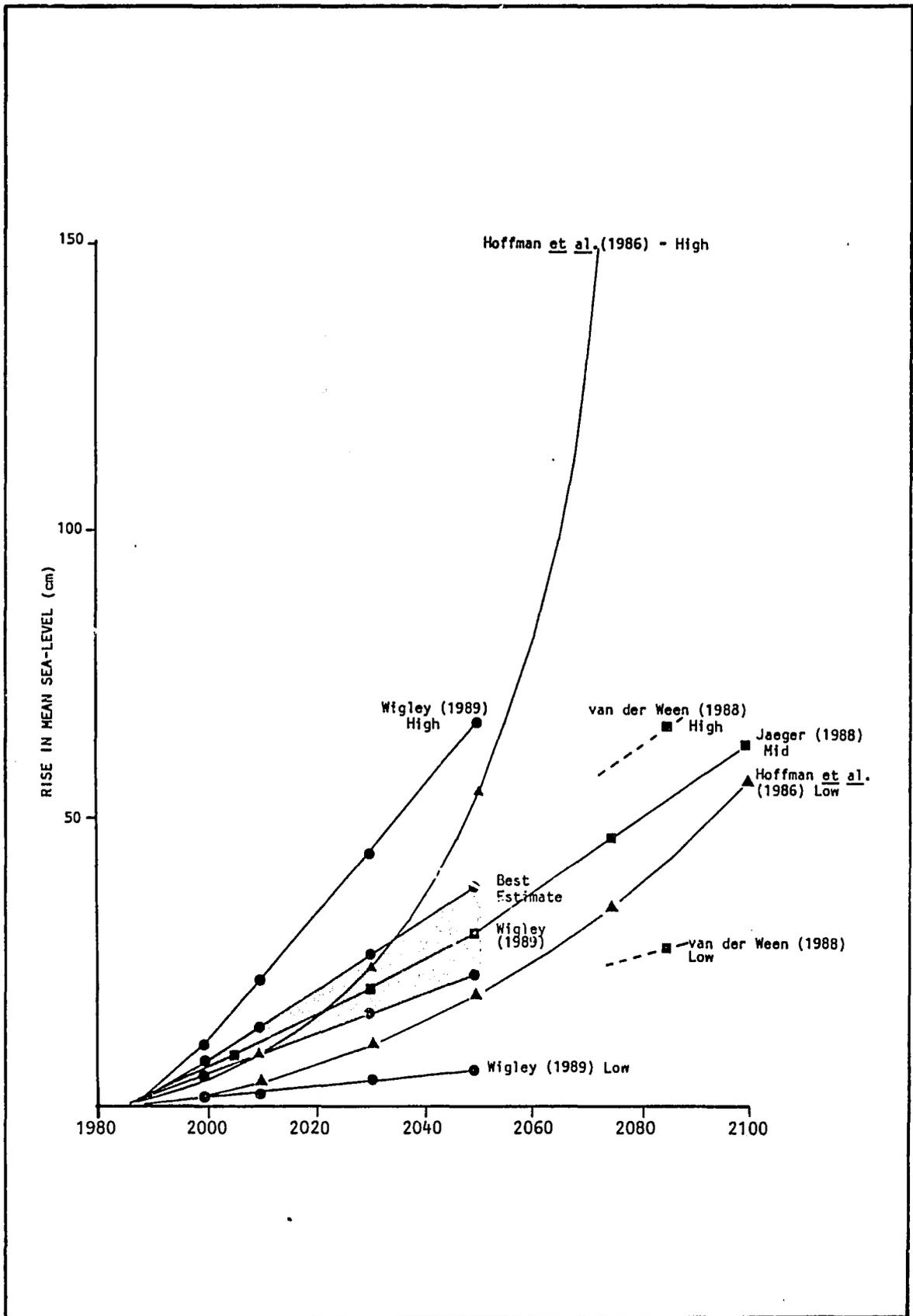


Figure 1.1(3). Various projections of sea level rise until the year 2100 (source: Royer, 1990).

width over the next 40 years in areas where sea level change is due solely to climate.

The situation in Antigua and Barbuda may be different from some others because of the fringing coral reefs that surround much of both islands and thereby provide a great deal of protection. Coral reefs tend to grow to just below the low water line. If sea-level rise is on the order of 3.7 cm/decade -- which is within the "best estimate" range (Figure 1.1(3)) -- then coral reefs may be able to grow upwards at a pace to match sea-level rises (Royer, 1990).

In the face of such uncertainty, most experts recommend that governments should adopt a flexible, adaptive strategy for coping with the expected effects of climate changes. This is easiest to implement in planning for the construction or renovation of infrastructure such as roads, buildings, and coastal facilities.

In the case of older infrastructure (which would have to be replaced in any event), the best and cheapest response may be to do nothing and accept the loss of the structures, provided that they can be rebuilt in an alternative location. Where existing, economically vital infrastructure is threatened and no alternative location exists, such as certain sections of coastal road and some coastal communities, an immediate defensive response would be justified provided it is cost-effective and environmentally sound.

In other cases, especially where infrastructure has not yet been built, measures to adapt to the warming trend should be taken only if such steps have good prospects of yielding benefits even without a climate change. If the predicted climate changes do occur, then the measures taken, of course, will yield a much greater benefit.

For example, implementing a coastal set-back policy would make sense because it also offers protection from storm surges and tsunamis, maintains the aesthetic qualities of the coastline, precludes monopolization of what should be a public resource by private interests and mitigates impacts from artificial lighting on nesting sea turtles.

## 1.2 ENVIRONMENTAL SETTING

### 1.2.1 Climate

**Antigua.** Year round high temperatures, steady easterly trade winds, and a marked dry and wet season are the main climatic features of the island of Antigua.

Temperatures average 29 degrees C (84.2 F) during the summer and 24 degrees C (75.2 F) during the winter, but extremes range from highs of 34 degrees C (93.2 F) recorded in August to lows of 15 degrees C (59 F) recorded in January.

Seasonal variation in rainfall is considerable as illustrated in Figure 1.2(1). Typically, there is a dry season that extends from January to March or April, when less than 20 percent of the rainfall occurs. May is a wetter month, averaging around four inches of rainfall, followed by a drop in rainfall in June and July before the true wet season from August to November, when approximately 50 percent of the annual rainfall occurs (Figure 1.2(1)). Almost half of Antigua's 44 inches of yearly rainfall is the result of storms that produce more than one inch of rain (OAS, 1990). Despite the seasonal pattern, the most critical feature of the rainfall regime is its variability and unpredictability.

There is considerable variation in rainfall both within different parts of the island and between years (see Table 1.2(1) and Figure 1.2(2)). Within a four year period from 1979 to 1983, rainfall varied from 66 inches to 22 inches (APUA, 1989).

The relative humidity in Antigua is high compared to other islands in the region (mean relative humidity is in the low 80's in the morning and in the low 70's in the afternoon); the heavy dews deposited at night are believed to contribute significantly to water availability in the drier regions (Loveless, 1960; GOAB, 1989b; Atkins Land and Water Management, 1983).

**Barbuda.** Barbuda is drier than Antigua and, in fact, is one of the driest islands in the Caribbean. Estimates of

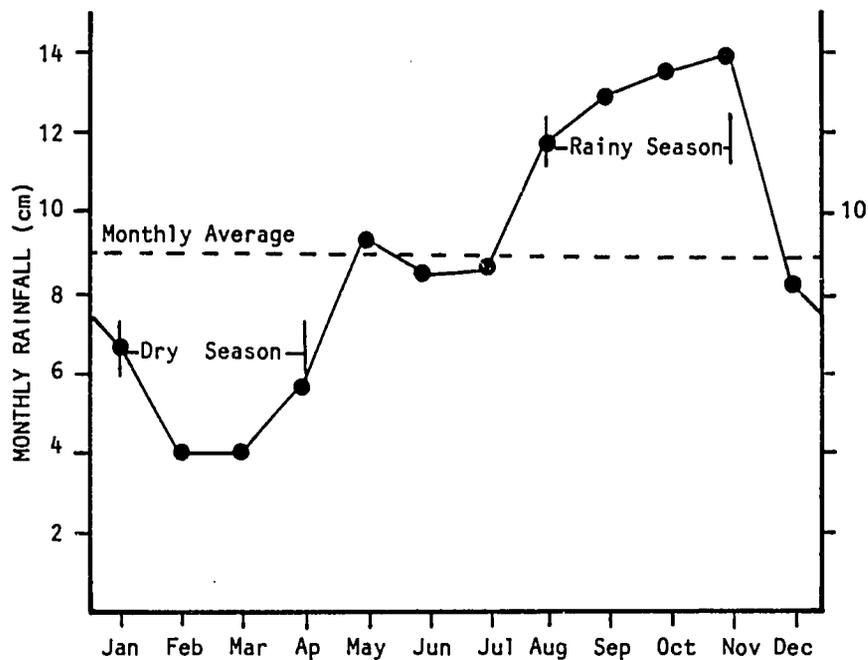


Figure 1.2(1). Monthly distribution of rainfall, Antigua, based upon figures recorded at nine stations over periods varying from 12 to 50 years (source: Loveless, 1960).

Table 1.2(1). Annual rainfall for selected stations, 1982-1988 (in millimeters).

Station	1982	1983	1984	1985	1986	1987	1988
Bethesda	935.0	-	726.4	864.9	1,030.2	-	1,628.1
Cades Bay	1,123.4	1,110.7	1,307.1	1,260.6	1,116.3	1,522.7	1,162.6
Christian Valley	1,310.6	1,034.3	1,300.7	1,150.6	966.0	1,690.0	1,000.5
Dunbar	1,022.4	567.2	1,295.9	481.8	844.8	1,227.3	1,070.9
Jolley Hill	1,255.5	972.6	1,318.8	1,237.0	1,209.6	1,622.1	1,540.8
Orange Valley	1,153.7	860.6	1,230.4	1,024.2	1,186.2	1,486.4	1,276.1
V.C Bird Airport	1,124.9	567.3	1,664.9	1,184.7	892.3	1,400.8	1,300.4

Source: Meteorological Office; in GOAB, 1989b.

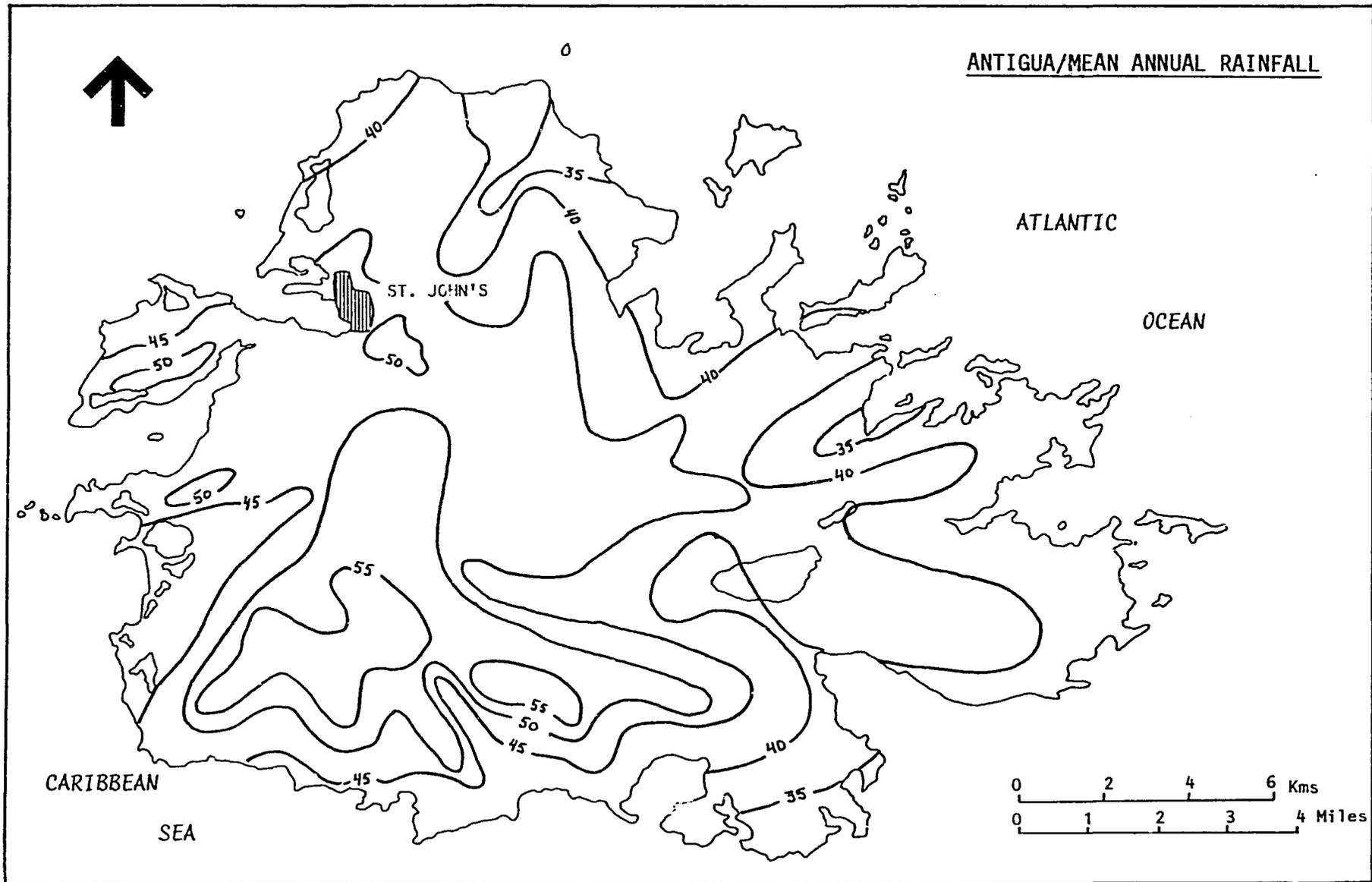


Figure 1.2(2). Mean annual rainfall (long average annual isohyets) for various locations in Antigua (source: Hill, 1966).

average annual rainfall are between 30 inches (Hill, 1966) and 39 inches (OAS, 1990). There is a dry season that lasts from December to July and, as in Antigua, a wet season that extends from August to November (OAS, 1990).

### 1.2.2 Topography

**Antigua.** Antigua can be divided naturally into three fairly distinct topographic regions, roughly equivalent in size (see Figure 1.2(3)):

- Volcanic region in the southwest
- Central plain
- Limestone region in the north and east.

The volcanic region is the highest in elevation and includes several peaks above 1,000 feet, the highest being Boggy Peak at 1,319 feet. It is bounded on the south by a narrow coastal plain and contains several small alluvial valleys.

The central plain lies on a diagonal belt separated from the volcanic region by the flood plain of the Bendals River and from the limestone region by a one mile wide, low-lying trough. The central plain consists of gently rolling hills, some of which exceed 500 feet in elevation.

The limestone region includes the northern and eastern third of Antigua as well as many of the islands off this part of the coastline. In the north, the flat, low-elevation landscape is marked by numerous, more or less isolated, conical hills that reach 400 feet in height. In the east, two 150 foot plateaus flank Nonsuch Bay. Much of the limestone region is separated from the central plain by an abrupt, but discontinuous, escarpment rising in places to over 350 feet.

According to Atkins (1983, adapted from Hill, 1966), 5 percent of the island is sloped less than 2 degrees; 65 percent is sloped 3-10 degrees; 20 percent is sloped 11-

20 degrees; 9 percent is sloped 21-30 degrees; and 1 percent is sloped more than 30 degrees (see Figure 1.2(4)). These figures are in marked contrast to neighboring islands such as Dominica, where almost two-thirds of the island's land area exceeds a 30 degree slope.

The coastline of Antigua is very indented, especially on the eastern or windward side, with numerous small islands ranging from Guiana Island (about 200 acres) and Long Island (approximately 120 acres) to tiny coral reef outcrops less than one acre (Loveless, 1960).

**Barbuda.** In comparison with Antigua, Barbuda's topography is relatively uniform and lower in elevation (Figure 1.2(5)). The most conspicuous differences are the absence in Barbuda of the volcanic mountains that define the western third of Antigua and the presence of dunes in Barbuda that make up large sandy fields, absent from Antigua (Morello, 1983). Some variations do exist in the topography of Barbuda. The Highlands, located in the east, reach elevations above 100 feet; it has an abrupt escarpment on the north and west, a gentle slope on the south, and sea cliffs on the east. Although the rest of the island is only a few feet above sea level, two levels can be distinguished, each containing numerous smaller depressions. A lagoon, averaging about one and a half miles wide, runs along most of the western side of the island. It is separated from the sea by a long narrow sand spit often only a few yards wide, with a winding entry in the north (Martin-Kaye 1959; Hill, 1966).

### 1.2.3 Geology and Soils

**Antigua.** The soils of Antigua and Barbuda have been studied in detail, and comprehensive treatments are found in Martin-Kaye (1956) and Hill (1966); the latter mapped the soils of Antigua at 1:25,000.

Antigua is partly a volcanic and partly a coralline island. Its major soil types can be grouped within the three main topographic

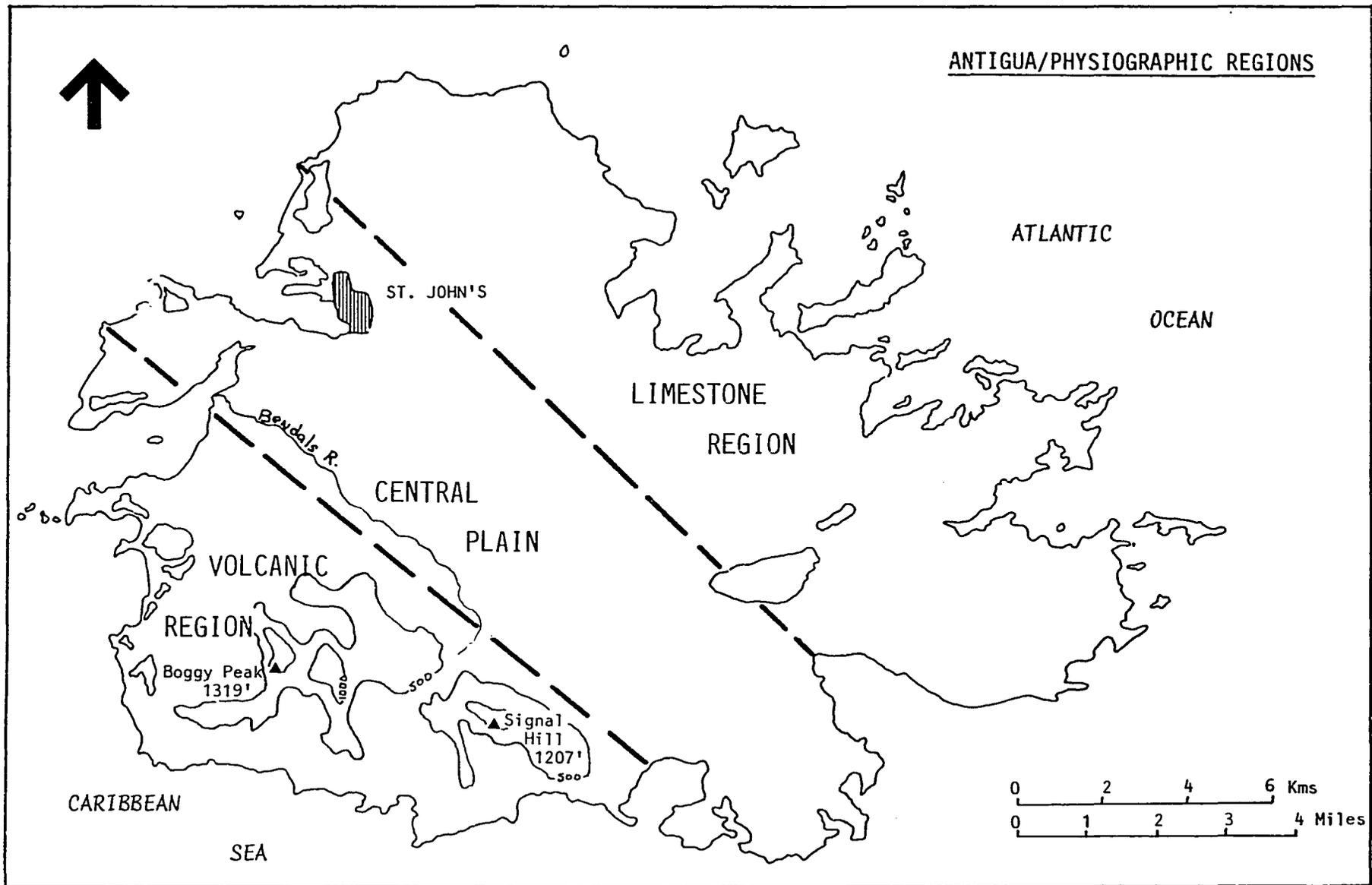


Figure 1.2(3). Physiographic regions of Antigua (source: Loveless, 1960).

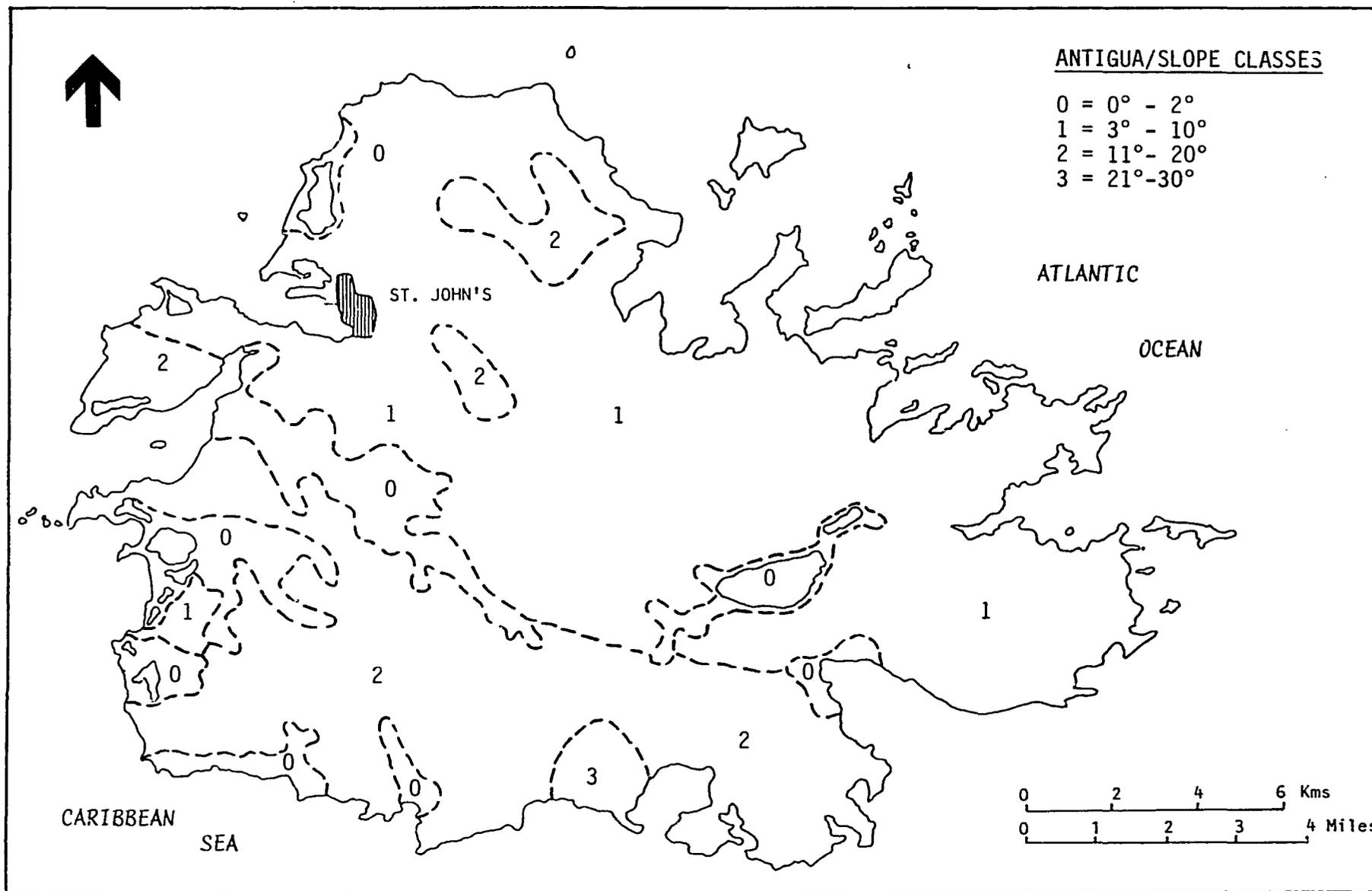


Figure 1.2(4). Distribution of land slope classes, Antigua (source: Atkins Land and Water Management, 1983).

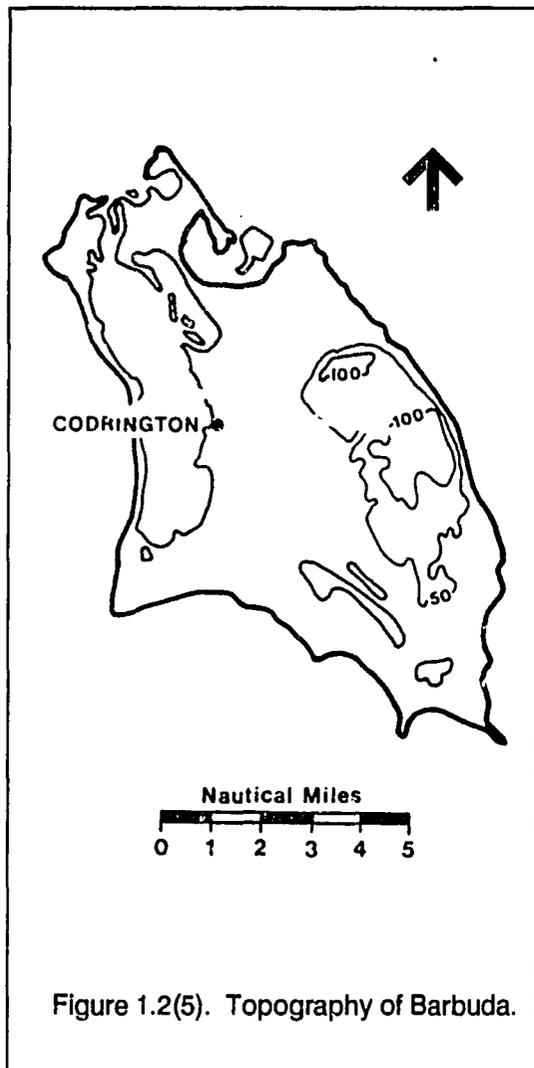


Figure 1.2(5). Topography of Barbuda.

areas. The volcanic region consists of igneous rock producing mostly clay loams. The soils are mainly neutral to slightly acidic and well-drained. Slopes are predominantly 11-20 degrees but include locally steeper areas. The central plain has heavy, hard-to-work clay soils in some areas, but most of the area has well-drained soils over tuffs (stratified volcanic detritus) and agglomerates. Slopes are less than 10 degrees. The limestone region has light soils over calcareous sandstones, heavier soils over calcareous grits, and deeper well-drained clays over calcareous marls. Some areas contain large amounts of almost pure calcium carbonate, and alkaline soils dominate throughout this region. Slopes generally are under 10 degrees (Loveless, 1960; Atkins, 1983).

Atkins (1983) provides a map that groups the 33 soils identified by Hill (1966) into three main categories. As shown in Figure 1.2(6), shallow soils over volcanic material or limestone occur on about half of the island; deep clays comprise one-third of the island; and the remainder consists of alluvial soils (14 percent), with four percent uncategorized.

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

A recent report (Ahmad, 1984) builds on previous soil surveys and maps to develop a land classification system for Antigua and Barbuda. Such classification systems are particularly useful as a basis for decision-making when formulating national agricultural policy. They also are an aid to governments in the development of rational land zoning policies designed to make the most efficient use of limited land resources.

Ahmad's land classification of Antigua and Barbuda is based on an eight class system proposed by the U.S. Department of Agriculture (Klingebiel and Montgomery, 1961) which was adapted for both islands. Soils within a "class" share similar land management restrictions, limitations or hazards based on the following factors: climate; relief; erosion; excessive wetness or dryness; and soil characteristics such as shallow profile, infertility, and impediments to root growth. Land having the largest number of alternative uses under a given system of management is placed in Class I, and land with the least number is placed in Class VIII. In general, Classes I-IV are regarded as suitable for mechanical cultivation; they, of course, are also suitable for a variety of other uses such as the growing of tree crops or forest plantations. Sub-class categories were also used and indicate how severely the restricting factors limit the use of the land compared to what would be expected based on the Class designation alone.

Since the USDA system evaluates suitability for mechanized agriculture on flat lands using high inputs -- the *exception* in much of the developing world, including Antigua and Barbuda -- the utility of Ahmad's report (1984) lies in the fact that he has mod-

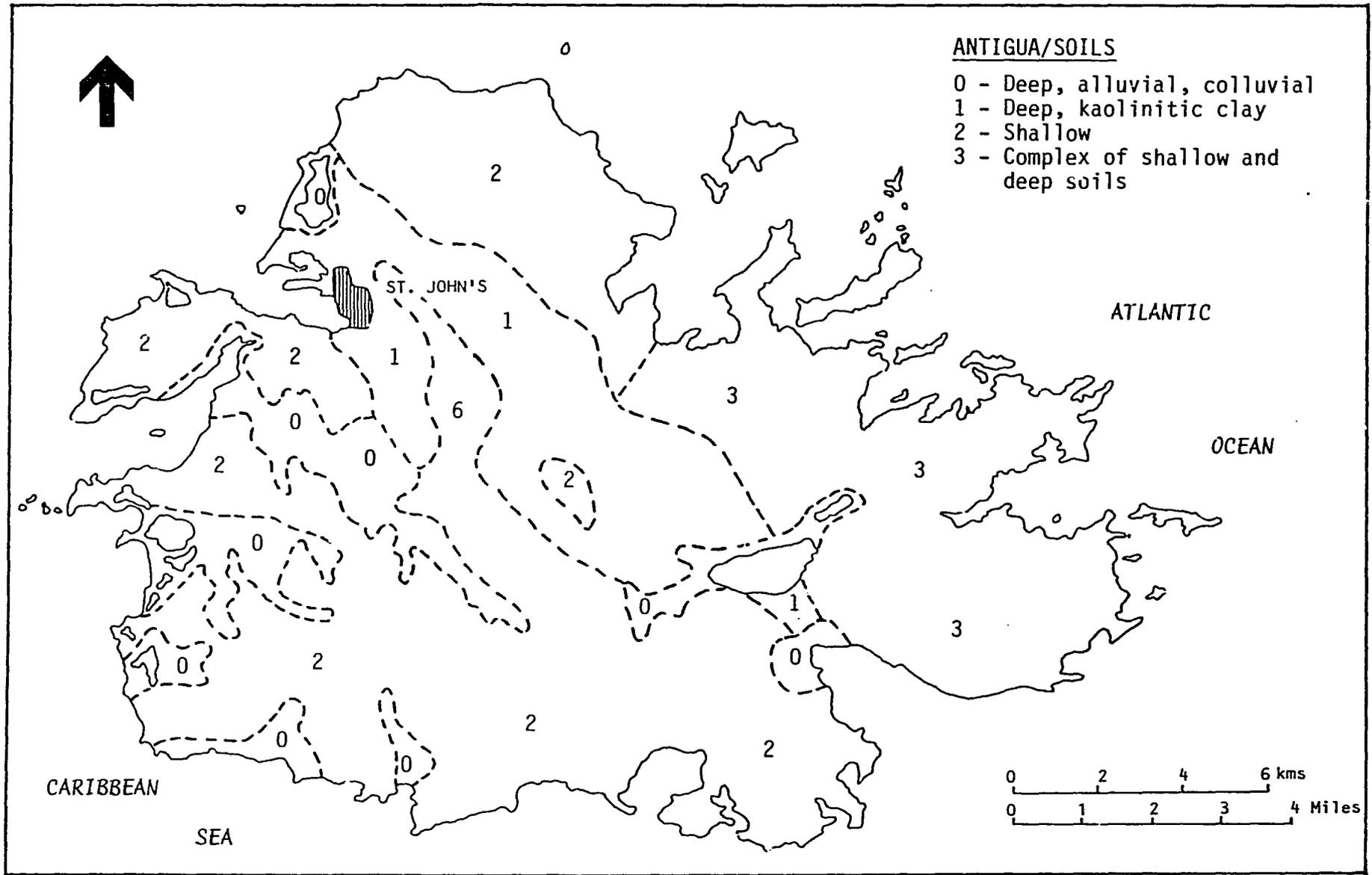


Figure 1.2(6). Soils map of Antigua (source: Atkins Land and Water Management, 1993).

ified the land classification system to reflect conditions in Antigua and Barbuda (see Table 1.2(2)). His study began by ground-truthing existing soil maps, including, wherever possible, interviews with farmers about cropping systems employed and soil management problems.

In Ahmad's work, "cultivation" is still used to refer to mechanical cultivation; but, as he notes, much cultivation in Antigua and Barbuda is done manually. Therefore, his data, which are the basis for the table on Land Capability reported in Government's Statistical Yearbook for 1988 (GOAB, 1989b), are conservative, in the sense that the same Class rating allows for more land use flexibility, given typical land use practices in Antigua and Barbuda, than it would in the United States. The amount of land falling into the various land use classes in Antigua and Barbuda is also presented in Table 1.2(2).

#### 1.2.4 Vegetation

The most comprehensive botanical treatment of Antigua remains Loveless' (1960) monograph, which was based largely on the field work done by Box and Charter in the mid-1930's. Loveless described Antigua's vegetation in terms of Beard's system for neotropical vegetation (Beard, 1955).

Nearly 50 years after the field work done in the 1930's, a plant ecologist working for OAS prepared an "ecological classification" of the vegetation of Antigua and Barbuda (Morello, 1983). The justification for taking this approach was that the "natural" vegetation had been altered beyond recognition by human manipulation, an argument that seems especially relevant for the CEP, which reputed to be a "state-of-the-environment" report. Accordingly, Morello's classification (1983) has been adapted for use in this Country Environmental Profile (see following sub-section).

It should be noted that the classification of vegetation into "types" is convenient but also artificial. Vegetation almost always

occurs on a time and space continuum; the boundaries between types is rarely sharp and usually changes over time. The forests are more distinct than the other types described and typically do not have any grass cover present. The remaining three types in Morello's classification truly represent a continuum, and the classification becomes more arbitrary. Grasslands are areas consisting exclusively of grasses and those dominated by grasses but containing some woody plants. In savannas, the woody element is more conspicuous; emerging shrubs and trees occur over a more or less complete grass understory. In the scrub forest, the shrubs and trees are more evident, and the grass layer is discontinuous.

Finally, it should be noted that the percentages given in Morello (1983) do not directly correspond to the vegetation types described in the adaptation found in the next sub-section; the figures shown do not therefore sum to 100 percent.

#### PRINCIPAL VEGETATION TYPES OF ANTIGUA AND BARBUDA

The following are the principal types of vegetation found in Antigua and Barbuda, as adapted from Morello (1983). They reflect the "natural" vegetation and the subsequent human-induced landscape.

##### FORESTS

[Forests occupy an estimated 15 percent of the land area and are sub-classified as follows.]

(1) **Humid valley forest.** This is the most structurally complex of the insular ecosystems of Antigua, but only small areas of this type exist. It is currently dominated by the ciba tree (*Ceiba pentandra*), with several *Ficus* spp, *Delonix regia*, and a number of wild fruit trees. The structure still consists of four layers or more of vegetation, although it is poor in vines, epiphytes, and palm trees and has no ferns. The type is found in areas of greatest water availability on well-drained soils in the southwest part of Antigua but does not occur in Barbuda.

Table 1.2(2). Features of the land capability classification system used for Antigua and Barbuda.

CLASS	DESCRIPTION	Antigua		Barbuda	
		Acres	(%)	Acres	(%)
I	Very good land that can be cultivated safely and permanently, using good methods. Negligible limitations, but the addition of fertilizers may improve production.	-	-	-	-
II	Good land that can be cultivated using easily applied protective methods; one limiting factor or degree of limitation exists.	4,835	7.4		
III	Land that can be cultivated using moderate to intensive conservation and management practices; two factors or degrees of limitation exist. In Barbuda, Class IIIe lands are limited by erosion, lack of rain; salinity or the nutrient status may be secondary limiting factors; rotational strip cropping is advised. Class IIIs are mainly shallow soils; stoniness, salinity, lack of rain and erosion may further restrict utilization.	22,662	34.6	6,640	18.1
IV	Land that can be cultivated only using very intensive conservation and management practices; three factors or degrees of limitation exist. In Barbuda, Class IVe land limitations are mainly excessive erosion and low rainfall; additional factors are adverse soil conditions including impeded drainage. Class IVs limitations are mainly adverse soil factors such as shallowness, stoniness or salinity, and low rainfall; secondary limiting factors are erosion or impeded drainage.	5,734	8.8	12,048	32.8
V	Land marginal for cultivation; four factors or degrees of limitation exist. In Barbuda, Class Ve lands are limited by extreme erosion, low rainfall, adverse soil conditions such as stoniness, shallow profile or impeded drainage. Class Vs lands are mainly limited by adverse soil factors; secondary limitations are low rainfall, impeded drainage and possible erosion.	8,858	13.5	13,312	36.2
VI	Land normally unsuitable for cultivation but may be used with extreme care by experienced farmers in manual agricultural systems.	20,357	31.1	-	-
VII	Land unsuitable for cultivation, such as bare rock, salinas, swamps, and land that may, through erosion, adversely effect neighboring lands; suitable for rough pasture, wildlife, recreation and water conservation.	3,041	4.6	4,724	12.9
VIII	Lands unsuitable for any kind of plant production, including pastures; suitable for the non-agricultural uses described for Class VII.	-	-	-	-
	TOTALS	65,487	100	35,724	100

Source: Adapted from Ahmad (1984) and GOAR, 1985b.

(2) **Slope forest.** This contains much of the deciduous forest referred to, but not described in Morello (1983). It is found in the volcanic region of Antigua and the highlands of Barbuda. Original vegetation has been greatly altered for production of wood.

(3) **Mangrove.** Three types -- red (*Rhizophora mangle*), white (*Laguncularia* spp.), and black (*Avicennia*) exist and are found on both islands.

(4) **Scleromorphic forest of white cedar** (*Tabebuia pallida*). This type is important only on Barbuda.

(5) **Mangrove edge forest.** A leguminous forest dominated by Haematoxylon (logwood) and Pithecellobium ("bread and cheese"). Very extensive on Barbuda but not important on Antigua.

#### SCRUBLANDS

[Scrublands are an indistinct group, sometimes considered part of the savanna complex. Collectively, thorny scrub types occupy 20 percent of the land area.]

(1) **Succulent thorny scrub.** Dominant species are *Pilocereus obilis*, *Opuntia dillenii*, *Agave obducta*, and *Acacia farnesiana*. In this ecosystem, Acacias behave as facultative deciduous trees, that is, they lose their leaves when water is unavailable. Biomass of grasses is minimal. This is a littoral ecosystem.

(2) **Thorny succulent-Sclerophyllic scrub.** This type shares two of the dominant species listed above -- *P. nobilis* and *A. obducta* -- but *Croton* replaces *Acacia*. It occurs in the driest environments on the island and is indicative of annual rainfall of less than 30 inches. This also is a littoral ecosystem.

(3) **Scrub-forest of sclerophyllic plants.** Dominated by large, leathery-leaved types (scleromorphic), such as *Coccoloba uvifera*, accompanied by *Byrsonima lucida* and *Coccolobis diversifolia*.

(4) **Thorny scrub.** The type is characterized by its lack of diversity, i.e., monospecific or paucispecific. It was induced by human activity and now occupies former cotton and cane fields in the central plain. It is made up of different combinations of *Acacia nilotica*, *A. lutea*, *A. tortuosa*, or *A. farnesiana*.

(5) **Scrub forest of microphyllic plants.** This type is characterized as an invader; old forests of *Bursera* and *Pisonia fragrans* appear. It was induced by human activity following exploitation of the forests for charcoal production.

#### SAVANNAS

[The leguminous savanna (parts of 2, 3, 5 and 9) is the most common, occupying some 65 percent of the two islands. Scleromorphic savanna occupies an estimated 5 percent.]

(1) **White cedar.** This type is found in the Barbuda highlands and the valleys of the volcanic zone of Antigua. *Acacia* does not invade.

(2) ***Prosopis chilensis*.** Type occurs from St. John's to Vernons, on central plains on well-drained and poorly-drained slopes. In leguminous savanna, *Prosopis* dominates over *Acacia*.

(3) **"Cerrado brasileiro" type.** This is a type of scleromorphic savanna occurring on clayey soil with visible parent rock of calcium carbonate. It can be found on the poorly-drained soils from the hills of the central plains of Antigua.

(4) **Cashew.** A type of scleromorphic savanna occurring on sandy beaches. *Acacia* does not invade.

(5) ***Acacia*.** A type of leguminous savanna occurring in any environment of Antigua; it is absent from Barbuda.

(6) **Guava** (*Psidium guava*). A type of scleromorphic savanna found on soils of different origins. *Acacia* does not invade volcanic areas.

(7) **Date palm savanna.** A type of scleromorphic savanna caused by human activity. It occurs on calcareous parent rock in the hills of the central plain of Antigua but not in Barbuda.

(8) **Cocos nucifera.** A type of scleromorphic savanna; it is difficult to distinguish natural trees from planted coconuts.

(9) **Leucaena savanna.** A leguminous savanna which is almost nonexistent except in very humid valleys such as Glanvilles and Willikies in Antigua.

(10) **Fruit tree savanna.** A type of scleromorphic savanna comprised primarily of sweet apple (*Annona cherimoya*), genip (*Genipa americana*), and guava (*Psidium guajava*). Acacia does not invade.

### GRASSLANDS

[The grasslands consist of two main types -- turf and tussock. Turf grass has most of its biomass close to the soil surface in stolons and rhizomes; tussock grass has biomass at several layers above the soil. Both grassland types often contain elements of savanna.]

(1) **Lemon Grass.** This vegetation type is planted; almost pure grasslands exist in Antigua. This grass (Citronella) has exocrine hormones that inhibit the development of other plants such as the fasciculated grassland and tussock grass.

(2) **Antigua hay grass.** *Andropogon caricosus*, an excellent forage species, is the most common turf grass on Antigua.

## 1.3 HISTORY AND CULTURE

### PREHISTORY

Antigua developed from a volcano that rose out of the sea about 34 million years ago during the Oligocene period. When the volcano subsided, coral began to grow on the remaining volcanic rock, and in time limestone of the Antigua formation was established toward the northeast of the island. Antigua thus differs from most other islands as being of both volcanic and limestone formation. This was important for both the prehistoric and later agricultural peoples who settled the island.

Because of its unique physical characteristics, Antigua appears to have many more archaeological features than any other island in the Eastern Caribbean. Its many reefs and mangroves in the northeast provided large quantities of marine resources for sustenance, and limestone formations yielded valuable flint for stone tool making by the earliest inhabitants. A non-agricultural and aceramic people inhabited Antigua at least 3,000 years BC in the area of Mill Reef on the east coast. They may have arrived from both the south and the northwest.

Sixty-two aceramic sites of the first group (or groups) of stone tool-making peoples (ca. 3500-100 BC) have been discovered to date as well as about 65 sites of a second group of agricultural and pottery-making peoples commonly known as the Arawaks. The Arawaks paddled up the island chain from South America sometime between 50-1100 AD. On Antigua, these seafaring farmers and fishermen found plenty of flat land, fertile valleys and reefs for their sustenance. Most prehistoric sites are found on the east and northeast coasts of the island because of the abundance of natural resources in these areas.

A third group known as the Caribs, living on Dominica and St. Kitts, foraged on Antigua for natural resources that were not as common in their homelands. Their raids continued through early European settlement and did not end until about 1705.

## ANTIGUA-BARBUDA "VITAL STATISTICS"

The nation of Antigua and Barbuda is situated at the northern end of the Lesser Antillean arc of islands, about 250 miles east-southeast of Puerto Rico. It has been described touristically as the "Heart of the Caribbean", for it is centrally located between the Greater and Lesser Antilles. Antigua and Barbuda's geographic position in the region has made it important historically, and it now serves as the hub for regional airline connections.

<b>Location</b>	ANTIGUA: 17 degrees/17 degrees 10 minutes North; 61 degrees 40 minutes/61 degrees 55 minutes West BARBUDA: 17 degrees 35 minutes North/61 degrees 48 minutes West (28 miles north of Antigua)
<b>Area</b>	ANTIGUA: 280 sq. km. (108 sq. miles) BARBUDA: 160 sq. km. (62 sq. miles)
<b>Highest Point</b>	ANTIGUA: Boggy Peak, 402 m (1,319 ft.) BARBUDA: Highlands, 38 m (125 ft.)
<b>Rainfall</b>	ANTIGUA: Annual Average - 107-114 cm (42-45 inches) BARBUDA: Annual Average - 76-99 cm (30-39 inches)
<b>Temperature</b>	Annual Average: 28 C (81.8 F) Minimum/Maximum: 23 C (74 F), January; 29 C (84 F), August
<b>Water Supply</b>	ANTIGUA: 7 reservoirs and 60 wells BARBUDA: catchments, cisterns, wells
<b>Vegetation</b>	ANTIGUA: In the southwest, evergreen deciduous forest and in the northeast, evergreen woodland BARBUDA: Xerophytic, dry woodland
<b>Physical Features</b>	ANTIGUA: Mainly coral-based and low lying, but the south is particularly fertile, with undulating hills of volcanic origin. The coastline is deeply indented and provides many natural harbors. BARBUDA: Low limestone island; to the north and west lies an area of lagoons and creeks separated by beach ridges and mangrove swamps.
<b>Population</b>	TOTAL POPULATION: 78,726 (1988); 1990 Estimates range from 82,000 - 87,000; New Census in 1991 BARBUDA ONLY: 1,100 (estimated)
<b>Economy</b>	Twenty years ago, agriculture was the backbone of the economy, accounting for 40% of GDP; sugar and cotton were significant export crops. Today tourism is the primary economic sector, with some manufacturing (export-oriented enclave industries), agriculture, fishing.
<b>Major Port</b>	Deep-water harbor at St. John's, Antigua, used by cruise ships and for cargo transportation.
<b>Airports</b>	V.C. Bird International Airport, approximately 9 km north of capital with two small airports on Barbuda: a nationally-owned facility near Codrington and a privately-owned airport near Coco Point.

## EUROPEAN SETTLEMENT

Columbus sighted the island in 1493 from near Redonda and named it Santa María la Antigua after a miracle-working virgin from the Seville Cathedral. In the late sixteenth and the first quarter of the seventeenth centuries Antigua was visited by potential Spanish and English settlers, but the island was not actually colonized until 1632. The first settlement was led by Edward Warner, the son of Sir Thomas Warner, who had already colonized St. Kitts in 1628. Antigua's oldest historical site is at the Savannah House ruin, the former home of the Warners and site of two of their tombs.

Tobacco was the first significant cash crop and was so listed as early as 1655. However, the island's soils and climate were marginal for tobacco production, and this coupled with a drop in market price led to the substitution of sugar as the primary crop. Sugar cane, around which the history of Antigua was to revolve for the next 300 years, had actually been introduced around the time of tobacco. By the time it took over as the leading crop toward the end of the 1700's, the shortage of an adequate labor supply had emerged as a serious problem. European indentured labor was not sufficient, and the colonialists looked to West Africa and slavery as the solution.

The first full-scale sugar plantation was established at Betty's Hope about 1674, when Christopher Codrington settled from Barbados, bringing the latest sugar technology with him. Antigua's topography suited the growing of sugar cane, and almost all of the island's forests were cleared for sugar cultivation. The central plain was the region best suited for the growing of cane, but land throughout the island was used; cultivation occurred nearly to the top of mountains. Antigua's low-lying lands allowed the easterly trade winds to power sugar mills more constantly than in the mountainous islands further south in the Lesser Antillean chain. Even today 109 stone windmill towers dot the landscape, mute evidence of the great prosperity of the family-sized plantation of a bygone era.

Plantation owners grew rich, but the social fabric of the island was uneasy, with a huge gap between the lifestyle of the privileged white settlers and the wretched conditions of the large slave population. The elite were in constant fear of slave uprisings. Slaves led by King Court (alias Tackey, Prince Klaas) narrowly missed blowing up the plantationocracy at a ball in the gunpowder plot of 1736.

Natural disasters such as hurricanes, droughts and earthquakes added to the challenges of life in Antigua, and many of the plantation owners preferred to live in England, using overseers to manage their estates. Thus, an economy developed that was focused almost entirely on trade and export. The land was exploited for cash crops (mostly sugar), while basic foodstuffs were imported.

## DEFENSE

The growing wealth of Antigua soon aroused the envy of other nations. The planters were obliged to fortify themselves strongly because Antigua had so many sheltered bays with smooth sandy beaches which made ideal landing places for surprise attacks. During the French Wars, Antigua found itself in the middle of enemy strongholds located in St. Kitts, Guadeloupe and Dominica. The French did successfully occupy Antigua for a brief period, but after only six months the island was returned to England by treaty in 1667.

The largest military complex was at Shirley Heights, which was started just after the loss of the American colonies in the 1780's. It became the Leeward Islands' military headquarters and was capable of holding and maintaining a complete regiment. Antigua probably had a greater number of fortifications, in relation to its size, than any other place in the world. At one time there were about 40 military installations around the coasts of Antigua, creating today's rich military heritage.

Antigua possesses several deep-sheltered harbors, one of which, English Harbor, became a favorite refuge for England's war-

ships in the Caribbean. In 1725, a Royal Dockyard was built at English Harbor, where the King's ships, responsible for patrolling the valuable British Caribbean sugar islands, were repaired and maintained. Captain Nelson, later Admiral and victor at the Battle of Trafalgar, was temporary Commander-in-Chief of the Leewards stationed at English Harbor in 1787.

With the defeat of Napoleon in 1815, Antigua's military establishments were no longer needed and gradually fell into decay. The last garrisons left in 1854, and the Dockyard was closed down in 1889. Today a restored Nelson's Dockyard is a National Park and one of the most complete surviving examples of an eighteenth century fortified naval base anywhere in the world. It has been revitalized as a haven for sea-going yachts and is one of the best examples of adaptive use of a historic monument in the Caribbean.

## POST EMANCIPATION

In 1804, a motion was passed in the British Parliament for the abolition of the slave trade, but it was not until three years later that the official act came into force and yet another 27 years before the slaves of Antigua were freed by the Emancipation Act of 1834.

Initially freedom for the masses was little better than slavery. Plantation owners were no longer responsible for feeding, clothing and caring of their labor force, and ex-slaves often had no choice but to work for the meager wages that were offered. Unhygienic conditions, inadequate medical attention and poor wages fostered destitution and resentment over the next hundred years.

The black population was denied land to set up its own villages. To keep workers on the estates, planters devised the Contract Act, by which laborers were given free housing and medical attention in return for an annual work contract. Villages did begin to form, however, mainly on church lands around chapels that had been built by the Moravians and Methodists.

In the meantime, the sugar estates were in trouble, for the price of sugar had begun to fall and there was competition from European beet sugar. The position of West Indian sugar planters became so critical that a Royal Commission was appointed in 1896 to look into the depression. One recommendation was that estates in the British West Indies should be run more scientifically. This led to the establishment of a central sugar factory at Gunthorpe's, where workers from all over the island were able to gather and compare grievances. Also for the first time the people were able to learn new skills and become more self-sufficient.

World War I caused further deterioration in the conditions of Antigua's laboring masses. The planters were earning high wartime prices for sugar and cotton, but they still were paying appallingly low wages; additionally, because of the war, food was in short supply. Under these conditions a riot ensued and in a confrontation on Newgate Street (now an historic landmark), two persons were killed when police fired on a crowd. The riot was unsuccessful in improving workers' conditions; it was not until six years later that even minor concessions were made. Labor conditions continued to worsen. Law and order was threatened, and the situation reached such a crisis that a Royal Commission was appointed under Sir Walter Citrine. He urged the formation of a labor union, and only sixteen days later on January 16, 1939, the first trade and labor union was born. It was from this union that the first truly representative government was later elected.

## BARBUDA

Barbuda was leased to the English Codrington family from 1668 until 1870, for the payment of one fat sheep a year. The island's land was too rocky to allow cultivation of sugar, but Barbuda was used to supply the Codrington's sugar estates on Antigua with marine resources, cattle, provisions and leather goods. Income was also derived from the proceeds of cargoes salvaged from the many shipwrecks that occurred along the island's low-lying coast. On August 1, 1860, Barbuda became an integral part of Antigua,

## THE INFLUENCE OF HISTORICAL AND CULTURAL FACTORS ON LAND USE PATTERNS

The dominance of the sugar economy in Antigua has produced a population with little intrinsic sense of land husbandry or basic pride and appreciation for the land. The majority of Antiguans are descendants of slaves who were used by plantation owners to exploit the land for the wealth it could produce, with little concern for maintaining ecological equilibrium. Almost none of the wealth produced went back into the land; instead it went toward supporting lavish lifestyles, elaborate defense systems and homes in England. The basic loyalties of plantation owners were to the Mother Country. As an indigenous, professional middle class began to develop in the nineteenth century, this focus continued to affect the perceptions of educated persons who were mostly schooled in Europe. Few had any desire to be connected to the land, even if they came back to Antigua.

The slaves could hardly have been expected to develop any concern for the well-being of the land; it did not belong to them and required back-breaking labor to work. It had no relation to their culture or ancestry, as they had been uprooted and forced to live in the West Indies. Thus, a basic African love of the land increasingly developed into more of a sense of alienation from the land. Not long ago, an older man, trained in engineering, was asked why he kept goats when he could see what damage they were doing to the vegetation and the land. "But it's not my land" was the reply. As tourism developed in the twentieth century, the rural population made every effort to secure jobs in hotels, rather than continuing to work the land. During the last years of sugar production, cane cutters had to be imported from other islands. Antiguans did not want to be seen working in the fields of their own country, as it was considered too "low class".

Ownership is a key factor in a people's ability to develop a sense of careful land use. Not much of the land in Antigua is owned by the people who work it. The remaining sugar estates were combined in the 1950's to form a Sugar Syndicate which fed the central sugar factory at Gunthorpe's; when this Syndicate collapsed, the Government acquired ownership of these extensive lands. However, Government does not have sufficient resources to manage the land, and much of it lies fallow and exposed to further degradation. As waste accumulates in an ever more "modern" lifestyle, the land along rural back roads is increasingly used as a dumping ground -- not for productive land uses.

Over the years the landscape of this little island has been exploited, abused and depleted. Forest cover has been cleared, resulting in erosion and a drying up of water sources. With the advent of tourism, similar patterns can be seen in the use of coastal areas. Mangroves are cut down, garbage is deposited in wetlands and beach sand removed, with drastic effects on both the shoreline and the protective fringing reefs. Most of the hotel owners, like the plantation owners, are from overseas and have shown little knowledge about or sensitivity to the delicate ecological balances at work in this tropical insular environment.

Of course, there always have been voices decrying these conditions. As early as 1721, the Body Ponds Act prevented the felling of trees around these natural reservoirs, and there are many laws governing the removal of sand, the disposal of waste, the tethering of animals, and so forth. However, enforcement has historically been minimal. The challenge to Antiguans in the years ahead is to develop viable land use and coastal zone management policies and to create an awareness that such policies and protections are in the best interests of the country and its people. With weak land-appreciation traditions to draw upon, education will be a key factor in developing such an awareness.

Source: Antigua and Barbuda Historical and Archaeological Society.

and the Antigua Legislature assumed responsibility for the island. The Codrington estate was now running at a loss, and its lease was finally relinquished in 1870.

## CONSTITUTIONAL DEVELOPMENT

As of 1672, Antigua was commissioned as part of the British Leeward Islands, which at the time consisted of Antigua, Barbuda, Redonda, St. Kitts, Anguilla, Sombbrero, and the Virgin Islands. From 1898 until 1937 the Leeward Islands were considered a Crown Colony. Antigua's only labor union ran five candidates for the 1946 elections, all of which were elected to sit on the Executive Council. It was the first time that this governing body, mainly composed of the plantocracy, had any labor representation. In 1951, with adult suffrage, a majority of labor members was returned to the Legislative Council, and the elected members began to share in the executive branch of government on an advisory basis through a committee system. In 1956 the Leeward Islands Federation was abolished and a ministerial system of government was introduced on a limited scale. The labor union again won all the elective seats. Constitutional advances continued in 1961 with the elected membership of the Legislative Council increasing from 8 to 10 seats and the position of Chief Minister being created. By 1966, Antigua made sufficient progress for its leaders to consider independence from Great Britain. In February 1967, Antigua, Barbuda and Redonda became an Associated State in which only foreign affairs and defense remained under the control of Britain. Then in November 1981 full independence was achieved when Antigua and Barbuda became the 157 member of the United Nations.

## 1.4 PHYSICAL INFRASTRUCTURE

In many ways, Antigua and Barbuda has infrastructural development far beyond most developing countries. There is an international airport with several daily flights to the United States and to Europe, a good road system, easy telecommunications with the rest of the world, and fairly reliable water and electricity service (Figure 1.4(1)).

### TRANSPORT

**Air.** V.C. Bird International Airport, located north of the capital, serves an average of 40 commercial flights a day. Direct connections to the United States, Europe, and other islands in the Caribbean are available on five international and several regional carriers. Leeward Islands Air Transport (LIAT), a regional carrier, has its headquarters in Antigua, and the country serves as a major hub for regional travel. Air cargo and small package delivery services are provided by all carriers (Antigua Chamber of Commerce, n.d.).

There are two small airports on Barbuda. The nationally-owned airport near Codrington has several commercial flights daily from Antigua. A privately-owned airport is located in the region of Coco Point (OAS, 1990).

**Sea.** Sea transport is available through several ports on Antigua. Deep Water Harbor near St. John's has facilities to handle containers, roll on/roll off and lift on/lift off cargo. Service is available to the United States, Europe and the Far East. A small amount of cargo is also shipped through port facilities located on Crabs Peninsula. During the severe drought in 1983-84, imported fresh water was unloaded at the Crabs facility (Antigua Chamber of Commerce, n.d.; GOAB, 1989b).

**Roads.** Roads service almost all parts of Antigua, and the relatively flat terrain compared to the Windward Islands makes it possible to drive from one end of the island to the other in under an hour (see Figure 1.4(1)). The European Development Fund is

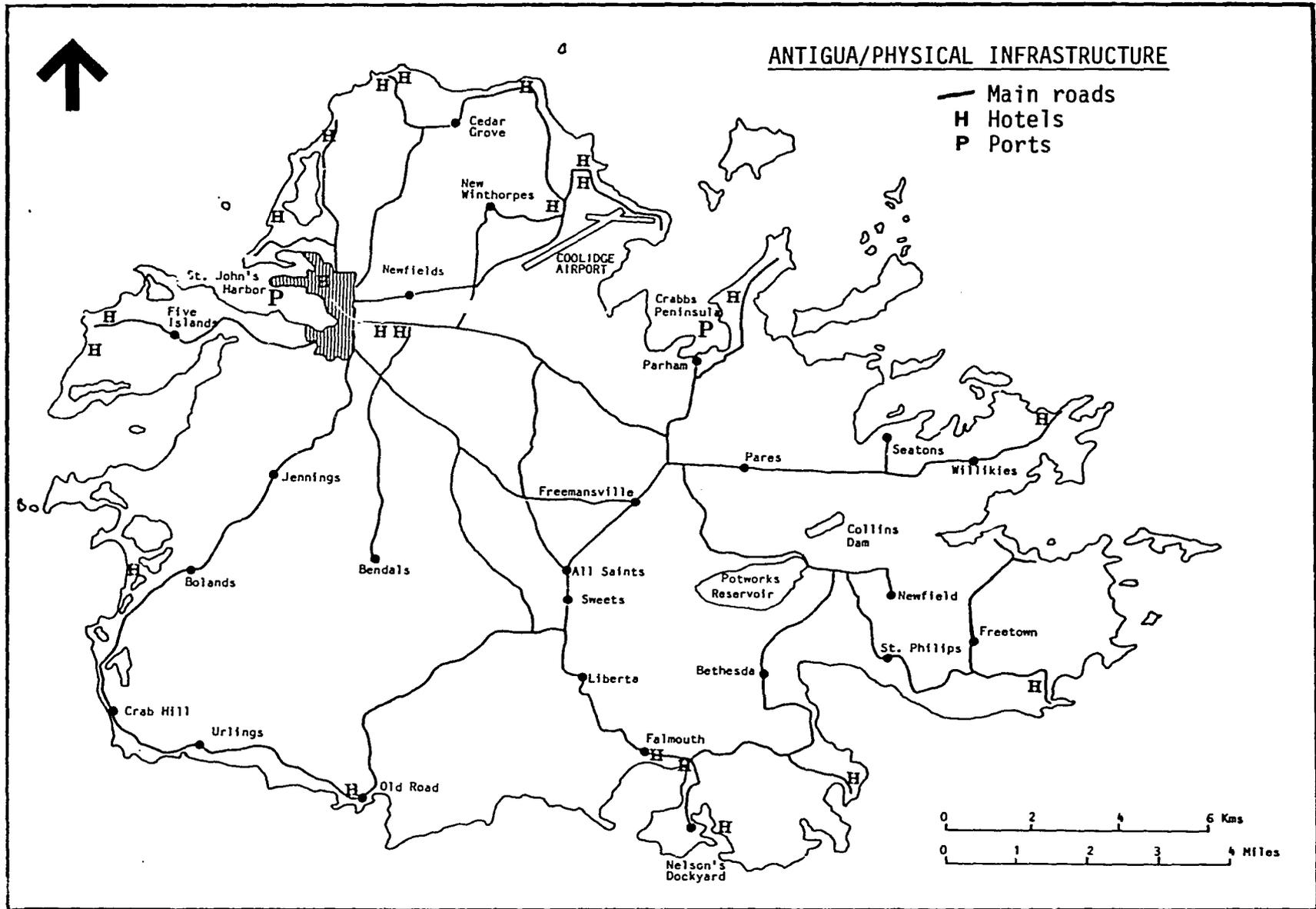


Figure 1.4(1a). Location of important physical infrastructure for the island of Antigua.

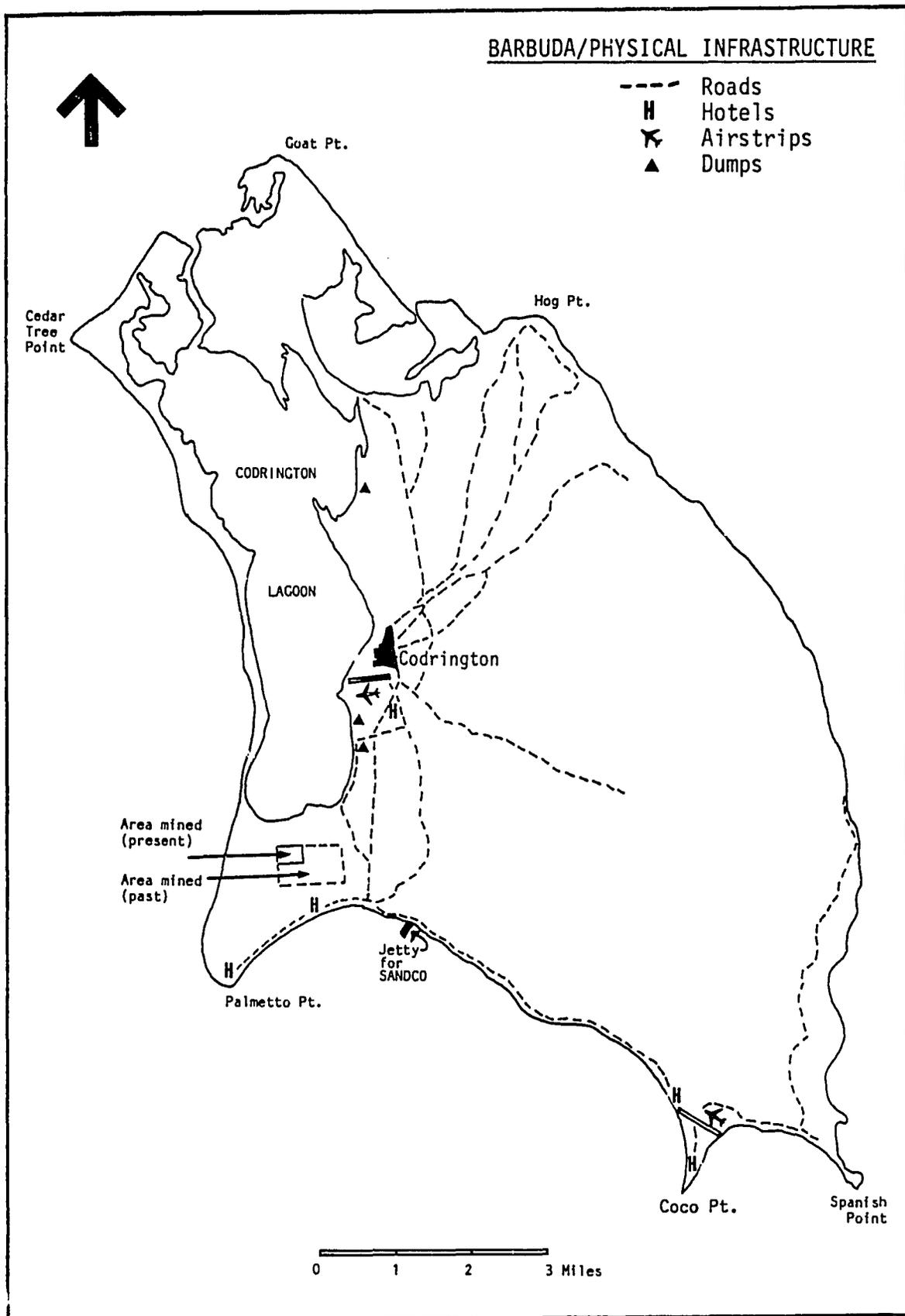


Figure 1.4(1b). Location of important physical infrastructure for the Island of Barbuda.

sponsoring a road improvement project to widen and resurface main roads to the remoter sections of the island. To facilitate expansion of commercial agriculture into presently uncultivated areas, several dozen miles of rough tracks would need to be regraded, but in general the roads are adequate to get agricultural goods to market.

Traffic congestion poses a serious problem in the St. John's area, particularly during business hours.

## COMMUNICATIONS

The Antigua-Barbuda Public Utilities Authority (APUA) provides telephone service to over 7,500 private and commercial subscribers throughout Antigua and Barbuda, and service is generally adequate. Coin-operated public telephones are located in most of the smaller towns and villages to serve those without telephones in their homes, although many of these phones are in need of repair. A microwave link allows APUA to provide all basic telephone services to Barbuda.

A private company, Cable and Wireless, provides overseas telephone, cable, telex, facsimile, electronic mail, and other electronic data transmission services. Cable and Wireless maintains a microwave transmission tower atop Boggy Peak (the highest point in Antigua) in the southwest part of the island. (Antigua Chamber of Commerce, n.d.; GOAB, 1989b; APUA, 1989).

## 1.5 SOCIO-ECONOMIC SETTING

### 1.5.1 Demographics and Human Resources

The 1970 Census, the last population census to be conducted in Antigua-Barbuda, enumerated a population of 64,794, with 63,723 persons in Antigua and 1,071 in Barbuda (for a brief sketch of the population history of Antigua-Barbuda see Bouvier, 1984). Planning is now underway for the 1991 population census, and the census questionnaire is currently being pretested. Antigua's failure to conduct a census in 1980-81 makes any discussion of recent demographic trends somewhat risky. In fact, current estimates of Antigua's population are quite imprecise since they have been based on assumptions regarding growth rates that have no empirical validity. The demographic data in Table 1.5(1) should therefore be interpreted with caution.

In the absence of census data for the 1980's, the 1984 Agricultural Census provides the only somewhat reliable data source on numbers of households, population size, and population distribution. One of the objectives of this census was to obtain a count of the number of households and persons in Antigua-Barbuda; it was not a substitute for a population census but was to help plan for such a census (Campbell, 1986). A post enumeration survey was conducted in 1985 to adjust for the undercounting of non-farm households, and the number of households and persons was adjusted upwards.

The relationship between population, resources and the environment is well documented; yet policy makers routinely ignore the incorporation of demographic data into the planning process. Given the fragile nature of insular Caribbean environments, their finite land area, and limited absorptive capacity, the question of future population growth and distribution must emerge as a top priority for policy makers in the 1990's. In the face of declining opportunities for emigration and increasing return migration and immigration, much of it attendant on the tourism-related economic restructuring underway, Antigua-Barbuda needs to formulate a coherent

Table 1.5(1). Selected demographic indicators for selected years, 1970-1988.

Indicator	1970	1975	1980	1984	1988
Estimated Mid-Year Population	64,794	69,475	72,944	75,067	78,726
Pop. Density (per sq. km)	147.2	157.8	165.7	170.5	178.8
Crude Birth Rate (per '000)	23.8	19.2	17.0	15.0	14.1
Crude Death Rate (per '000)	6.3	6.8	5.3	5.1	5.6
Rate of Natural Increase (%)	1.75	1.24	1.17	0.99	0.93
Estimate Pop. Growth Rate (%)	-	0.83	0.89	0.68	2.12
Total Fertility Rate	3.27	-	-	-	1.7
Births to Teenage Mothers as					
a Percent of all Births	-	26.7	30.3	25.7	20.8
Crude Marriage Rate	-	-	-	2.70	4.85
Residents Returning by Air	-	18,629	27,633	44,571	59,790
Residents Leaving by Air	-	16,904	24,913	28,789	56,335
Difference	-	1,725	2,720	-	3,455
Estimated Labor Force ('000s)	-	24.5	30.4	14.3	-
Estimated Total Employment ('000)	-	19.8	24.1	30.8	-
Estimated Unemployment Rate (%)	-	19.2	20.7	10.2	-

Notes:

1. Population density figures do not include uninhabited Redonda.
2. "Residents Leaving by Air" figure for 1984 does not show data for May and July which were not available.

Source: Statistics Division, Ministry of Finance, Government of Antigua-Barbuda.

Government policy to absorb returnees and immigrants.

## POPULATION SIZE

Table 1.5(1) shows mid-year estimates of the population of Antigua-Barbuda for selected years from 1970 to 1988. The 1984 Agricultural Census placed the population at 70,134, a difference of 5,000 from estimates of the Government's Statistics Division. Current estimates put the population of the country at between 82,000 (Department of Statistics) and 87,000 (Peters, 1990). Bouvier's (1984) projections for 1990 show an estimated population of 85,000. Bouvier's projections are questionable, since they begin with a base year for which there were no reli-

able age/sex data, and make a series of assumptions regarding future patterns of migration and fertility that have, unfortunately, turned out to be incorrect. For example, under Bouvier's low projection, the total fertility rate (TFR) was expected to decline to the replacement level (2.1) by 1990 and remain at this level until 2030, while net migration was assumed to be zero. Currently, however, the TFR has declined to an estimated 1.7, while net migration is now positive.

It is precisely these kinds of problems (unanticipated changes in fertility and migration, lack of familiarity with what is actually happening on the ground, the depopulation effects of a natural disaster, etc.) that makes the exercise of projecting population an imprecise one. Indeed, it is of dubious utility to

project populations more than 15 to 20 years at a time, and projections must be continuously revised.

## POPULATION DENSITY

Antigua-Barbuda's population density of 179 persons per square kilometer is average by OECS standards. However, if Antigua were taken alone, its population density would rank it near the top with Grenada and St. Vincent. With projected increases in population growth, densities will rise and will require greater planning attention to avoid the accompanying environmental and social problems so evident in small, densely-populated mass tourism islands. Already in some areas in and around St. John's, densities of 2,700 persons per square kilometer are common, and since these areas often have inadequate sewage and sanitary facilities, concerns about public health issues have increased. Barbuda on the other hand has a very low population density, estimated at 6.8 persons per square kilometer.

## POPULATION DISTRIBUTION

Table 1.5(2) shows changes in the population distribution between 1970 and 1984. Like most small Caribbean islands, settlement patterns in Antigua have long favored residence in and around the capital/port city and reflect a strong urban orientation (McElroy and de Albuquerque, 1981). In 1970, an estimated 53.8 percent of the population of Antigua resided in the city and parish of St. John's, which is about the same percentage recorded in the 1946 census. By 1984, the city and parish of St. John's accounted for 58.2 percent of Antigua's population. Areas of greatest growth between 1970-1984 were those areas within commuting distance of the city of St. John's and along the major road arteries leading into the capital -- Factory Road (St. John's Village, Potters), Old Parham Road (Skerrets, Casada Gardens), Fort Road (Gambles, Paradise View), Friar's Hill Road (Upper Gambles), All Saints Road (Newton, Belmont), and Valley Road (Gray's Farm, Gray's Hill).

Linked to increasing urbanization/suburbanization has been the steady loss of population from some more distant rural communities. For example, in 1970, 2,394 persons lived in Liberta, while the 1984 Agricultural Census put the population of Liberta at 1,508. Similarly, communities like John Hughes, Buckleys, Sawcolts, Swetes and Bethesda have also been losing population. As the process of urbanization/suburbanization intensifies, it is estimated that by the year 2000 over half the population of Antigua will live within a five kilometer radius of St. John's. Like the experiences of other islands (e.g., the United States Virgin Islands, New Providence, Bermuda) which have undergone the tourism-led economic restructuring currently underway in Antigua, it is anticipated -- despite some of the disaggregating effects of tourism -- that there will be a further concentration of economic activity in and around St. John's. Furthermore, with planned improvements in the infrastructure, the sustained growth in household and personal income, and the ubiquity of the automobile, the pace of suburbanization should quicken.

The environmental impacts of this ongoing urbanization/suburbanization process are quite far reaching. St. John's already has major infrastructural problems -- there is vehicular congestion; parking is extremely difficult; there are open sewers, unsightly construction waste, and inadequate solid waste removal; and the overall aesthetic and environmental quality of the city is quite unattractive to residents and tourists alike. In addition, a critical housing shortage in and around St. John's exists, and this has led in some areas (Gray's Farm Villa, the Point) to the proliferation of squatter settlements. Such settlements give the town an unplanned look and also pose an environmental health hazard. Unfortunately, because of the high cost of urban/suburban real estate, squatting is the only alternative for some of the poorer segments of the society.

The "suburbs" likewise suffer from some of the same problems as St. John's -- increased vehicular traffic, poorly maintained roads, inadequate solid waste disposal, etc. Much of this growth has been unplanned and haphazard (see Section 7 of the Profile).

Table 1.5(2). Number of households and persons and average household size, 1970 and 1984, by enumeration districts.

Enum. Districts	Corresp. Parish	No. of Households		No. of Persons		Avg. Household Size	
9, 26, 29-31, 33-46	St. John's	1970	8,460	1970	34,587	1970	4.09
		1984	11,808	1984	40,810	1984	3.46
		% chg	39.6	% chg	18.0	% chg	-15.4
14-18	St. Mary	1970	1,532	1970	6,836	1970	4.46
		1984	1,884	1984	7,407	1984	3.93
		% chg	26.6	% chg	1.9	% chg	-11.9
6-8, 11, 12	St. Paul	1970	1,501	1970	6,683	1970	4.45
		1984	1,567	1984	5,624	1984	3.48
		% chg	4.4	% chg	-15.8	% chg	-21.1
13, 21, 22, 32	St. Peter	1970	1,228	1970	5,724	1970	4.66
		1984	1,529	1984	5,526	1984	3.61
		% chg	24.5	% chg	-3.5	% chg	-22.5
23, 25, 27, 28	St. George	1970	1,144	1970	4,421	1970	3.86
		1984	1,385	1984	4,777	1984	3.45
		% chg	21.1	% chg	16.7	% chg	-10.6
47	Barbuda	1970	226	1970	1,071	1970	4.74
		1984	275	1984	1,047	1984	3.81
		% chg	21.7	% chg	-2.2	% chg	-19.6
TOTAL Antigua/Barbuda		1970	15,216	1970	64,284	1970	4.22
		1984	19,868	1984	70,134	1984	3.53
		% chg	30.6	% chg	9.1	% chg	-16.4

Source: Campbell, 1986.

## FERTILITY

Table 1.5(1) shows very significant declines in the birth rate from 24 per 1,000 population in 1970 to a current rate of about 14 per 1,000, which gives Antigua-Barbuda the lowest birth rate in the Caribbean, on par with "developed" countries like Canada, the United Kingdom, Norway and Sweden. While accurate measures of the TFR are unattainable because of the lack of population data by age and sex, the estimates shown in

Table 1.5(1) underscore a remarkable fertility transition in the space of two decades, without parallel in the region, Barbados excepted. The 1988-1990 estimated TFR of 1.7 is much below the replacement level of fertility. Much of the decline in fertility can be explained by invoking "modernization" factors -- improvements in female educational attainment, greater female labor force participation, the widespread availability of contraceptives, and delayed marriage; but, additionally, values regarding family size have

also undergone a change, and Antiguan women today appear to desire fewer children than did their counterparts 10 to 20 years ago.

The policy implications of a below replacement level of fertility need to be carefully considered by planners in Antigua. The long-term prospects suggest there should be some increase in immigration, a situation that might occur naturally as the Antigua economy moves towards full employment and as critical labor shortages continue in some sectors of the economy.

## MORTALITY

Declines in mortality (Table 1.5(1)) have been less spectacular because the mortality transition has been underway significantly longer than changes in fertility patterns. There is some evidence to suggest that the crude death rate has reached its nadir at five per 1,000 population and is inching upwards with the aging of the Antiguan-Barbudan population (in 1984 the mean age of the population was estimated at 27.5 years). Life expectancy for both sexes is currently estimated at 71 years (Pop. Ref. Bureau, 1990). When population data by age and sex become available from the 1991 census, it should be possible to generate up-to-date life tables. Improvements in medical care, living conditions and nutrition have certainly contributed to increased life expectancy, but changing dietary practices, particularly the consumption of high fat and processed, frozen and canned food, have already brought in a whole new series of diet-related health problems.

Private medical care and the Holberton Hospital are adequate for the basic health needs of the population; yet the practice of seeking both routine and specialized health care off island (Guadeloupe, Puerto Rico, St. Croix, the United States and Canada) continues. The Springview Hospital in Barbuda is also adequate but still relies on the Barbuda Medical Program which brings in doctors and dentists from the United States on a rotational basis.

## MIGRATION

Like most Caribbean societies, Antigua-Barbuda has had a long migration tradition, with citizens migrating to Panama and the Bermuda dockyards at the turn of the century, to the Dominican Republic in the first two decades of this century, to Aruba and Curacao in the 1940's and 1950's, to Great Britain in the late 1950's and early 1960's, and the United States, the U.S. Virgin Islands (USVI), and Canada after 1962. Emigration declined significantly after 1973, particularly following the tightening of immigration restrictions in the USVI, the most popular destination for Antiguan emigrants (the 1980 U.S. Census identified 4,951 persons in the USVI who were born in Antigua [de Albuquerque and McElroy, 1989]). Since the early 1980's, some of those persons have been returning to Antigua to retire or set up businesses (de Albuquerque, 1989b); yet return migration remains an unappreciated demographic phenomenon in Antigua of significant policy relevance (returnees often have considerable savings and much needed skills). The increases in land sales in July and August (the most popular months for expatriate Antiguan to return home) are a clear harbinger that many Antiguan living abroad do intend to return; indeed, many of them have made a significant commitment to return by building houses and investing in businesses.

Table 1.5(1) also shows the movement of residents by air between 1975-1988. While not an acceptable method of estimating emigration and return migration (arrival data are much more carefully collected than departure data), in one year, 1978 (not shown in Table), the number of departing residents exceeded returning residents.

Immigration into Antigua-Barbuda has received very little attention from Government. Yet if the experiences of other Caribbean mass market tourist destinations (e.g., the Bahamas, Barbados, Cayman Islands, St. Maarten, USVI) are any guide, immigration might become a vexatious policy issue in the future. Already there has been significant immigration into Antigua, starting in the 1970's with Dominicans who came to work primarily in the tourist industry. Other immi-

grant groups are also becoming more visible as their numbers increase -- Vincentians in the Police Force, persons from the Dominican Republic as hostesses, service workers and in manufacturing, Afro-Guyanese in the hotel industry, trades, manufacturing, and teaching, and Europeans and North Americans in the hotel, restaurant, yacht chartering, and other tourist-related businesses. In addition, there has been a fairly sizable and growing retirement community of mostly North Americans -- a phenomenon whose long-term social consequences have not been seriously examined in the region.

Despite a slight contraction in the Antiguan-Barbudan economy in 1988 and 1989, labor shortages continue in many areas, particularly in construction, teaching and health care. The number of work permits issued continues to rise (755 in 1985 and 1,655 in 1988), with most of those (61 percent) being issued to OECS and CARICOM nationals (GOAB, 1989b). If an OECS political union becomes a reality, or if travel and immigration

restrictions are lifted between OECS member states, then immigration into Antigua from other OECS territories should significantly increase.

#### AGE AND SEX STRUCTURE

Reliable data on the age and sex structure of the population are unavailable. However, it can be inferred, given changes in fertility, mortality and migration, that the population today has a very different age and sex structure from that enumerated in 1970.

In 1970, the male:female sex ratio of the population was 89.4 and in 1984 it was estimated at 95.4, indirect evidence of declining emigration. Table 1.5(3) shows the age distribution of the population in 1970 and 1984. The effects of declining fertility are clearly visible in the under 10 age group, while the effects of increasing life expectancy can be seen in the older age groups. It would also appear that emigration declined significantly,

Table 1.5(3). Age distribution of the population in 1970 and 1984.

Age Group	1970		1984	
	No.	%	No.	%
0 - 5	9,543	14.7	8,471	12.0
5+ - 10	9,676	14.9	8,013	11.4
10+ - 20	9,304	14.4	8,137	11.6
15+ - 20	7,101	11.0	8,141	11.6
20+ - 30	8,554	13.2	12,699	18.2
30+ - 40	5,130	7.9	7,937	11.3
40+ - 50	5,309	8.2	5,228	7.5
50+ - 60	4,869	7.5	4,611	6.6
60+ - 70	3,161	4.9	4,005	5.7
70+	2,147	3.3	2,892	4.1
TOTAL	64,794	100.0	70,134	100.0

Source: Statistics Division, Ministry of Finance, GOAB; Campbell, 1986.

and there was some return migration during the 1970-1984 period, since the most noticeable difference in the two age distributions is in the population aged 20-40, the age group with the greatest propensity to migrate.

## EDUCATION

Table 1.5(4) shows enrollment data for selected years, 1980-1986. Although there appears to be a decline in enrollment, particularly at the primary level (the result of declining fertility), enrollment data are unreliable because for most years enrollment returns to the Ministry of Education were incomplete. Enrollment declines are not equally spread throughout the school system; in fact, while some schools in rural areas might eventually have to be closed, other schools in St. John's and its environs are severely overcrowded.

In terms of educational policy, GOAB is committed to equality of opportunity; yet the percent of recurrent expenditure allocated to education has remained stagnant at about 13 percent (see Table 1.5(4)), down from approximately 14 percent in the 1970's. As a result, some schools are badly in need of repair, renovation and re-equipping. Dependence on large numbers of non-degree trained and untrained teachers continues. Teachers' salaries are relatively low, and given tight labor market conditions, turn-over rates are high as degree-trained Antiguan are easily lured to more lucrative occupations. The Ministry of Education has to annually recruit teachers from elsewhere within the region, primarily Guyana, and also relies, to some degree, on VSO and Peace Corps volunteers.

The quality of educational output, as measured by local and external examination results, is discouraging. Passes in the CXC Basic and General exams remain in the 50 percent range, and Antigua ranks lowest among OECS territories for CXC results (*Outlet*, December 1, 1989).

All these negative indicators reinforce perceptions regarding the generally poor quality of public education in Antigua and

Barbuda and create a strong demand for private education. Thus, despite a commitment to equality of opportunity through the provisions of universal free primary education, the dual educational system, a legacy of colonial times, persists and serves to perpetuate the existing class structure.

## LABOR FORCE AND EMPLOYMENT

Table 1.5(1) shows estimates of relevant labor force statistics. Growth in employment has far outpaced growth of the labor force and total population and is a direct result of the buoyancy of the Antiguan economy in the 1980's. Parallel declines in unemployment also occurred in the 1980's. Currently, unemployment is less than seven percent, and much of that is hard-core unemployment. In some sectors of the economy labor shortages exist. Both the labor force and total employment will grow in the 1990's but at a slower rate, with most of the growth coming through increasing female labor force participation.

The challenge of the 1990's will not be so much one of absorbing school leavers, but of finding meaningful work for young adults. Unfortunately, the tourist industry is not expected to create the kinds of meaningful employment young Antiguan will find attractive, and Antigua will therefore have to increase its reliance on imported workers. Through more and better vocational training and other programs, GOAB hopes to create a better trained and more sophisticated labor force to meet the demand of the 1990's.

In the area of public-sector employment, GOAB must find a way to reduce the number of employees and to create, in the words of the Minister of Finance (GOAB, 1990a), a "more productive and well-managed government work force." In fact, the Minister had earlier decried (GOAB, 1989a) the "attitude to work" in the country, the part-time work habits of some Government employees, and the practice of pay days becoming like national holidays.

Table 1.5(4). Selected socio-economic indicators.

Indicator	1976	1980	1982	1984	1986	1988
Pop. per physician	2,700	-	-	1,787	1,695	1,640
Pop. per dentist	17,547	-	-	12,511	10,899	9,841
Pop. per hospital bed	319	-	337	359	404	410
Per cap. expenditure on health (EC\$)	68	-	-	180	274	418
% of current exp. on health	14.3	-	-	13.1	12.4	12.9
School enrollment (all levels, all schools)	-	15,962	16,359	11,886	10,789	-
Total no. of teachers	-	-	749	781	763	-
Per cap. expenditure on education (EC\$)	67	-	-	169	259	391
% of recurrent exp. on education	14.1	-	-	12.3	12.0	12.0
Property crime rate (per 100,000)	-	-	2,654	2,421	2,104	2,967
Violent crime rate (per 100,000)	-	-	488	317	325	267
Total stayover visitors ('000s)	-	97.9	97.3	141.5	164.0	187.2
Air	86.5	86.6	87.0	129.1	149.3	176.9
Sea	-	11.3	10.3	12.4	14.7	10.3
Cruise ship visitors ('000s)	70.2	107.1	66.8	66.4	122.8	199.8
No. of telephone subscribers*	2,706	3,540	4,940	5,698	6,586	8,372
Electrical consumption (kwh)	-	-	44.8	46.6	52.4	61.4
Est. value of bldg. applica. (EC\$ millions)	-	35.5	43.7	49.5	80.7	221.8
Total no. of reg. vehicles	-	-	9,775	12,006	15,620	19,686

Note: \* Does not include coin boxes.

Source: Statistics Division, Ministry of Finance, GOAB.

## MODERNIZATION OF THE COUNTRY'S SOCIETY

By all measures, consumption, particularly private consumption, has grown remarkably in the 1980's, fueled by the very visible increase in the standard of living/purchasing power of most citizens which is, in turn, a direct result of the economic boom of the 1980's. The banking system has had excess liquidity through much of the 1980's, and consequently credit has been readily available. Antiguans and Barbudans

have therefore been able to finance new home construction and purchase motor vehicles and a significant range of consumer durables. Table 1.5(4) provides some data on the relatively rapid modernization of Antiguan society. In the 1980's the number of registered motor vehicles more than doubled, electricity consumption increased 44 percent, the number of telephone subscribers increased by 136 percent, and the estimated value of construction permits increased more than six fold. Antiguans-Barbudans who formerly travelled in search of work began to travel in record

numbers for vacation purposes. In 1988, an estimated 56,000 nationals spent approximately EC\$23 million on airline tickets, the bulk of which were for vacation purposes (GOAB, 1990). Indeed, the sophisticated tastes and buying patterns of some Antiguan necessitate frequent shopping/vacation trips to St. Maarten, San Juan, Miami and New York.

Since most of this remarkable transformation is the result of tourism development, Government has hinged its future development plans on the expansion of the tourist industry. To this end, it has decided to double the number of hotel rooms to 5,000 by 1995 and has targeted 300,000 stay-over and 340,000 cruise ship visitors by the year 2000 (Weston, 1990; see also Section 5 of the Profile). Such a major commitment to the tourism sector will require drastic improvements and upgrading of the infrastructure, particularly the roads, harbors, airport, power generating capacity and water supply. Given the country's debt problem, much of it due to heavy borrowing on non-concessionary terms to finance costly infrastructure improvements (McElroy and de Albuquerque, 1990), GOAB's ability to borrow on capital markets for further improvements of the infrastructure is limited (see Section 1.5.2).

The environmental consequences of the kind of modernization Antigua has undergone are much more visible on small, fragile islands than continental systems. Mangrove swamps have been drained to make way for tourist developments, beach sand mining continues unabated because of the high cost of imported sand and lack of enforcement of existing laws, St. John's harbor is becoming more polluted because of marine, industrial, and other wastes, and the list goes on. Additionally, changing consumption patterns and increasing dependence on packaged/processed imported foods and other items have contributed to a solid waste problem. Paper, cartons, disposable diapers, packaging materials, bottles, cans, styrofoam, and plastics are everywhere visible and a grim reminder of the economies-of-scale problem facing small islands when it comes to recycling options. Industrial wastes such as motor oil, car batter-

ies, and tires are also becoming more visible, as are junked cars.

The closing years of the 1980's witnessed a growing awareness of environmental problems in Antigua-Barbuda, due in part to the efforts of the country's environmental NGOs (see also Section 10.3 of the Profile). Public displays at the Museum of Antigua and Barbuda on Earth Day, radio and television spots, newspaper articles, and clean-up campaigns served to heighten the awareness of Antiguan to the fragile nature of their insular environment and to such problems as beach sand mining, coral mining, sea level rise, raw and partially treated sewage discharge into swimming areas, filling in of mangroves, littering, the bulldozing of archaeological/historical sites, and other critical environmental issues.

This growing awareness is being reinforced in the schools as some teachers are now teaching a new environmental component included in the CXC syllabus of several subjects. The textbook *The Caribbean Environment* (Wilson, 1988), the work of the Caribbean Conservation Association (CCA), and several regional environmental workshops served to spark an interest in environmental issues among some teachers. Some of this can be seen in the growing number of inquiries related to the environment received from school children at the National Museum in St. John's.

The 1989 summer clean-up campaign of St. John's ("Antigua Clean As A Whistle"), sponsored by the Body Shop, the Environmental Awareness Group, and other organizations, also served as a catalyst for some businesses to help keep their portion of the public streets reasonably clean. One response of Government to a growing environmental awareness has been to establish the Historical, Conservation and Environmental Commission. However, it is believed by many local environmentalists that solutions to these environmental problems will not come through Government intervention alone or solely through the introduction of new legislation (existing ordinances continue to be ignored and unenforced), but rather through a concurrent massive public educational campaign that

should begin in the schools. Already there are signs that some school children are avoiding littering and are appealing to their adult relatives and friends to do the same. The emerging, renewed interest in the natural and cultural patrimony of Antigua-Barbuda is certainly a welcome development.

### 1.5.2 National Economy and Development Trends

Until the post-World War II era, sugar dominated the economy. In the early 1960's, over 90 percent of all cropland was devoted to sugar cane, but poor prices, high costs and labor shortages caused the collapse of the industry in 1967 and various attempts to rehabilitate a Government-owned sugar industry have been unsuccessful. Cotton production has also become negligible (World Bank, 1984). As a result, the contemporary economy is characterized by the decline of agriculture, continued dependence on foreign dollars, and a successful pattern of diversification towards tourism, hotel construction, and light manufacturing.

Foreign dollars flow into Antigua-Barbuda from five different sources: exports, tourist spending, wages from Antiguan and Barbudans working abroad, foreign investors, and foreign government and bank loans. Crude calculations suggest that, on the average, one foreign dollar from these outside sources produces one local dollar of Gross Domestic Product (GDP).

Economic diversification began in the 1960's and accelerated in the 1970's because of the sugar crisis. Tourism grew with the advent of direct jet service to the United States and the rapid establishment of several foreign-financed hotel resorts. Later a deep-water cruise port was constructed in the capital of St. John's (Weston, 1990). Early export manufacturing in textiles and food processing was stimulated by the Aid to Pioneer Industries Act in 1964 (later revised as the Fiscal Incentives Act of 1975). During the 1990's the Government has promoted both industries

heavily with generous tax concessions and provided necessary infrastructure.

The effects of these policies can be seen in Table 1.5(5). Between 1978 and 1988, per capita real GDP rose nearly 80 percent, electricity output doubled, stay-over visitors increased 120 percent, and the value of total tourist expenditure (stay-over and cruise) rose over six-fold. The basis for this growth has been the restructuring of the economy away from sugar. Tourism has become the lead sector accounting for approximately half of all GDP and employment (Thorndike, 1986). During the decade, for example, the direct contribution of hotel and restaurant activity alone grew from 11 to 15 percent of GDP, and the contribution of related construction rose from 7 to 12 percent. As a result, Antigua-Barbuda now ranks at the top (with the British Virgin Islands) in economic affluence among its OECS neighbors.

### RECENT DEVELOPMENTS

Since the worldwide recession of the early 1980's, real GDP has grown at a rapid seven to eight percent annual rate. A slight slow-down (6.4 percent) in 1989 was caused by Hurricane Hugo's damage to tourism and agriculture (*Caribbean Update*, 1990). However, four major imbalances -- excessive foreign debt, weak investment, over-dependence on tourism, and labor shortages -- cloud the economic future and constrain the country's ability to cope with mounting environmental stresses.

### THE DEBT PROBLEM

The most dangerous imbalance is the excessive amount of foreign debt that has been incurred in recent years and that is mortgaging the country's future. At the end of 1988, Antigua-Barbuda's total external debt amounted to US\$267 million, a figure which represented over 80 percent of total GDP. Annual debt service obligations -- yearly payments due on borrowed principal and interest -- amounted to 16 percent of export sales and half of all Government revenues. Most serious of all, debt arrears or unpaid past due

Table 1.5(5). Antigua-Barbuda GDP at factor cost by economic activity in current prices, percent distribution.

Indicator	1978	1988	Change
GDP (\$EC million)	177.2	727.0	549.8
Percent Shares:			
Agriculture	9	5	-4
Manufacturing and Mining	7	6	-1
Construction	7	12	5
Hotels and Restaurants	11	15	4
Government	15	15	0
Other <sup>1</sup>	51	47	-4
TOTAL	100	100	
Per Capita GDP in Constant Factor Prices	2,294	4,080	1,786
Electricity Generation (million kwhs)	46.0	95.0 <sup>2</sup>	49.0
Total Stayover Visitors ('000)	79.9	176.9	97.0
Tourism Expenditures (\$US million)	29.5	221.9	192.4

Notes: <sup>1</sup>Includes mainly transport, banking/reality, retail trade and other services.  
<sup>2</sup>Estimate.

Source: For 1978: World Bank (1984); for 1988: CDB (1988) and GOAB (1988).

obligations stood at 20 percent of GDP (*Caribbean Update*, 1990).

These long-term commitments were made to capitalize on Antigua's growing reputation as a leading Caribbean resort, yachting, and cruise ship destination. Much of this foreign borrowing was used to finance the Government's Royal Antiguan (Deep Bay) Hotel and to complete the 40-unit phase of the shopping complex at Heritage Quay (CDB, 1987). The monies were also used to make needed infrastructure improvements to the airport and to the road and telephone systems, as well as to construct new desalination and power plants.

Because these obligations were undertaken at a time of fiscal weakness and regular budget deficits, Antigua-Barbuda became overly dependent on foreign capital (CDB, 1988) and was forced to borrow commercially on expensive terms involving short-term (five years) repayments at high interest rates. Present efforts to meet these yearly obligations have created a cash crisis and caused payment arrears. These arrears, in turn, have produced a loss of credit worthiness which suggests it may become increasingly difficult to secure fresh finance in the future. On the one-to-one foreign-to-local dollar basis, this translates into slower economic growth in general and reduced construction activity in particular.

## DOMESTIC IMBALANCES

Several domestic imbalances are tied to the debt build-up. In the first case, several studies have indicated that heavy Government borrowing from domestic banks during the 1980's both reduced the amount of loan funds available for local investment (World Bank, 1985) and caused sharp interest rate increases that discouraged business borrowing (McElroy and de Albuquerque, 1990). In a recent report (1988), the Caribbean Development Bank has argued that most of the local credit available for borrowing has been used to finance consumer purchases and to build up inventory in the wholesale and retail trades instead of providing fresh capital for new ventures in agriculture and manufacturing.

A second major imbalance has been the Government's focus on tourist promotion and construction to the point of overlooking the negative consequences for agriculture and manufacturing (CDB, 1987). Although this emphasis was motivated by the high unemployment created by the sugar collapse, most available labor, finance, tax incentives, and infrastructure have been channeled to support tourism, while the non-tourist industries have languished at times and performed modestly at best. This weakness suggests that the economy remains vulnerable because of its over-dependence on tourism, an industry frequently shaken by recession and oil price shocks. For example, it took three to four years for the number of total visitors (cruise and stay-over) to regain pre-recession levels in the early 1980's (CTRC, 1986; CTO, 1989).

Third, labor shortages have constantly plagued agriculture, have recently "contributed to the closure of several factories" (*Caribbean Update*, 1990), and presently "have manifested themselves in the construction sector" (Weston, 1990), despite a steady stream of returning migrant workers. High wages in Government, tourism, and construction have consistently attracted labor away from the softer sectors. During the 1980's, hotel service workers earned 80 percent more per week than agricultural laborers. The difference was higher for construction workers

(Carib.-Central Am. Action, 1982) and for Government workers who were granted 20-plus percent annual wage increases some six times between 1978 and 1988 (McElroy and de Albuquerque, 1990; CDB, 1988). Because of the Government's large role in the economy, employing roughly 30 percent of the work force (USAID, 1985) and because of rapid growth in tourism and construction, rising wage pressures continue to threaten light manufacturing and to inhibit diversification into domestic agriculture.

## AGRICULTURE

In 1960 agriculture, primarily for export, contributed 20 percent of GDP and employed one-third of the work force. Today it accounts for less than five percent of GDP and ten percent of total jobs. The long-term success of Antigua-Barbuda's restructuring will in great part depend on the durability of the new sectors, i.e., an established tourism industry, a developing manufacturing base, and domestic agriculture.

Although Government has attempted to support a policy of crop and livestock diversification aimed at the local market, domestic farming has been constrained by labor scarcity, uneconomic farm size, and inadequate rainfall and other unfavorable weather conditions during planting and harvesting periods (World Bank, 1985). Agriculture is also plagued by insecure land-lease arrangements, Government price controls that discourage production, slack demand and protectionism in CARICOM markets, poor marketing and infrastructure, and inappropriate land management practices. For example, low grazing fees and meat prices encourage over-grazing which can ruin good pasture land, cause damage to nearby cash crops from untethered stock, or, in severe cases, cause erosion and loss of soil productivity.

These natural and institutional problems have taken their toll on traditional resource uses. According to Table 1.5(6), since 1961 the number of farms has fallen 60 percent and acreage in farms has been cut over 80 percent. Much of this decline has occurred in the past decade in tandem with rapid

Table 1.5(6). Selected agricultural indicators, Antigua and Barbuda, various years.

	<u>1977</u>	<u>1987</u>		<u>1978</u>	<u>1987</u>
Total tourists <sup>1</sup> ('000s)	104.1	326.7	Vegetable and Fruit		
No. hotel rooms	1,382	2,752	Production ('000s lbs.)		
Health expend. per cap. (\$EC) <sup>2</sup>	68	351	Bananas	1,395	154
Education expend. per cap. (\$EC) <sup>2</sup>	67	330	Beans	33	76
			Cassava	154	68
			Coconuts	2,561	568
			Cucumbers	387	297
			Egg Plant	178	456
			Grapefruits	40	123
No. farms	<u>5,747</u>	<u>2,298</u>	Onions	282	68
Acreage in farms	34,089	6,225	Oranges ('000s)	102	104
% under 5 acres	91.1	95.4	Pineapples	242	232
Sugar cane (tons)	193,554	2,500	Pumpkins	352	428
Cotton lint ('000s lbs.)	195,935	4,600	Sweet Peppers	114	85
			Sweet Potatoes	414	402
			Tomatoes	931	309
			Yams	343	112
	<u>1978</u>	<u>1987</u>			
Fish landings (m. tons)	2,437	1,635			
Lobster landings (m. tons)	195	73			
	<u>1980</u>	<u>1987</u>			
Beef animals	2,951	4,032			
Sheep and goats	1,142	697			
Pigs	1,711	2,510			

Notes: <sup>1</sup>Includes air and cruise visitors.

<sup>2</sup>The Eastern Caribbean dollar is equivalent to US \$0.37.

Source: Regional Council of Ministers, 1963; ECLAC, 1988; GOAB, 1988.

growth in tourism. Between 1977 and 1987, the number of visitors (both stay-over and cruise) tripled, the number of hotel rooms more than doubled (see Table 1.5(6)), and per capita Government expenditures on health and education rose over five-fold as rural labor and capital migrated from traditional pursuits to Government and tourism.

As a result, less labor-intensive beef and small livestock farming replaced vegetable and fruit production. Two-thirds of the selected produce listed in Table 1.5(6) recorded output declines. Fish and lobster landings also fell substantially despite brisk markets in Puerto Rico, the U.S. Virgin Islands, and the French Antilles. Several reasons for the de-

clines include: decreased effort because of labor scarcity, poor management, over-fishing, and inadequate credit and distribution facilities.

Although farming and fishing will not generate significant employment gains in the near term (CDB, 1987), many new Government initiatives appear to be headed in the right direction. These include streamlined leasehold procedures, improved irrigation, various programs of technical assistance for fruit and livestock production, the improved performance of the Central Marketing Corporation, and new Government incentives like duty-free concessions on imported equipment and subsidized inputs (CDB, 1988).

## MANUFACTURING

As is typical among other Leeward Islands undergoing economic modernization, manufacturing in Antigua-Barbuda is small-scale, in the early stages of development, and characterized by modest and fluctuating growth. The existing mix of industries serves domestic and foreign markets and involves the relatively low value-added enclave type relying heavily on imported inputs for processing and assembly by local labor. Firms include garments, electronic assembly, furniture, alcoholic and non-alcoholic beverages, foodstuffs, household appliances, paints and packaging materials. All take advantage of the tax, import, and factory rental incentives commonly available in most OECS countries, and import tariffs protect the firms selling locally.

A number of problems have plagued manufacturing. These include, on the supply side, the shortage of trained labor and the lack of available factory space as well as a low-cost regular supply of electric power. On the demand side, production has been constrained by the small size of the local market, slow growth and protectionism in regional markets, and an inability to significantly penetrate markets in the United States, Canada, and Europe. Some Government-sponsored improvements, however, include the installation of new electricity generation capacity and the construction and lease of new factory shells. Less progress has been made on raising labor productivity and reducing wage costs. Present hourly manufacturing wages in Antigua-Barbuda are already "over five times higher compared to those in selected low-wage Asian countries" (World Bank, 1988).

## TOURISM

The 1980's represent a turning point in the maturation of Antigua-Barbuda's tourist industry. During the past decade, the number of stay-over visitors, cruise passengers, and hotel rooms doubled. Before the slight fall-off in arrivals in 1989 because of the damage caused by Hurricane Hugo in September, total visitor expenditures had doubled between 1984 and 1988. Over the same period, the average length of stay fell

from 7.5 to 7.0 days, and the average hotel occupancy rate declined from 68 to 60 percent (CTO, 1989; CTRC, 1986). The shorter stay may reflect the large share of Americans (47 percent) and West Indians (15 percent) in the Antiguan tourist profile who habitually make shorter visits than UK (13 percent), European (13 percent), and Canadian (8 percent) tourists. Falling hotel occupancy rates may reflect the large number of new hotel rooms that became available over the same years. Both declines may also partially reflect visitor reaction to the increased crowding associated with rapidly rising tourist densities over the decade.

The overall success of the industry is partly due to the Government's promotion efforts and infrastructure/facility expansion and partly due to the abundance of Antigua's natural assets. These include many natural harbors, sparkling coral sand beaches and reefs, picturesque and varied land and seascapes, and a rich heritage of historical buildings and sites (Seward and Spinrad, 1982).

With the completion of the new cruise ship pier at St. John's and the large-scale, multi-phased renovation of the downtown and market areas underway (OAS, 1986a), Antigua is positioned to become a prime tourist destination if past trends continue through the present decade (McElroy and de Albuquerque, 1989). This is especially likely if the planned new hotel rooms materialize since an 80 percent expansion to roughly 5,800 is projected for 1992 (IMF, 1986). Current patterns of seasonality suggest this may pose future crowding problems since over 50 percent of stay-over visitors and roughly 60 percent of cruise passengers customarily visit during the short five-month (December through April) winter season. In 1989 the number of cruise passengers slightly exceeded the number of stay-over visitors (CTO, 1990).

## ENVIRONMENTAL ISSUES AND POLICY

Three issues will dominate the economy in the 1990's:

- the changing character of tourism;

- the progress of agricultural and manufacturing diversification; and
- the debt problem.

All will impact the environment, and all must be addressed concurrently because they are mutually related. Projections for total cruise and stay-over visitors in the year 2000 are double present levels (Weston, 1990). Controlling such high densities in sustainable ways will demand careful management and planning. Overly rapid growth will provide the foreign exchange and taxes to ease the debt crisis but will likely threaten the natural assets which draw the tourists in the first place, the quality of island life for residents, and the success of farming and new industry. If growth is too slow, the debt crisis will continue to drain off resources needed for infrastructure maintenance and expansion and for environmental protection and restoration programs.

The correct blend of economic incentives and environmental policies will become crucial to finding the "middle ground." Some specific suggestions are listed below to illustrate the range of possibilities. The two primary benefits of most of these proposals lie in (1) promoting sustainable resource uses and practices and (2) raising revenue to cover the costs of monitoring and enforcement procedures.

- Assess dock charges for cruise ship passengers and landing fees for air arrivals to cover the cost of airport and pier maintenance;
- Require private developments over some minimum size to prepare an Environmental Impact Assessment (EIA) as a pre-condition for tax incentive consideration; as a related issue, strict adherence to building codes and/or mandatory self-contained water, power, or sewage treatment facilities in the design of projects could be variously negotiated as part of the overall benefit package;

- An EIA is especially recommended for large-scale Government infrastructure projects, and set-aside funds should be included to cover both monitoring and mitigation strategies;
- Large-scale public and private projects, particularly those in the coastal zone, should be phased in over multi-year stages to avoid depleting the labor force and to allow for environmentally-sensitive construction;
- Prime state-owned agricultural land should be zoned and land use regulations established;
- Favorable terms for long-term leasehold and/or ownership by smallholders farming Government land should be tied to the level of environmentally-sound cultivation practiced on such lands;
- Eliminate price controls on locally-grown meat, to encourage production and support of research on local animal feeds and to raise the profitability of animal husbandry;
- Raise irrigation charges to increase cost recovery from users and to encourage efficient use of a scarce resource;
- Design a structure of tax incentives that includes some benefits for local farmers, fishermen, and manufacturers who supply the tourism and construction sectors;
- Provide similar incentives to hotels, factories and construction firms based on their share of local food and input purchases.

The expected expansion of tourism and construction during the coming decade will open up a large number of small local entrepreneurial opportunities. These will occur especially in those areas which link agri-

culture, industry and tourism as rising population and visitor densities produce new, commercially-exploitable markets now served by imports. Even small local import replacement could provide tangible environmental benefits because it would allow significant reductions in the volume of visitors needed to sustain rising tourist expenditures.

An example is instructive. Assume that there are presently 200,000 stay-over tourists. Further assume that 90 percent stay in hotels/guest houses, spend an average of US\$160 per day and visit Antigua for seven days. These assumptions yield a total visitor expenditure of approximately US\$200 million. Using the dollar-for-dollar, foreign-to-local multiplier of 1.0, this \$200 million in tourist spending creates roughly \$200 million in the country's GDP.

Further assume that present import leakages can be replaced by local food, handi-craft, and construction materials by only five percent. This would raise the multiplier to

1.05. The higher multiplier would raise the stay-over GDP contribution to over \$210 million local GDP ( $200,000 \times 0.90 \times \$160 \times 7.0 \times 1.05$ ). Alternatively, the original \$200 million could be generated with 10,000 fewer overnight visitors ( $190,000 \times 0.90 \times \$160 \times 7.0 \times 1.05$ ).

Such strengthening of the local economy would tend to reduce crowding, resident-visitor tension, waste disposal problems, and natural and infrastructural stresses and provide the ingredients for a sustainable visitor industry compatible with the unique and fragile character of the island environment. If successful, Antigua-Barbuda could become a model for mature Caribbean destinations, demonstrating how the local economy can be integrated into an amenity-defensive tourism style that does not require rising promotional budgets to annually pump-up densities nor the increasing proliferation of artificial, imported, man-made attractions to replace the natural assets lost through environmental neglect.

## SECTION 2 LAND RESOURCES

### 2.1 AGRICULTURE AND FORESTRY

#### 2.1.1 Overview

##### AGRICULTURE

Antigua-Barbuda's landscape today is a result of natural resource exploitation that began with colonization in the early seventeenth century. In the space of a few decades, much of the natural vegetation had been cleared for cultivation of tobacco, indigo, cotton and then sugar cane. Production of sugar cane in Antigua under the colonial plantation system was well established by the close of the eighteenth century. Only 5,500 acres (of a total land area of 69,120 acres) are reported to have been spared from cane production (Cater, 1944). Fields of sugar cane were even observed on the peaks of many hills in the southwest mountain range (Mackler and Hannah, 1988).

A series of events, including the abolition of slavery in 1834 and the serious economic depression that followed, resulted in progressively smaller plantings of cane on the remaining estates. By 1938, 52,000 acres of land previously in sugar cane production had been abandoned. This trend continued until the mid-1960 period when the sugar industry completely collapsed. A revival of the industry was attempted in 1972, but this was abandoned after two years of low rainfall and poor prices for the sugar crop.

Several other crops have been grown on plantation systems. Cotton was re-introduced as a supplement to sugar cane in the early 1900's. Competition from foreign markets, weak production systems, and low and variable rainfall combined to make cotton production marginal in Antigua. If it were not for the unique, prized qualities of the sea island cotton grown in Antigua, the industry would have collapsed earlier. An attempt to revive cotton production during the 1980's failed primarily due to the ravages of Hurricane Hugo in 1989.

Much of the land that became available with the end of sugar production is used today by small-scale farmers. The Antigua and Barbuda Agricultural Census (OAS, 1984a) reported a total "official" acreage operated by all farmers of 6,225 acres (2,790 hectares); Barbuda comprised almost eight percent of this total (Table 2.1(1)). Over 6,000 farmers were identified in the census, and 4,658 farms were listed. Approximately 50 percent of the farms were operated by landless farmers, and another 40 percent of the farms were under two acres (0.8 hectares) in size. The census identified only 66 farms in Antigua larger than 10 acres (4 hectares).

Nearly 70 percent of Antigua and Barbuda's farmers pursue this occupation on a part-time basis only. Agricultural production is divided almost equally between home use only (30 percent), mainly home use (33 percent), and commercial production (37 percent) (OAS, 1984a). Commercial production is mostly for domestic consumption and includes a wide range of food crops and fruits. Production figures of field crops for selected years during the period from 1984 to 1988 are shown in Table 2.1(2).

An attempt was made by a U.S. producer in the mid-1970's to grow corn under large-scale mechanized conditions, but this failed. Production practices designed to grow corn in the American Midwest and the use of inappropriate equipment led to rapid soil degradation and erosion (OAS, 1990). A project to promote peanut production is ongoing in Barbuda, but with only a few exceptions agricultural production continues to be practiced on a small to medium scale by farmers who grow a diverse set of crops.

Most farmers also raise some livestock, at least a few cattle, goats or sheep. Livestock figures for 1984 are shown in Table 2.1(3). Much of the land that became

Table 2.1(1). Agricultural land use\* in Antigua-Barbuda (acres), 1984.

CATEGORY	ANTIGUA			BARBUDA			TOTAL
	<u>Private</u>	<u>Public</u>	<u>Total</u>	<u>Private</u>	<u>Public</u>	<u>Total</u>	
Temporary Crop	1,921.2	198.0	2,119.2	98.5	8.0	106.5	2,225.7
Improved Pasture	463.4	-	463.4	-	-	-	463.4
Other Pasture	837.9	870.0	1,707.9	14.8	52.5	67.3	1,775.2
Permanent Crop	716.4	61.7	778.1	36.4	201.3	237.7	1,015.8
Lying Fallow	577.2	10.0	587.2	50.2	21.3	71.5	658.7
Unsuitable	82.5	0.3	82.8	1.1	2.0	3.1	85.9
<b>TOTAL</b>	<b>4,598.6</b>	<b>1,140.0</b>	<b>5,738.6</b>	<b>201.0</b>	<b>288.1</b>	<b>486.1</b>	<b>6,224.7</b>

\* Excludes unofficial use of public and private lands.

Source: 1984 Agricultural Census as reported in GOAB, 1989b.

available with the end of cane production is used as unimproved pasture, particularly by those without their own land. According to OAS (1990), there are over 20,000 acres of unimproved pasture used to raise cattle and small ruminants. Some cattle is raised by land-owning livestock producers who fence their land and control grazing.

There has been a steady decline in the agricultural sector, particularly since the 1960's. Agriculture's contribution to GDP declined from 11 percent in 1978 to 7.5 percent in 1983 (World Bank, 1985) and currently rests at less than five percent (see Section 1.5.2 and Table 1.5(5)).

As pointed out in the recent OAS assessment of the agricultural sector (OAS, 1990), tourism has long since replaced agriculture as the leading sector of the economy, contributing well over half of GDP. Government's considerable expenditures for infrastructure development to support the tourist

industry have meant reduced amounts for other sectors, and agriculture has suffered the consequences of this shift in economic emphasis.

Nevertheless, the Government of Antigua and Barbuda has recognized since the mid-1980's that the agricultural sector could play a more meaningful role in the economy, particularly given GOAB's obligation to curtail growth of public sector expenditures in order to meet debt service requirements. A World Bank report (1985) reported that agricultural performance was considerably below potential and suggested a strategy moving towards a diversified agricultural system of fruit and vegetable production. The large area of underutilized, flat agricultural land in Antigua (with at least some access to irrigation), coupled with the potential linkage between the agricultural and tourism sectors, have stimulated expansion of market gardening over the last several years.

Table 2.1(2). Production of field crops for selected years, 1984-1988.

CROPS	UNIT OF QUANTITY	1984	1985	1987	1988
Avocado	' 000's	82.5	29.8	23.0	28.0
Bananas	' 000 lbs.	685.0	154.4	154.0	185.0
Beans	"	81.0	217.8	76.0	91.0
Beets	"	14.2	135.3	142.0	170.0
Cabbage	"	118.0	258.4	204.0	245.0
Carrots	"	557.0	303.9	326.0	391.0
Cassava	"	117.0	121.1	68.0	32.0
Cotton Lint	"	4.6	72.0	66.0	79.0
Coconuts	' 000's	717.0	462.5	568.0	678.0
Cucumbers	' 000 lbs.	316.0	606.6	297.0	356.0
Eddoes	"	49.0	27.0	88.0	96.0
Egg Plant	"	219.0	343.4	456.0	547.0
Ginger	"	91.0	90.0	179.0	215.0
Grapefruit	' 000's	97.4	17.8	123.0	148.0
Hot Peppers	' 000 lbs.	32.4	1.1	4.0	5.0
Limes	"	51.8	396.0	458.0	550.0
Maize	"	396.5	83.0	105.0	126.0
Mangoes	' 000's	401.6	812.2	1,102.0	1,322.0
Melons	' 000 lbs.	26.1	270.0	1,235.0	1,482.0
Okras	"	21.0	265.8	116.0	139.0
Onions	"	84.0	50.4	68.0	82.0
Oranges	' 000's	208.8	70.4	104.0	125.0
Paw Paw	' 000 lbs.	0.9	1.7	3.0	4.0
Peanuts	"	16.0	-	-	-
Pineapples	"	448.0	204.9	232.0	278.0
Pumpkins	"	480.0	370.9	428.0	514.0
Squash	"	40.0	329.0	154.0	185.0
Sweet Peppers	"	193.0	60.2	65.0	78.0
Sweet Potatoes	"	1,076.0	222.1	402.0	482.0
Sugar Cane	' 000 tons	2.5	-	-	-
Tomatoes	' 000 lbs.	434.0	331.4	309.0	371.0
Yams	"	215.0	60.4	112.0	134.0

Note: 1984 data from the 1984 Agricultural Census (OAS, 1984a).

Source: Agricultural Extension Division, Government Agricultural Station, and Statistics Division of the Ministry of Finance, as reported in GOAB, 1989b.

Table 2.1(3). Number of livestock in Antigua-Barbuda, 1984.

LIVESTOCK	ANTIGUA	BARBUDA
Cattle	9,992	1,072
Sheep	5,619	473
Goats	9,319	229
Pigs	2,425	12
Chickens	19,554	529
Horses	179	184
Donkeys	713	215

Source: 1984 Agricultural Census as reported in GOAB, 1989b.

In spite of constraints to expansion of agricultural activities, such as lack of farmer credit, difficulty in securing long-term leases to agricultural land, high labor costs, and high capital investment requirements, expansion of agriculture in Antigua-Barbuda is considered feasible. The large percentage of land regarded as well-suited for intensive agricultural use (40 percent as per Ahmad, 1984) supports expansion of the sector. The fact that Government owns 60 percent of the land could protect this area from being converted into non-agricultural uses; however, Government's failure to provide adequate tenure security could just as easily discourage private farming ventures, thereby further weakening the agricultural sector.

## FORESTRY

Cater (1944), among others, noted that the natural vegetation of Antigua had been radically altered and that land clearing had led to widespread erosion. It is probable that extensive deforestation was caused by cutting wood to fuel evaporators used in sugar production. These drastic changes to the vegetation resulted in one of the first laws to protect forests in the Caribbean, the Body Ponds Act No. 15 of 1721. This Act prohibited the felling of trees within 30 feet of the edge of the Body Ponds in the southwest part

of Antigua and remained in effect for over two hundred years (Cater, 1944).

The almost complete destruction of Antigua's original forests and the continuous cultivation of sugar cane over 300 years made classification of native vegetation difficult. Cater suggested the following original forest types, on the basis of his reconnaissance study:

- **Mangrove Woodland.** The original size of these coastal forests is difficult to determine due to over exploitation.
- **Littoral Woodland.** These forests occurred on the coast a short distance from the sea. The most common species identified include seaside grape (*Coccoloba uvifera*) and manchineel (*Hippomane mancinella*).
- **Cactus Scrub.** A large number of species may have been present, and agaves were also reported.
- **Thorn Woodland.** The most common species are thought to have included acacias (*Acacia* spp.), logwood (*Haematoxylum campechianum*) and wild tamarind (*Leucaena glauca*).

- **Deciduous Seasonal Forest.** Species thought to be characteristic were turpentine (*Bursera simaruba*), red cedar (*Cedrela odorata*) and white cedar (*Tabebuia heterophylla*).
- **Semi-evergreen Seasonal Forest.** Climax type on the wettest slopes of the volcanic southwest; white cedar and Spanish ash (*Inga laurina*) were indigenous to this type. Cater states that West Indies mahogany (*Swietenia mahogoni*) found in this formation may not be a native species.
- **Evergreen Seasonal Forest.** Spanish oak (*Andira inermis*) and probably Antigua whitewood (*Bucida buceras*) may have been the dominant species.

These forest types represent Cater's reconstruction of the original forest on the basis of vegetation he observed on a reconnaissance survey in 1943. The forest types correspond to formations found at progressively higher elevation and greater rainfall (from sea level to the highest elevation -- 402 meters -- at Boggy Peak).

An historical view of Antigua's forests is also provided by Beard (1949). A 300 acre stand of woodland on the slopes above Wallings Reservoir was selected by Beard for study in the early 1940's. His work included a survey of a one-half acre quadrant within the lower slopes of the stand, and the results yielded 47 forest species. According to Cater (1944), part of the regeneration in Beard's study site was at least partially due to artificial seeding in 1912. In any event, a similar inventory at Brecknocks Reservoir showed 14 forest species. Beard also makes mention of *Prosopis* and *Acacia* species, which had become naturalized by the time of his visit to Antigua. *Leucaena*, mahogany, albizzia (*Albizzia lebeck*), and a number of important tropical fruit trees are indicated as introductions in Beard's report. Loveless (1960), on the basis of field work by Box and Charter during the period 1932 to 1938, identified two major forest vegetation types -- Seasonal For-

est and Dry Evergreen Forest -- and three subgroupings of each.

A study undertaken for the OAS by Morello in 1983 best describes the vegetation in Antigua and Barbuda at the present time. The recurrent planting of sugar cane over several centuries and the extensive area under cane production are considered by Morello to have destroyed for all practical purposes all evidence of the natural vegetation. The introduction and rapid naturalization of many plant species, including five or six species of *Acacia* and *Prosopis chilensis*, which now dominate many areas previously in agricultural use, have created pioneer ecosystems that are maintained by current land use practices. Morello suggests the need to evaluate and classify vegetation types on the basis of the well-established scrub growth. A description of Morello's vegetation classification for Antigua and Barbuda is presented in Section 1.2.4 of the Profile. Unfortunately, no area estimates are available for any of the vegetation types identified by Morello.

Current estimates of forested area vary substantially according to assessment methodology and year of estimate. Even within the same time frame, variation results from differences in classification systems and interpretation of forest versus scrub cover.

According to a study in 1983 (DFS, 1984), there are reportedly 13,838 acres (5,600 ha; 20 percent of land area) in woodland cover, and 24,710 acres (10,000 ha; 36 percent of land cover) under scrub growth. OAS (1990) provides figures of woodland areas based on assessments done for a Geographic Information System (Wirtshafter, *et al.*, 1987): 15,190 acres of woodlands in volcanic areas; 8,455 acres in limestone hills.

A recent limited inventory was undertaken by Mackler and Hannah in 1988. A portion of the Wallings watershed, surveyed by Beard in the 1940's, was reinventoried. Results of that work indicate the vegetation at Wallings Reservoir has changed considerably in 44 years. Some preferred species such as Spanish oak had declined considerably, "most likely due to harvesting for charcoal." Some early successional species and remnant trees

from the agricultural period such as mango (*Mangifera indica*) were absent from the inventory, or were much reduced in numbers. According to Mackler, the forest had deteriorated from use as a source of supply of wattle for fish traps, fuelwood and posts. The report concludes that the control of cutting in the area is possibly less effective than in former times (Mackler and Hannah, 1988).

Lugo also reports that locally produced firewood, charcoal, and fence posts are obtained mainly from uncontrolled cutting in natural woodlands (Lugo, 1984). Some cutting for boat building components is reported, and slender poles for fish traps are observed stockpiled along roadways in the southwest part of Antigua. Other impacts on the forest resource result from clearing for small-scale agriculture, particularly in the Brecknocks and Body Ponds areas, and from urban development activities island-wide. Large-scale hotel and related recreational developments along Antigua's coastline have destroyed considerable mangrove forests. Reports reveal the destruction of seven major mangrove swamps and the filling of most salt ponds (Williams, 1990; see also Section 3 of the Profile).

In addition to the commercial benefits which result from wood products, forests in Antigua and Barbuda are important as sources of bush teas and for the habitat they provide wildlife.

### **2.1.2 Problems and Issues**

#### **DEFICIENCIES IN AGRICULTURE AND FORESTRY POLICIES**

**Agricultural Policy and Legislation.** Henry (1990) points out the serious environmental impacts of farming under a poorly defined agricultural policy. He concludes his report by making a plea for Government support to ensure rapid institutional strengthening in the agricultural sector, including policy development and planning capabilities. Henry emphasizes the need for better management of the sector rather than the *ad hoc*, mostly disorganized approach -- with its emphasis on

meeting short-term and immediate requirements -- that has plagued agricultural policy in the past. Defining a comprehensive policy and implementing a plan for sustainable agriculture are critical at the present time.

The OAS (1990) report, summarizing the accomplishments of its NRAD (Natural Resources Assessment for Agricultural Development) project in Antigua and Barbuda, makes several important points regarding the environmental effects of agricultural production in the country. Noteworthy is the projection that economic growth for the country is expected to increase demand for agricultural goods. Assuming that this demand is met by domestic production, rather than imports, the response by the agricultural sector could be met by two approaches: (1) increased land area used for agriculture and/or (2) increased productivity. Relative to the first option, if the large amount of land now being used as unimproved pasture is included as "agricultural land," then there is very little additional land in the country available for expansion of agriculture. Construction for tourism and urbanization will further reduce that option.

The second alternative, increasing agricultural yields by generating more product from the same amount of land, raises environmental concerns. There is a possibility that this emphasis will encourage production methods that increase yields regardless of the short- and long-term consequences for the land. Environmental issues related to the agricultural sector in Antigua and Barbuda are discussed below. Additionally, OAS (1990) raises a related issue, namely that an agricultural policy favoring export agriculture over import substitution could be expected to be more harmful to the environment and to Antiguan-Barbudans. The report states, "An export strategy will require lower cost of production and therefore a greater use of harmful chemicals. Furthermore, production will have to occur on a wider scale thus increasing the intensity of exposure [to agrochemicals] by the domestic population."

Lack of secure land tenure can also deter agricultural development because farmers are not able to use their land as collateral for loans to improve their operations. The is-

sue is especially critical when the desired improvements are for the introduction of soil and water conservation practices -- typically, the returns on these investments are long-term and may not directly translate into immediate individual economic gain. It is clear that farmers and livestock producers cannot be expected to invest in conservation measures unless they are confident that they will reap the returns of their investment.

The basis for establishing a Government lease policy are outlined in a document prepared by Dacosta (1983) working under the auspices of the OAS/NRAD Project. Assisting farmers who are otherwise confined to the most marginal (and ecologically fragile) lands to obtain long-term leases or freehold title could have substantial environmental benefits. Providing for a GOAB agricultural policy with these objectives in mind needs to be encouraged.

**Forest Policy and Legislation.** Deficiencies in existing forestry and wildlife policy, legislation and regulations are recognized as deterrents to proper protection and management of forest resources; such deficiencies also discourage investment in the sector (Henry, 1990). With the assistance of FAO, a draft national forestry and wildlife policy and associated legislation have been prepared (McHenry and Gane, 1988). This draft has been discussed with a cross section of governmental and non-governmental persons. Among other revisions suggested, most of those consulted agreed that each of the two sectors (forestry and wildlife) should be the focus of a single piece of legislation. FAO is in the process of preparing a draft Forestry Act and a draft Wildlife Act. Presumably, the revised drafts will incorporate the main points included in the preliminary draft, specifically:

- To select, establish and manage forest reserves on Crown Land and to include watersheds and catchment areas in management strategies; multiple use would be encouraged, including utilization for forest products, such as charcoal, poles, and other timber products, and for wildlife habitat; reserves would be set aside on a

watershed basis, beginning in the volcanic southwest hills; boundaries would be marked and designated under the law, and provision for enforcement of the reserve designation would be provided for.

- To begin a watershed protection program, watersheds would be addressed in order of priority; Crown and private lands would be included in the assessment and critical areas would be designated as conservation areas; a national heritage law would regulate land use activities and prescribe land use practices; land tenancy would be addressed; areas would be identified for tree planting; staffing requirements to undertake management and an extension component would be provided for.
- To set up a forestry fund for reforestation purposes with income to be derived from severance taxes levied on forest products; payments would be required for water supplied from catchment areas.
- To introduce a private forestry incentive scheme by encouraging tenant farmers and private farmers to plant trees and protect natural regeneration and to practice agroforestry; technical assistance would be provided; tenure agreements would be improved; grants and loans would be available from the forestry fund and would be payable when trees are harvested.
- To initiate silvicultural research, including cultivation of agroforestry species; utilization of forests for economic return (i.e., wood products) would be included; research and demonstration projects would be carried out on conveniently located Government lands.

- To designate and safeguard heritage sites through protection of cultural and historic features and areas of scenic and scientific interest, including terrestrial and marine wildlife; regulations to control use of these resources would be included.
- To safeguard threatened and endangered plant and animal species; specific guidelines would be included for species on the land and in the marine environment.
- To build institutional capabilities, Forestry and Water Divisions would be created within the Department of Agriculture; protection, management, administration, and other organizational responsibilities for natural resources would fall under this mandate; personnel, equipment and other facilities would be provided within the limits of available resources.
- To improve consultation and coordination with other ministries of Government, environmental impact assessments would be required for all environmentally sensitive development proposals.
- To prepare a sectorial development plan with a ten year span which would include a mapping of resources, selection of land for reforestation, research and demonstration priorities plus administrative arrangements, staffing requirements, and training needs.
- To initiate a public education program to explain the role of forests and related natural resources and to encourage social responsibility; such efforts to be targeted to politicians and other leaders, church groups, schools and to the general public using a variety of media.
- To share expertise and services with other OECS countries; to exchange information, research and training, and to provide mutual assistance in technical expertise; foreign assistance and cost-sharing would be possible on a sub-regional basis.

## ENVIRONMENTAL ISSUES

Environmental problems associated with agriculture and forestry in Antigua-Barbuda can be classified into four categories: (1) effects of agrochemical inputs; (2) competition for water; (3) poor use of land and mismanagement of watersheds; and (4) the effects of agro-processing. These problems can be expected to intensify if the proposed resurgence of agricultural activity to meet local and tourism demands is successful.

### (1) Agrochemicals

Lausche (1986) refers to a survey reporting Antigua and Barbuda to be the largest importer of pesticides in the Lesser Antilles, and the Director of Agriculture recently cited the large number of agrochemicals being used in crop and livestock production (Henry, 1990). A wide variety of pesticides is available, and these appear to be used by even the poorest farmers in the country. Archer (1984) makes reference to the use of several herbicides, fungicides, and insecticides on crops. Dioquat was reportedly used on fruit and vegetable crops. Betz (1989), in her report on land-based sources of marine pollution in the Caribbean, cites Hammerton (1985 report to CARDI and USAID) in which he lists seven types of fungicides, 14 types of herbicides, 18 types of insecticides, acaricides, and nematocides available for use in Antigua and Barbuda.

Pesticide pollution resulting from run-off of materials used by vegetable producers in the Potworks area is considered to be a contributing factor to the fish-kill recently observed in that reservoir (Fernandez and Williams, 1990). An investigation by the Department of Agriculture into this incident

identified nine pesticides (Diazinon, Lannate, Sevin, Malathion, Vapam, Maneb, Bravo, Reglone, and Gramaxone) and suggests that pesticides may enter Potworks by wind-drift, run-off and erosion, and flush back of irrigation systems.

Henry (1990) notes that even the less toxic agrochemicals can present health and environmental hazards due to over use and/or misuse. Improper application results in degraded soil and polluted surface and groundwater, and presents a health risk for farm workers. Pesticide resistance resulting from over use of these chemicals is a well-documented world-wide phenomenon; it is suspected as a factor in population increases in some destructive insects which have been observed by some farmers in Antigua and Barbuda (pers. commun., L. Merchant, Secretary, Antigua-Barbuda Cooperative Farmers Association, 1990).

Only small amounts of fertilizers were used in the past for production of food crops. Ahmad (1984) indicates a reluctance on the part of small-scale farmers to use fertilizers. With increased agricultural activity, especially by farmers trained in commercial practices, use of fertilizers and pesticides will undoubtedly increase, posing greater potential for chemical run-off from cultivated land. Section 6 of the Profile also discusses the problem of agrochemical pollution and presents policy recommendations to address this issue.

## **(2) Water Availability**

Competition for water resources is intense in Antigua. The dry climate coupled with an irregular rainfall pattern exacerbates the problem of water supply. Small ponds and surface catchments have been an important source of agricultural water supply for many years (McMillan, 1985). Demand is growing to use surface water resources for agricultural irrigation. Concurrent with agricultural requirements is a persistent pattern of rapidly increasing urbanization in Antigua, which has also increased demand for water. As discussed in Section 2.2 (Freshwater Resources), agricultural use of water supplies is consid-

ered a lower priority than municipal demands. Traditional water catchments such as Potworks are being used for domestic supply, and their use for agricultural irrigation as originally planned is restricted. Thus, it is even more critical that attention is paid to increasing the availability and utility of the limited rainfall that the island receives. McMillan (1985) points to the need for a comprehensive watershed program, including watercourse stabilization and encouragement of farming practices designed for water and soil conservation.

## **(3) Watershed Management Concerns**

**"Slash and Burn Agriculture".** The use of fire, particularly to clear undesired vegetation and to promote growth of forage vegetation, continues in a destructive manner in Antigua, particularly in the Brecknocks and Body Ponds areas (Henry, 1990). Destruction of secondary forest in an early stage of successional development results. Within the last two years, forest species introduction trials, incorporating a variety of exotic trees, have been destroyed by uncontrolled burning, most likely originating from slash and burn operations (Henry, 1990). Such agricultural practices result in soil erosion and a loss of valuable forest, wildlife habitat, protection for watersheds, and aesthetic values important for tourist satisfaction. Data on the total area burned annually are not compiled. However, Hill (1988) reports over 400 acres burned in the dry season beginning in late 1987 (see Section 2.2 for more detailed discussion).

### **Uncontrolled Livestock Grazing.**

Uncontrolled livestock grazing adversely affects vegetation and watersheds. Grazing accelerates land deterioration (especially during wet periods), deforestation, erosion and general denudation of the land resources (Garel, 1986). Given the current pattern of inefficient livestock production systems in Antigua-Barbuda, GOAB diversification plans to expand the livestock industry to reduce imports and broaden the economic base could further threaten the environment. The Agricultural Census (OAS, 1984a) listed total numbers of livestock (cattle, sheep and goats) in the country at that time (see Table 2.1(3)). As al-

ready indicated, a majority of livestock farmers are landless and graze their cattle on rough pasture in watershed areas.

The objective of several ongoing and projected projects in the country is to provide assistance to the livestock industry by improving pasture. The aim is to reverse the present degradation of land due to uncontrolled grazing and to increase meat production in order to reduce imports and gain greater self-sufficiency.

- USAID and the British Overseas Development Administration have focused their efforts on fencing, forage production, stock improvement, and establishment of communal pastures.
- CARDI's Forage Project, initiated in 1983 in various parts of the Caribbean, demonstrated the feasibility of forage "banks" or areas of pasture seeded with woody plants suitable for intensive forage production. These banks are used as "feed lots" during dry periods when open grazing is scarce.
- The European Development Fund (EDF) is committed to assistance in livestock development under an agreement with the GOAB. The EDF initiative is a four year project and includes demonstration of improved feeding and production techniques; a scheme for establishing breeding and fattening farms of 1.5 to 4 hectares; the establishment of a 200 hectare communal grazing area for landless farmers; and upgrading of staff in the Veterinary and Livestock Division of the Department of Agriculture. The long term objective of the project is to establish viable livestock farms and communal grazing areas that will demonstrate an alternative to practices which presently result in degradation of land through uncontrolled grazing.

**Reforestation.** There is a long, and mostly unsuccessful, history of attempts to reforest Antigua. Cater (1944) mentions direct seeding of the Wallings catchment area at the turn of the century. Cater also documents small areas of planting at Body Ponds and at Fort James, using casuarinas (*Cassuarina*), whitewood, and eucalyptus (*Eucalyptus*). Sugar cane estate owners are reported to have planted trees, including eucalyptus and mahogany. In 1940 and 1941 the Superintendent of Agriculture planted a few acres at Brecknocks with casuarina, eucalyptus and almond (*Terminalia*). In spite of these early attempts, Cater (1944) concluded that "there was never a well conceived, sustained programme of afforestation at any time."

Beard (1949), in his assessment of forestry in the Windward and Leeward Islands on behalf of the Colonial Forest Service, provides a conceptual background to the practice of forest management and proposes the management of estate woodlands. Species perceived as suitable for intensive management in the Caribbean are recommended by Beard, several of which would have been appropriate for conditions in Antigua. Again, there is no evidence to indicate that any reforestation or management of existing forest resulted from Beard's recommendations.

A modest proposal for afforestation of some 55 to 60 acres was suggested by Allen (1979) in a draft report to the Caribbean Development Bank. Allen's proposal focused on development of 45 acres of leucaena, including nine acres of species trials, and provided suggestions for a study of marketing and pricing of local forest products, institutional strengthening of the Forestry Division, development of a forest policy, and legislative needs. An investment of EC\$242,436 was proposed for implementation of the project over a three year period, but the plan was never implemented.

More recently, FAO has proposed to assist Antigua and Barbuda through its worldwide Tropical Forestry Action Plan. The primary function of the Plan is to coordinate forestry and forestry-related activities and to serve as an umbrella project through which donors can provide support in a coordi-

nated fashion. In theory, this umbrella would include both large projects, such as the CIDA proposal discussed below, and small projects that might be implemented by a local non-governmental organization (see also Chalmers, 1990).

In conjunction with GOAB, the Canadian International Development Agency (CIDA) has proposed a Natural Resource Management Project (Prins, 1988). Negotiations are proceeding with CIDA to develop a working agreement, including staffing needs and other preconditions (Henry, 1990). One precondition is the establishment of a Natural Resource Management Committee to coordinate the efforts of all GOAB agencies involved in the management of natural resources. The project development document (Prins, 1988) defines the principal elements of the project:

- Assistance in the technology of monitoring, planning and controlling the use of natural resources;
- Assistance to the Department of Agriculture in methods to protect soils, watersheds and the margins of reservoirs through afforestation;
- A scholarship, in-service training and public participation program;
- Afforestation of 200 acres per year, with associated site preparation, out-planting design, and follow-up maintenance.

The Pan American Development Foundation is beginning implementation of an agroforestry project in cooperation with the Antigua and Barbuda Cooperative Farmers Association (see also Section 10.3 of the Profile). Agroforestry systems will be demonstrated in conjunction with typical farming systems on a 50 acre site at Sandersons, Antigua (Ince, 1990).

Agroforestry techniques can be used to improve the economic viability of farmers while conserving the natural resource base. For example, livestock projects can incorpo-

rate forage trees into pasture improvement activities. Leguminous species such as *Gliricidia* and *Leucaena* can be managed under a pollarding system for protein rich forage. Trees incorporated into fencing or used as windbreaks or for soil conservation can have aesthetic benefits as well.

Tree cropping potential in Antigua was examined by the OAS/NRAD Project. As pointed out in the summary document (OAS, 1990), Antigua is not a traditional commercial fruit tree producing country. The southwestern region of Antigua is, however, suitable for tree crops, based on soil, topography, and rainfall conditions. Tree crops, especially mango, have been grown in limited areas of better rainfall for many years, and two Government-operated commercial orchards have demonstrated their potential over a ten year period. The proposed tree crop development project seeks to promote the development of tree crops on a total of 300 acres over a five year period (OAS, 1990). As proposed, the project would address major factors which limit tree crop production and will include:

- Improvement and expansion of the two GOAB nurseries to supply planting material including grafted cultivars; demand for planting stock is projected at 5,000 trees per year;
- A top grafting component to convert 500 established mature mango trees to preferred varieties;
- 100 acres of Government land at Christian Valley to be divided into 10 acre plots for allocation to tree farmers; this demonstration would be supported by advisors in fruit production;
- Marketing support to be provided by supplying packaging materials, grading and cool storage facilities, and roadside fruit stands; export markets would also be developed.

## PROMOTION OF URBAN FORESTRY INITIATIVES

The importance of trees, shrubs and other vegetation in urban areas cannot be overemphasized. The benefits of these plants go beyond their obvious aesthetic value and include serving as noise barriers, removing airborne pollutants and adding oxygen to the environment, and providing shade and wildlife habitat. The need for these benefits is important in Antigua as urban development continues and as additional facilities for tourist accommodation are built. Well-planned landscaping and rehabilitation of natural vegetation on development sites should be required as part of the development permitting process. Planting new trees and caring for existing trees should also be addressed in older neighborhoods.

The St. John's Botanical Garden is becoming a focus of an urban forestry initiative. The plan for the Garden includes rehabilitation and addition of trees and shrubs to enhance the facility. Residents and tourists will both benefit from this effort. A public education and awareness program could be launched in conjunction with improvements at the Botanical Garden and might include tree identification and care as well as programs which emphasize the benefits of trees.

The Ministry of Agriculture is responsible for the Garden. The present budget allows for payment of salaries for the maintenance crew, fuel for mowing grass, and other incidental expenses, but no funds for tree replacement or major improvements to the grounds are presently available (pers. commun., P. Blanchette, Department of Agriculture, 1990).

The projected cost of implementation of the project is EC\$2.4 million. Two models analyzing financial options were proposed by OAS. Both models involve subsidizing the participating farmers with Government funds to ease the cost of investment and to provide income during the establishment period (projected to be three to five years before substantial fruit crops are produced). A positive effect on the balance of trade from project activities is projected after the initial year of implementation (OAS, 1990). In spite of some use of pesticides and fertilizers, which could contaminate groundwater, it is projected that "the concentration of chemicals in tree crop production is small and this negative effect on groundwater would be minimal" (OAS, 1990). Overall, it is anticipated that there would be a net positive effect on the environment from the project.

#### (4) Processing of Agricultural Products

As also discussed in Section 4 of the Profile (Energy and Industry), the agro-pro-

cessing industry is contributing to pollution problems in the country, especially of marine/coastal environments. As the agricultural sector grows to meet import substitution requirements and tourism demands, additional processing is likely to take place in Antigua. In the past, waste from abattoirs processing local livestock products has caused problems for the marine environment (Archer, 1984), and there are plans to develop abattoir activity.

#### 2.1.3 Policy Recommendations

*(1) Harmonize policies and legislation for the natural resource components (land, water, and forests) that affect the agricultural sector in order to ensure that the sector's contributions to the economy meet projections as presently articulated in national development plans.*

As noted in Section 2.1.2, the background analysis and framework have been laid

to allow more efficient use and greater protection of the country's land and forest resources. Government should facilitate completion of the proposed Forestry Act and Wildlife Act and provide the support needed to enable designated agencies to monitor and enforce regulations for sustainable management of these resources.

Similarly, the draft Water Resources Act draws on a decade of analysis of issues and opportunities relating to this resource (Burchi, 1981, 1988, 1989). As also noted in Section 2.2 (Freshwater Resources and Watersheds), it is critical that an institutional vehicle and administrative procedures be identified which ensure that technical input from the agricultural sector inform national water allocation decisions.

The proposed CIDA Natural Resource Management Project represents an excellent opportunity to begin an integrated approach to management of the country's lands, forests, and watersheds. The fact that legal or historical control of these resources is dispersed among several Government departments is a serious obstacle, but not an acceptable justification, for allowing the country's resources to be mismanaged and squandered. The necessary integration is possible but will require diplomacy and a willingness to compromise in order to promote national interests.

*(2) Ensure that farmers and livestock producers have adequate tenure security in order to encourage utilization of soil and water conservation practices.*

The land tenure situation in Antigua and Barbuda is confusing, and there is disagreement about whether lack of tenure is a serious obstacle to improved performance of the agricultural sector. It is much more clear, however, that uncertainty over future rights to use of a parcel of land does discourage conservation investments such as the planting of trees or the building and maintenance of soil erosion controls. Tenure security, at least through the time period needed to realize economic returns on capital and labor investments, is essential if Government wishes to

promote the conservation measures needed to protect the country's resource base.

*(3) Provide support for more environmentally appropriate agriculture and use of forest resources.*

**Control of Agrochemicals.** The need for control and regulation of agrochemicals and promotion of their safe and economical use is paramount (Henry, 1990; also see Section 6 of the Profile). In his recent report, Henry points to the apparent adequacy, at least on paper, of the Pesticide Control Act. Regulations, however, have not been developed, and both Henry (1990) and Lausche (1986) emphasize the need for supporting regulations to give full force to the Act.

In the recommendations prepared as part of the investigation of fish-kills at Potworks Reservoir, Fernandez and Williams (1990) recommend steps to reduce chemical deposition in this critical reservoir. These recommendations, *which can also be applied nationally*, include:

- Appointment of a panel of individuals to oversee land use adjacent to Potworks Reservoir and to make recommendations for control of agrochemicals used in the area;
- Training of farmers in the utilization of effective and appropriate tillage techniques to limit erosion and run-off into Potworks;
- Implementation of precautions to control back-flushing of agrochemicals, as occurs when drip irrigation fertilizer injectors are cleaned;
- Creation of a buffer zone around Potworks to absorb chemicals migrating from farm land;
- Periodic testing of Potworks water for contamination;

The training and licensing of personnel using chemicals.

**Support for an Organic Farming Initiative.** In his report to a recent national workshop on conservation and development, Henry (1990) noted the need to promote agricultural practices that were less dependent on chemical inputs, for example, the use of integrated pest management. Several local farmers have expressed an interest in organic production (pers. commun., L. Merchant, Secretary, Antigua-Barbuda Cooperative Farmers Association, 1990), and representatives of an organic produce marketing corporation visited Antigua in 1989 to determine interest and potential supply of organic fruits and vegetables to the U.S. market.

Government could support the establishment of a demonstration organic farm, utilizing both local expertise and international authorities on organic methods. There is a need to augment the organic matter content of most Antigua soils, particularly in those areas where production is concentrated. Research into production under organic methods and the use of natural pesticides and other low-input (i.e., low petrochemical input) approaches should be a part of a demonstration farm project.

**Support for Agroforestry Initiatives.** Opportunities to promote agroforestry, as a means to improve economic viability while conserving the natural resource base, should be encouraged. Agroforestry is a major component of FAO's Tropical Forestry Action Plan (Chalmers, 1990). The Ministry of Agriculture has expressed interest in the Plan but also is understandably concerned about the possible personnel demands it may require. GOAB should support its Ministry of Agriculture on this initiative and identify resources to enable it to take advantage of this opportunity.

## 2.2 FRESHWATER RESOURCES AND WATERSHEDS

### 2.2.1 Overview

Antigua and Barbuda is characterized by low annual rainfall, a situation made worse by the fact that the amount of precipitation varies sharply between the wet and dry seasons and is highly variable between years (Figure 2.2.(1); also see Section 1.2.1 for a more detailed discussion). There are no permanent lakes or rivers in Antigua or Barbuda, although the largest river in Antigua -- the Bendals River -- has water except during prolonged droughts (Loveless, 1960). Droughts occur every 5-10 years and are a regular, if unpredictable, feature of the environment (Figure 2.2(2)). When several low-rainfall years occur consecutively, as in 1964-68 and 1983-84 (see Table 2.2(1)), the country faces critical water shortages. In the 1983-84 drought, water had to be imported from neighboring countries.

The three topographic regions in Antigua (see Sections 1.2.1 and 1.2.2) strongly influence the hydrology of the island:

- *Volcanic region.* This region has the highest elevations and contains several mountains with the steepest slopes on the island. The orographic effect is the principal factor contributing to the southwest's greater rainfall (45-50 inches per year). The region does not have any large groundwater supplies in the volcanic rocks; however, aquifers exist in several of the alluvial valleys.
- *Central plains region.* The central plains and northern limestone area is lower in elevation and gentler in topography. The region receives intermediate values of rainfall -- averaging 45 inches per year.
- *Limestone region.* This region, situated on the eastern side of Antigua, receives the least rainfall, some 35-40 inches per year (McMillan, 1985; Montgomery, 1983).

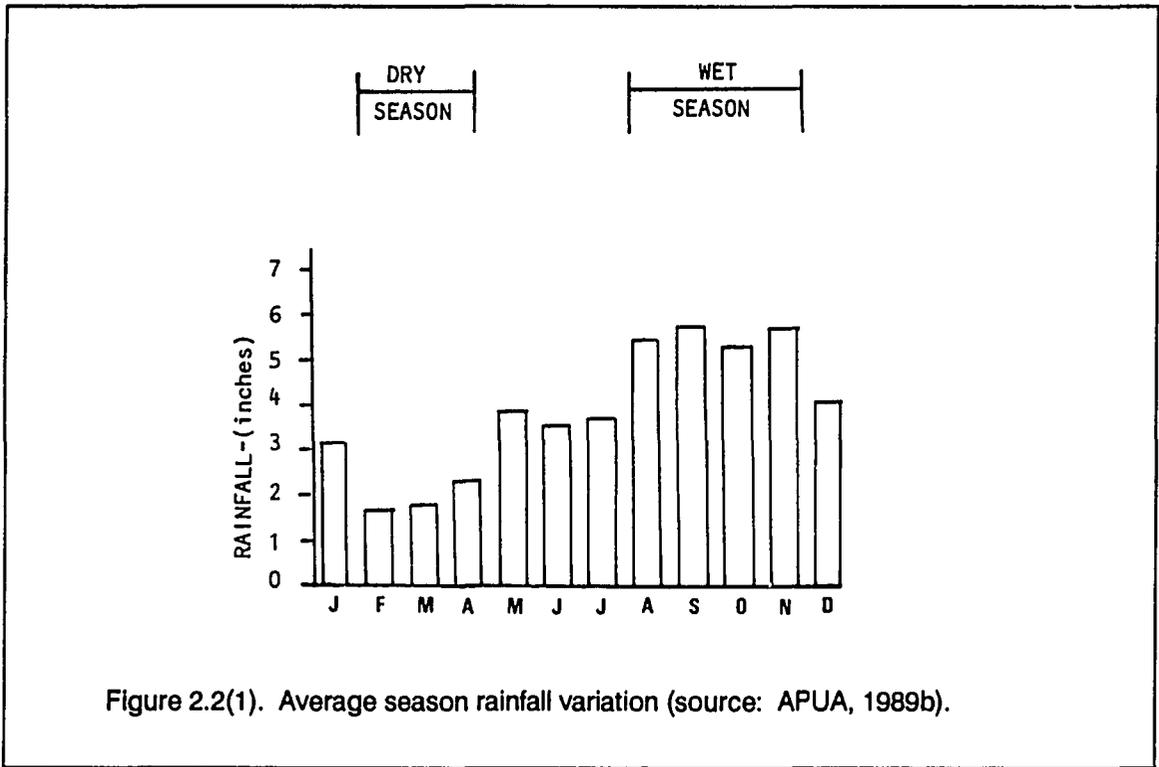


Figure 2.2(1). Average season rainfall variation (source: APUA, 1989b).

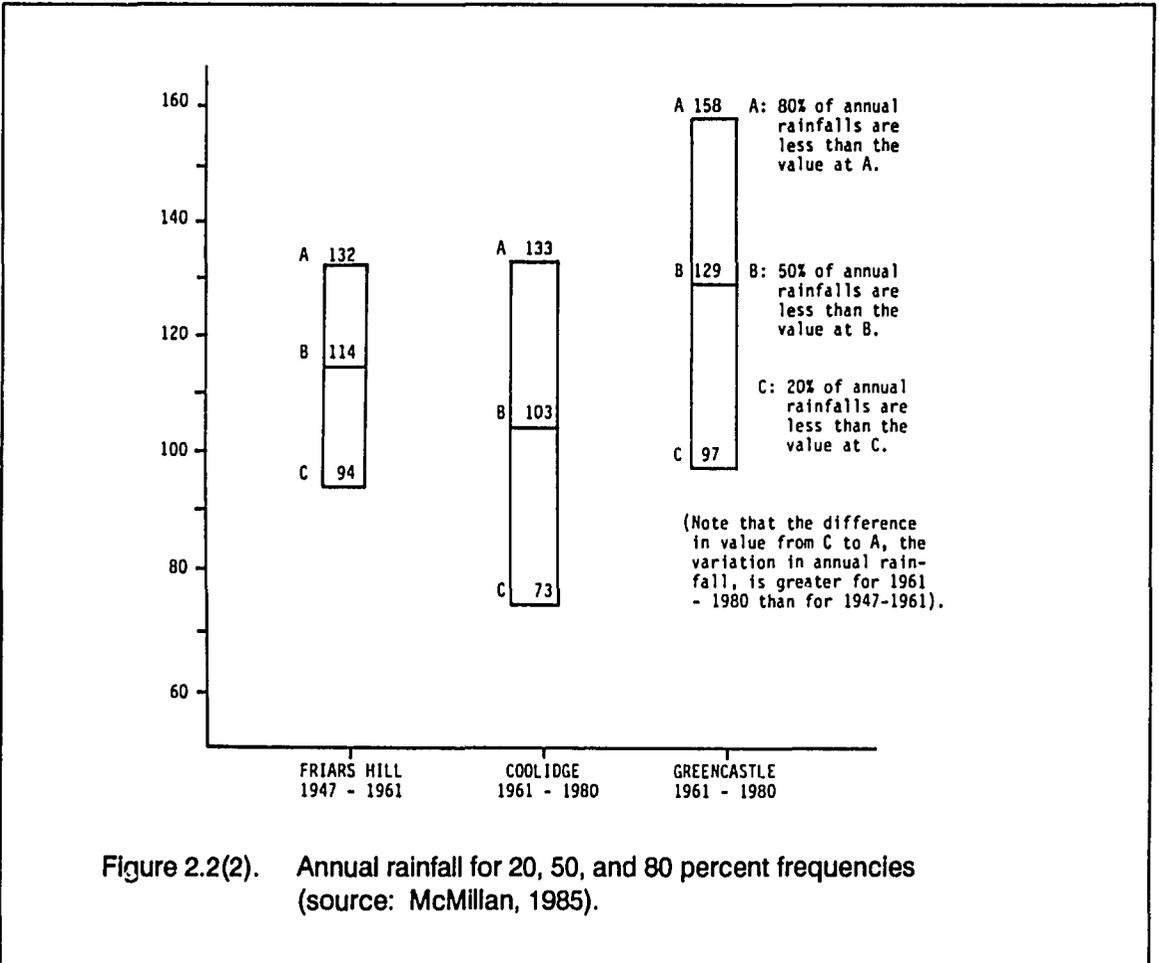


Figure 2.2(2). Annual rainfall for 20, 50, and 80 percent frequencies (source: McMillan, 1985).

Table 2.2(1). Annual rainfall in inches, 1950 - 1984, (periods of prolonged drought: 1964-1968 and 1983-1984).

Year	Rainfall	Year	Rainfall
1950	50.05	1971	45.18
1951	60.79	1972	45.92
1952	56.78	1973	27.73
1953	29.15	1974	50.70
1954	41.58	1975	37.78
1955	46.89	1976	40.89
1956	49.42	1977	38.50
1957	43.79	1978	49.00
1958	47.35	1979	66.00
1959	41.55	1980	33.00
1960	40.76	1981	58.00
1961	40.58	1982	40.00
1962	50.91	1983	22.26
1963	44.06	1984	33.25
1964	34.46	1985	--
1965	31.69	1986	35.12
1966	29.74	1987	56.23
1967	34.58	1988	51.82
1968	27.19	1989	43.32
1969	52.05	1990	21.73 (8 mos.)
1970	61.23		

Source: APUA, 1989b.

## WATERSHEDS

A watershed is a topographically defined area having a common drainage system. It can be defined broadly (e.g., 86 were identified for Antigua in a study by Halcrow, 1977) or narrowly (e.g., these 86 have been grouped into 13 watersheds by McMillan, 1985). The decision is somewhat arbitrary, and it primarily is a function of management needs. Watersheds can be used as the fundamental units to assess hydrological budgets and erosion and to provide for land use planning and management.

McMillan's 13 watersheds are listed in Table 2.2(2), with their existing and proposed storage capacities as of 1985; they are also shown in Figure 2.2(3). The 13 watersheds have been further grouped into six major watersheds that occupy 43 percent of the island's area and contain 80 percent of

groundwater supplies and 90 percent of surface water storages. These six areas are:

- Creekside
- Potworks
- Christian Valley
- Fitches Creek
- Parham
- Bethesda.

Within these watersheds are found 50 percent of the island's total forest land, 90 percent of its crop production, 60 percent of livestock production and 70 percent of the Antiguan population (Fernandez, 1990). Barbuda has been divided into ten watersheds, shown in Figure 2.2(4).

Soil erosion from Antigua's watersheds has been identified as a problem from hills in the southern region. However, three factors combine to reduce the overall erosion

Table 2.2(2). Antigua watersheds with storage capacity estimates for existing and proposed agricultural and municipal water supplies (acre-feet).  
See Figure 2.2(3) for location of watersheds.

WATERSHED	AGRICULTURE		MUNICIPAL	
	EXISTING STORAGE	PROPOSED STORAGE	EXISTING STORAGE	PROPOSED STORAGE
1	30.6	82.9	4,010	(4) -
2	200.4	202.2	278	4,120 (5)
3	334.5	18.2	-	-
4 - 11	9.2	25.2	166	160
12 - 20	2.0	-	50	140
21 - 26	-	-	-	80
27 - 46	5.2 (1)	10.7	-	-
47 - 53	570.4 (2)	32.5	-	-
54 - 62	19.2	33.6	-	-
63 - 66	33.4	59.1	-	-
67 - 77	38.4 (3)	16.3	-	-
78 - 84	2.2	-	-	-
85 - 86	2.5	2.2	-	-
<b>TOTALS</b>	<b>1,248.0</b>	<b>482.9</b>	<b>4,504</b>	<b>4,500</b>

NOTES:

- (1) Does not include Red Hill (46 AF) and Picadilly (c. 2 AF).
- (2) Includes Bethesda (540 AF).
- (3) Does not include Langfords (99 AF).
- (4) Potworks (3,700 AF), Collins (310 AF).
- (5) Creekside (2,900 AF), Body Ponds (1,200 AF).

Source: McMillan, 1985.

problem relative to other Eastern Caribbean islands: relatively gentler topography, less erosive rains and reversion of abandoned agricultural lands to scrub (Atkins, 1983). Some of the protective benefits of vegetative cover in scrub lands is lost through the practice of burning the lands annually to promote regeneration of younger, more edible fodder. No estimates exist on the amount of land surface affected by this practice although it is clear that it occurs widely, including on sloped lands.

A regional CARDI-sponsored study of soil and water conservation (Atkins, 1983) noted the surprising absence of on-farm water conservation practices in Antigua-Barbuda (e.g., mulching, strip-cropping on contours, cover cropping and intercropping, run-off measures such as tied-ridges, and agro-forestry), despite the scarcity of agricultural water. Support for these practices is assigned as a collaborative responsibility to the Agricultural Engineering Unit and the Extension

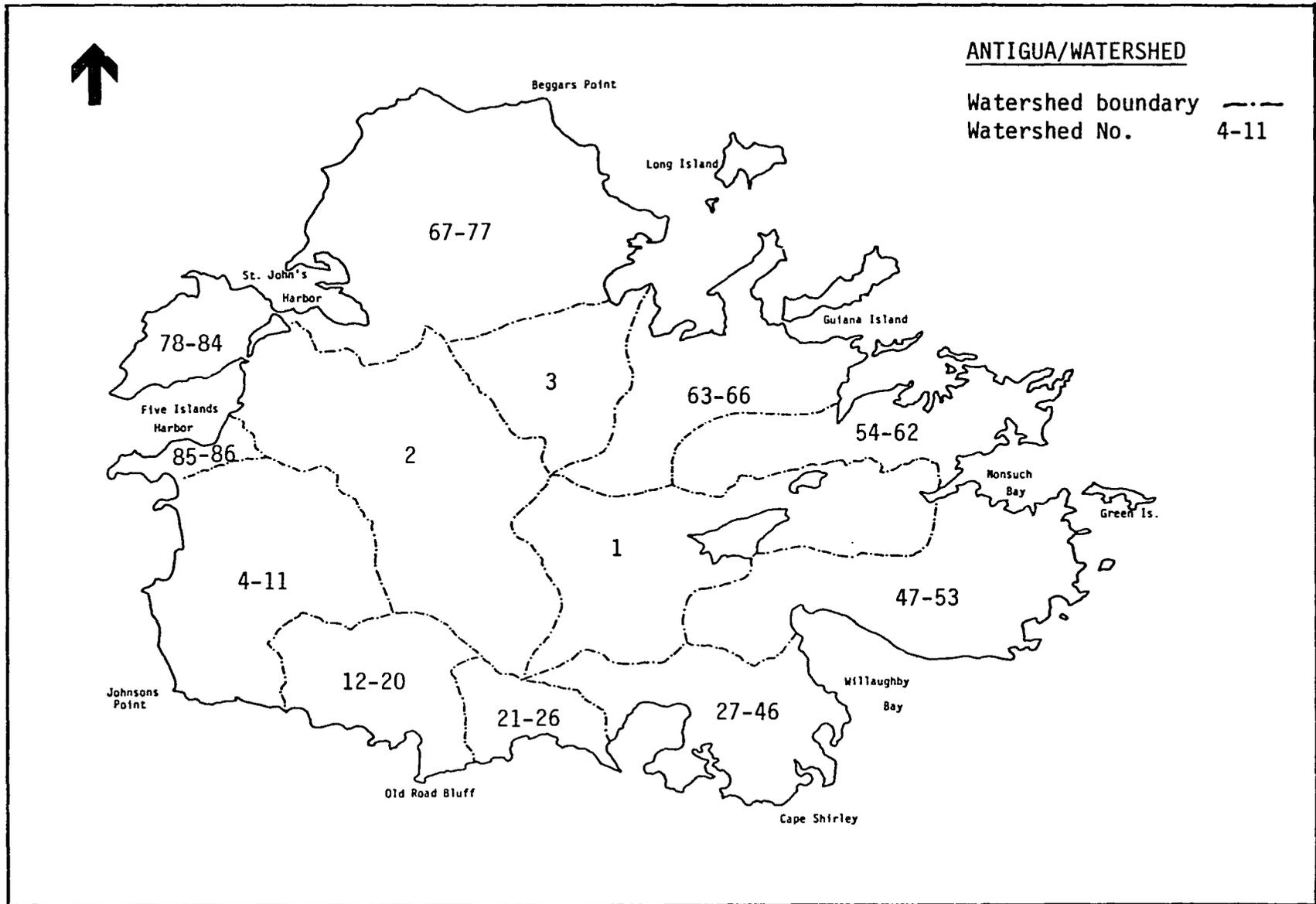


Figure 2.2(3). Watersheds of Antigua (source: McMillan, 1985). See also Table 2.2(2).

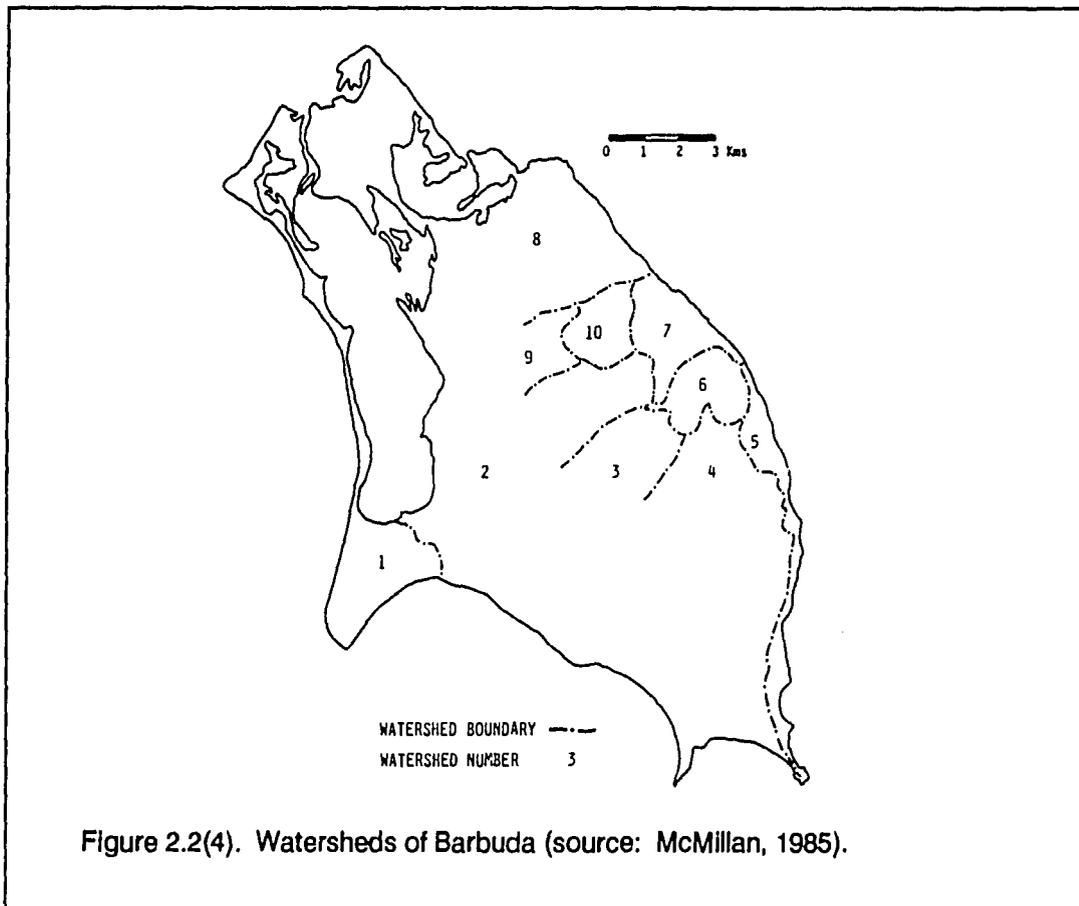


Figure 2.2(4). Watersheds of Barbuda (source: McMillan, 1985).

Division of the Ministry of Agriculture. The Agricultural Engineering Unit, responsible for the construction component of the collaboration, consists of three individuals. Although additional labor can be hired for specific jobs such as mini-dam construction, the Unit is still inadequately staffed and funded to meet all farmer requests in a timely fashion, in addition to its other responsibilities for the maintenance and rehabilitation of Government lands (pers. commun., G. Fernandez, Agricultural Engineering Unit, 1990).

#### KEY CATCHMENT AREAS

Catchment areas are components of a watershed upslope from a water intake or collecting area. They can be defined within the broader watershed because they supply water for more specific purposes such as drinking water or irrigation.

There has not been any recent assessment of the country's catchment areas,

and little is known about their condition (e.g., vegetated or barren) or management status (e.g., used for grazing or contain residences) (pers. commun., G. Fernandez, Agricultural Engineering Unit, 1990; V. Yearwood, APUA Water Division, 1990).

#### WATER SUPPLY/DEMAND AND TREATMENT

##### (1) Water Supply

In 1983-84, Antigua and Barbuda experienced a severe drought, and water had to be barged in from Guadeloupe and Dominica. Since then over 20 new wells have been developed or rehabilitated to bring the total to 45 operational wells; transmission lines have been renovated and expanded; and two desalination plants have been developed (APUA, 1989a).

Water use can be divided conveniently into two groups, agricultural and non-

agricultural (municipal). The latter includes domestic, commercial (industries and hotels), government, harbor and airport facilities. There are four sources of water for municipal use. Groundwater and surface ponds/reservoirs are the primary ones; desalination plants and cisterns also provide for municipal water needs. Surface supplies are the source of irrigation water for agriculture, with occasional use of groundwater when municipal demands allow.

**Groundwater.** Groundwater in much of Antigua and Barbuda is saline. Despite this, estimates from 1980 listed this as the source of some 45 percent of Antigua's water supply production (Montgomery, 1983). Current estimates are that groundwater supplies about 25 percent of water demand (Burchi, 1988). Antigua's groundwater system can be divided into five main well fields (supply figures shown in million gallons per month):

Collins-Bristol Springs	7.1 MG/M
Follies	0.2 MG/M
Claremont-Cades Bay	2.6 MG/M
Bendals	7.6 MG/M
Valley	7.9 MG/M

Total production is 25.4 MG/M (APUA, unpublished data, 1990).

Groundwater in much of Barbuda is too saline for use, with the notable exception of Palmetto Sands, a 1,500 acre (i.e., a 405 million gallon\*) area of beach sands on the island's southwestern shore. Mather (1971) estimated that the area could supply 14.3 MG/A; according to McMillan (1985), recharge estimates suggest a potential yield six times greater.

**Ponds and Reservoirs.** There are more than 500 ponds distributed throughout Antigua, the majority of which are less than one Acre-Foot storage capacity (McMillan, 1985). These small ponds are used primarily for agriculture. Several of the larger areas are shown in Figure 2.2(5), with information on their size provided in Table 2.2(3). Many of the reservoirs are used for both agricultural and non-agricultural needs. In McMillan's

1985 study, he reports there are seven small to medium reservoirs in the volcanic region, ten in the central plains, and two in the limestone region.

The total estimated storage capacity (using a minimum size storage area of greater than 0.1 Acre-Foot) in 1985 was 5,752 Acre-Feet, equivalent to 1,553 MG (Table 2.2(2)). The storage capacity reported by APUA in 1989 was 1,254.3 MG (Table 2.2(4)). The lower value could reflect differences between APUA's definition of storage capacity and McMillan's definition, or it could mean that some of the storage areas reported in 1985 are no longer functional.

Many of the ponds found in Antigua are shallow and are fed by relatively large catchment areas. Less than 1 inch (2.54 cm) of run-off can fill these storage areas to capacity. Run-off is affected by soil type and soil moisture content, slope, shape and size of catchment, and rainfall intensities. According to McMillan (1985), run-off data are only available for Creekside and Potworks; no data exist for smaller catchments or for the limestone areas in Antigua and Barbuda. However, McMillan (1985), using a run-off model based on data from other parts of the world to supplement the data available for Antigua-Barbuda, estimated run-off for two regions of Antigua and one for Barbuda. As shown in Table 2.2(5), typically there is enough run-off to fill Antigua's small storage ponds during about half the months. (Regions 1 and 2 refer to Antigua; Region 3 refers to Barbuda, but the issue of run-off levels is not relevant in Barbuda, where the water supply is primarily from one large storage area.)

Shallow ponds do not "stockpile" water well; agricultural and non-agricultural demands, coupled with high evaporation rates, deplete them quickly. Therefore, the availability of water from a shallow pond is a function of the run-off in that catchment during the particular month in question. On the other hand, water supply for the larger dams and reservoirs is better computed by examining annual run-off values. These larger storage areas require on the order of six to seven inches to fill to capacity. This amount was

\* 1 Acre-Foot (AF) = 0.27 Million Gallons (MG).

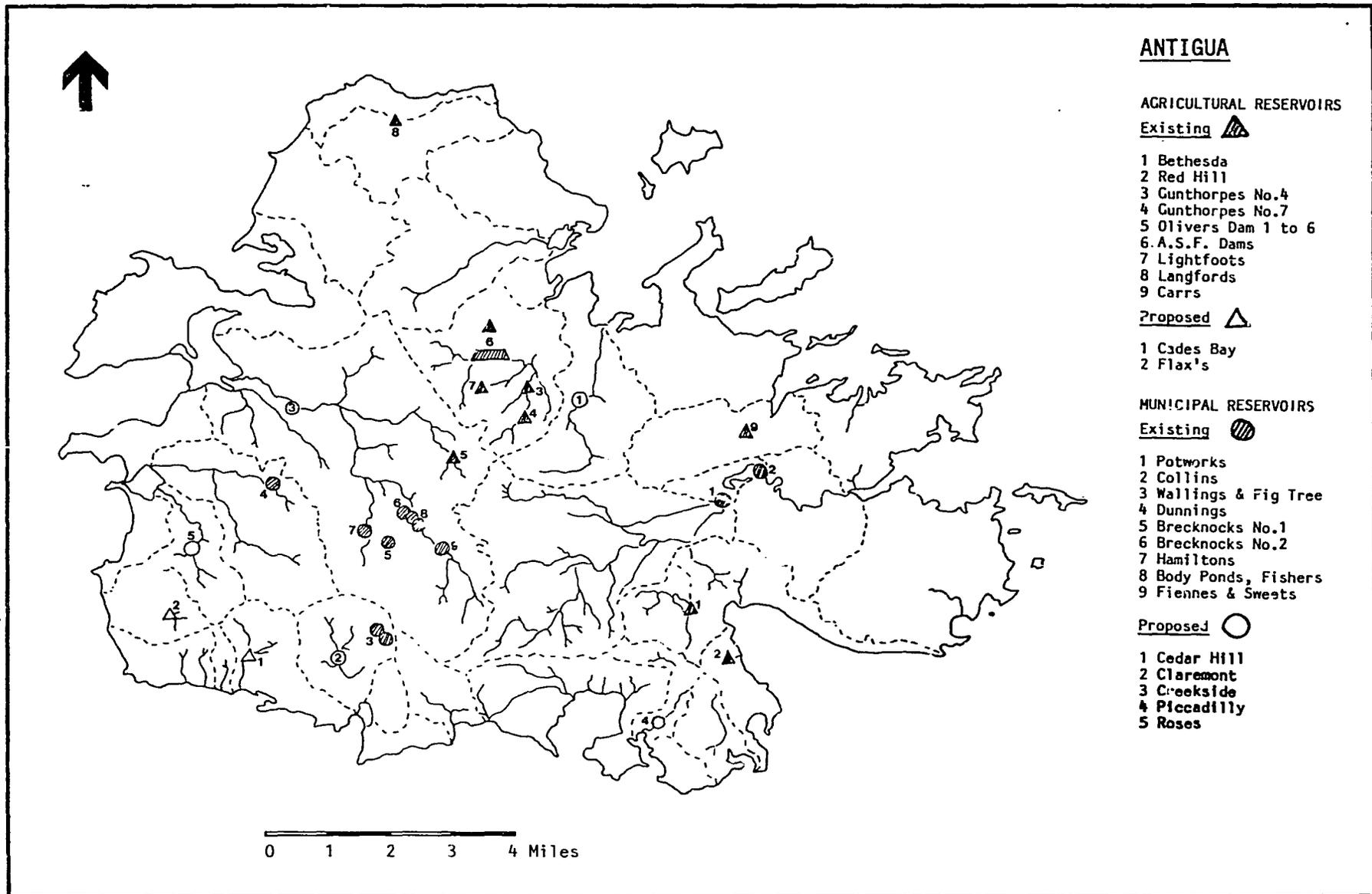


Figure 2.2(5). Several of the larger agricultural and municipal reservoirs for the Island of Antigua (source: unpublished data, circa 1982, provided by G. Fernandez, Agricultural Engineer, Department of Agriculture, GOAB).

Table 2.2(3). Size and storage capacity of several of the larger agricultural and municipal reservoirs in Antigua. See also Figure 2.2(5).

AGRICULTURAL RESERVOIRS			MUNICIPAL RESERVOIRS		
NAME	SIZE (Acres)	STORAGE VOLUME (Acre - Foot)	NAME	SIZE (Acres)	STORAGE VOLUME (Acre - Foot)
<u>EXISTING</u>			<u>EXISTING</u>		
Bethesda	676	5,17	Potworks	6,100	3,700
Red Hill	80	46	Collins	500	330
Gunthorpes No. 4	50	26	Wallings and Fig Tree	268	50
Gunthorpes No. 7	185	67	Dunnings	390	233
Olivers Dams 1 to 6	260	59	Brecknocks No. 1	150	20
A.S.F. Dams	610	116	Brecknocks No. 2	100	74
Lightfoots	35	2	Hamiltons	470	100
Langfords	1,050	110	Body Ponds, Fishers, Fiennes and Sweets	2,000	96
Carrs	1,075	4			
<u>PROPOSED</u>			<u>PROPOSED</u>		
Cades Bay	648	100	Cedar Hill	1,125	200
Flax's	139	50	Claremont	843	140
			Creekside	6,293	2,900
			Piccadilly	500	100
			Roses	649	160

Source: Unpublished data, circa 1982, provided by G. Fernandez, Agricultural Engineer, Department of Agriculture, GOAB.

received in 13 of 20 years in Region 2, and in 19 of 20 years in Region 1 (McMillan, 1985).

**Desalination.** Antigua has two 1 MG/D (million gallons/day) desalination plants, constructed over the past two years (APUA, 1989a). However, they are not always in operation and seldom produce water at full capacity.

**Cisterns.** Many individual residences have cisterns that provide some, and in a few cases all, of the household water needs. There are no reliable data to estimate the

contribution that this water-collecting method makes to meeting the country's water demand.

## (2) Water Treatment

Most municipal water is treated with chlorine, which is a cheap, easy-to-handle disinfectant with a residual effect. There are three main treatment plants -- Bendals, Delaps and Wallings -- which produce 18 MG/M, 43 MG/M and 18 MG/M respectively. Municipal water supplied to several

Table 2.2(4). Water capacity and water consumption data for years 1984 - 1987.

	1984	1985	1986	1987
<u>Capacity</u> (Million Gallons)	1,253.10	1,253.10	1,254.30	1,254.30
(a) Reservoirs	1,245.40	1,245.40	1,245.40	1,245.11
(b) Storage	7.75	7.75	8.95	8.95
<u>Consumption</u> (Million Gallons)	439.90	846.00	811.90	885.64
(a) Industrial and Commercial	155.00	200.00	209.50	230.30
(b) Residential	170.00	329.00	344.70	372.00
(c) Public Stand Pipe	114.90	246.00	257.70	283.31

Source: APLA, 1989a.

Table 2.2(5). Estimated mean monthly run-off, Antigua-Barbuda, in centimeters (2.54 cm. = 1 inch).

	REGION 1 (ANTIGUA)	REGION 2 (ANTIGUA)	REGION 3 (BARBUDA)
Month 1	2.0	1.0	0.8
Month 2	0.5	0.2	0.2
Month 3	1.5	0.5	0.4
Month 4	1.5	1.0	0.8
Month 5	5.8	4.8	3.8
Month 6	1.5	1.0	0.8
Month 7	3.0	2.3	1.8
Month 8	5.1	3.7	3.0
Month 9	6.1	4.8	3.8
Month 10	6.6	5.6	4.5
Month 11	8.1	5.6	4.5
Month 12	5.1	2.5	2.0
Year Totals	46.8	33.0	26.4

Source: McMillan, 1985.

areas is not treated. APUA has plans to chlorinate this water as well, and in the meantime it conducts a continual water quality monitoring program. Water is checked daily for bacteria, chlorine residual, pH, color and turbidity, and all wells in the system are checked weekly for bacteria, sodium chloride and iron (APUA, 1990; APUA, unpublished, 1990).

The Barbuda system is supplied from a single well that serves Codrington, where most of the population resides (McMillan, 1985).

### (3) Demand

Table 2.2(4) shows municipal water consumption patterns for 1984-1987, the last year for which data are available. The previous reliable estimate (derived by multiplying the estimated population size by an estimated per capita consumption value) is for 1980 and suggests that the demand was 746 MG/year (McMillan, 1985). McMillan's 1980 estimate is 306 MG more than APUA's 1984 figure. APUA's figure presumably is based on actual water sales and reflects the fact that 1984 was a severe drought year. Consumption in 1987 was 886 MG, but demand rose sharply by 1988 in response to the newly operational desalination plant. Demand is now approximately 1,500 MG/year (APU data provided for CEP project).

Agricultural water needs are considered subordinate to municipal needs. This is official policy of the Public Utilities Authority, although APUA does supply water for agricultural use on an *ad hoc* basis (McMillan, 1985; Burchi, 1989). For most of the crops grown in Antigua and Barbuda, water is the limiting factor, and, aside from cost considerations, agriculture could easily consume any available water not being used for other purposes. In most cases, however, this would not be a cost-effective use of water.

The recently completed OAS summary of agricultural development in the country (OAS, 1990) does look at particular situations where irrigation could be cost-effective. It estimates that a total of 2,353 acre-feet (635 MG) could be available for irrigation

water, based on developing surface water storage capacity in an economically rational manner (OAS, 1990). It is beyond the scope of the CEP to evaluate agricultural water needs for the country. It is noted, however, that water allocation decisions depend on economic and other policy considerations, not plant physiology needs; the latter would require far more water than Antigua and Barbuda can supply.

## WATER MANAGEMENT: INSTITUTIONS AND LEGISLATION

### (1) Institutions

**Antigua Public Utilities Authority (APUA).** APUA has overall responsibility for managing the country's water resources. The Planning and Development section of the Water Division is responsible for hydrological and hydrogeological studies, the development and construction of wells, the planning and design of dams, and contracting out major construction projects. The Operations and Maintenance section is in charge of pumping stations and water treatment plants, small construction projects, and the installation, inspection and repair of water meters.

The Water Division is also responsible, under the Public Utilities Act of 1973, for establishing, operating and maintaining a sewage system, but currently no system exists.

**Central Board of Health.** The Central Board of Health (Ministry of Labor and Health), charged with environmental health responsibilities, also monitors freshwater quality. A staff of about 20 supervisors and public health inspectors collects water samples from municipal stand pipes for laboratory analysis. The inspectors investigate possible environmental health issues and report to supervisors weekly. Inspectors are authorized to enter private property, but, in practice, they do not always assert this right (*pers. commun.*, D. Matthey, Central Board of Health, 1990).

**Ministry of Agriculture, Fisheries, Lands, and Housing.** There are four Divisions that have some responsibilities relating to watershed management.

Forestry Division:

- Forest development and management;
- Public education on forestry protection.

Soil and Water Conservation Division  
(also referred to as Agricultural Engineering Unit):

- Planning, construction and maintenance of soil and water conservation structures;
- Irrigation design and layout;
- Mini-dam construction.

Extension Division:

- Promotion of soil conservation, tree cropping and good land husbandry.

Lands Division:

- Land allocation, policy and eviction.

The Ministry of Agriculture, the Ministry of Public Works and Communications and the Ministry of Public Utilities and Aviation (which includes the APUA), all share responsibility for dams, ponds, streams, and catchment protection (pers. commun., G. Fernandez, Department of Agriculture, 1990).

**Development Control Authority (DCA).** DCA is responsible for ensuring that new public buildings provide storage facilities of at least ten imperial gallons of water per square foot of roof surface. Other new buildings are required to have a minimum capacity of 50 imperial gallons per occupant (pers. commun., G. Fernandez, Department of Agriculture, 1990).

**(2) Legislation**

FAO has been working with the Government to develop an improved legislative and institutional framework for the development, use and conservation of the country's freshwater resources. The three reports by FAO's consultant (Burchi, 1981, 1988 and 1989) provide a thorough and detailed assessment of existing and recommended legis-

lation to deal with water withdrawal and users' rights; data collection, water resource planning and administration; water pollution control; and watershed protection. The combined studies recently culminated in preparation of a "Draft Cabinet Paper For A Bill For A Water Resources Act" (Burchi, 1989) which notes that despite the fact APUA has been given "control" of virtually all waters in Antigua-Barbuda, confusion exists because private land owners are entitled to draw water for certain uses free of Government interference. Therefore, the first recommendation of FAO's draft Water Resources Act is that the State should be granted "superior user rights in all water resources in Antigua (and Barbuda) as a trustee for and on behalf of all Antiguans (and Barbudans)."

A related, ongoing FAO effort focuses on forestry and wildlife policy and legislation (McHenry and Gane, 1988). In response to the request of Government, FAO is re-drafting forestry and wildlife legislation into separate acts. Watershed protection was featured in the first draft and presumably will be dealt with in one or both of the redrafted acts (see Section 2.1, Agriculture and Forestry, for further discussion).

**2.2.2 Problems and Issues**

**NEED FOR A NATIONAL WATER POLICY:**

Because water is a limited resource, water-related issues are critical in determining national policies for Antigua-Barbuda. Nevertheless, the country does not have a comprehensive national water policy. Most of the recent improvements in supply and delivery of municipal water were an offshoot of the severe drought of 1983-84. The facts seem to support the assumption that another crisis will be required before the country's water situation will be fully assessed and considered as an essential part of national economic and development planning. An assessment of the country's water supply and demand should be the basis of a water policy that considers, among other things:

- What is the existing and projected per capita demand for municipal water? How much do/could cisterns contribute to the amount being supplied by APUA? What is the suppressed demand?
- How large a tourist population can Antigua and Barbuda support given the limitations of its water supply? Will additional storage facilities be necessary? Should hotels be required to have their own desalination units and to maintain them in operational condition, at least to be able to supply their own needs during the dry season?

What is existing and projected agricultural demand for irrigation water? Would this change if farmers knew that their requests for water would be considered on equal priority with municipal demands? What can be done to improve rain-fed agriculture via water catchment practices and

other water conservation measures?

What could/should a water conservation plan and policy look like for Antigua and Barbuda? What kind of educational and outreach programs would be needed to support such a conservation policy?

**Inadequate Meteorological Data.** In order to develop a national water policy and to include water availability as a factor in development planning, it would be useful to have a better definition of spatial variations in rainfall, run-off, and evapotranspiration. According to McMillan (1985), the Coolidge Meteorological Office is the only source of such data for Antigua; a private individual collects rainfall data for Barbuda. In years past there were 70-95 rain gauges throughout Antigua, but these have been allowed to fall into disuse (Atkins, 1983; McMillan, 1985). As noted by McMillan (1985), one or two hydrological stations per area are needed in at least the three main hydrogeological areas of Antigua in order to provide a sounder basis for establishing a water resources policy.

### WATER CONSERVATION: CHANGING ATTITUDES

Most of the population, perhaps with the notable exception of farmers who tend to be acutely aware of the need for more water, does not identify with the water shortage problem in Antigua-Barbuda. People recognize that water shortages exist -- at the national level -- but they lack motivation or pressure to translate that fact into actions that might affect their personal behavior. For example, it is not uncommon to see people washing cars at a public tap, leaving the water running while they wipe the car. APUA has attempted to promote conservation through its policy that domestic supplies are charged a progressively higher rate as consumption increases.

Many communities once had an unofficial "water warden", usually an older woman, who informally monitored water use and brought social pressure to bear on those who wasted this common-property resource. The custom seems to have died, with the women having been replaced by laws that are seldom enforced.

## **INSTITUTIONAL COORDINATION**

The Public Utilities Act of 1973 is the key piece of legislation regarding water administration in Antigua and Barbuda. It vests the Antigua Public Utilities Authority with responsibility for water administration without clearly defining what that responsibility entails. Most of APUA's expertise and almost all of its resources are focused on meeting municipal water needs.

There is a serious gap in water planning and management for other uses of water (i.e., non-municipal needs), and the 1973 Act does not adequately define a process for making water resource allocation decisions. As noted in FAO's consultations, APUA's decisions affecting the availability of water to water-dependent sectors such as agriculture are "widely perceived as arbitrary and capricious" (Burchi, 1989). No formal mechanism exists to ensure that the needs and input of all affected sectors are represented in the decision-making process.

## **WATERSHED ISSUES**

There are too few resources allocated to enable the agencies responsible to properly manage the country's watersheds. For example, the condition of key catchment areas needs to be assessed, which would then help determine priority areas for rehabilitation work. Little information exists about the extent of squatting and illegal use of Government watershed lands, encroachment on key catchment areas, the extent of unauthorized fires to clear land for livestock grazing, and the consequences of any of these activities on soil erosion or other aspects of environmental degradation. Money and staff are needed to monitor and enforce legislation that would promote rational use of these multi-purpose areas. Furthermore, legislation covering these issues is in need of upgrading, as discussed in FAO's report on forestry and wildlife policy and legislation (McHenry and Gane, 1988).

CIDA has offered to support a natural resources management project that would include a strong emphasis on watershed rehabilitation through afforestation and promotion

of conservation activities (CIDA, 1988). The proposal has the support of the Department of Agriculture but seems to have stalled in the process of obtaining support from the other necessary parts of Government (pers. commun., F. Henry, Director of Agriculture, 1990).

## **DRINKING WATER POLLUTION**

As also discussed in other sections of this CEP, contamination from agricultural practices (Section 2.1) and waste disposal (Section 6) poses a danger to drinking water supplies. Since several of the biocides used in agriculture in Antigua-Barbuda are very hazardous to human health and since fertilizer contamination resulting in high nitrate levels (10 mg/liter as nitrogen or 45 mg/liter as nitrate) is very toxic to infants, concern about the quality of potable water seems warranted. Except in rare cases in response to a crisis such as the fish-kill observed in Potworks (Grant, 1990; Fernandez and Williams, 1990; Hayden, 1990), surface water is not monitored for contamination.

Legislation exists to prevent or control contamination of catchment areas and wells; however, these are rarely enforced. For example, APUA is empowered to prevent cultivation or grazing within 30 feet of surface drinking water supplies (Fernandez, 1990). The construction of a potential source of pollution, including residences, is prohibited within 80 feet of any wells. Recently, wells had to be abandoned in Roses and Liberta because of high bacteriological counts associated with violations of this setback ordinance (EAG, 1990).

In addition to instituting more effective watershed and catchment area management, it may be necessary to upgrade pre-treatment equipment (coagulation, sedimentation, and filtration) at water production facilities. It is not uncommon for the water entering Antigua's treatment plants to have too high a color reading (i.e., above 10 c.u.; EAG, 1990). One of the dangers of chlorinating water without prefiltration is that a class of carcinogenic compounds called chloramines can be formed if the waters are rich in organic

substances. There is no information on the extent to which this may be a problem in Antigua and Barbuda.

As municipal water use increases, so too will the amount of effluent produced. Since all water eventually drains to the coast, effluent levels in drainages and along the coast will increase (as also discussed in Section 3, Marine and Coastal Resources, and Section 6, Pollution and Environmental Health).

### **BARBUDA'S WATER SUPPLY**

This island is even drier than Antigua, and although water demand is far less in Barbuda, the island's water supply is a source of concern. The groundwaters are generally saline, with the notable exception of Palmetto Sands, a 1,500 acre (600 ha) area of beach sands on the southwestern shore. This freshwater body is undeveloped but in jeopardy due to the mining of sand in recent years. Sand mining has left the water table near the surface and subject to evaporation. Barbuda's topography and geology are not well suited to dam construction. Imported bentonite could be used to make some existing depressions impermeable, but this would be an expensive way to store fresh water (McMillan, 1985).

#### **2.2.3 Policy Recommendations**

*(1) Government should undertake the preparation of a National Water Policy.*

A National Water Policy, as the term is being used in this section, would include several related components:

- 1) A Water Resources Act, such as that proposed by FAO (Burchi, 1989) with revisions if necessary, would provide the foundation for the rational use of the country's freshwater resources.
- 2) A Master Plan is an essential tool for development planners. Water is a key resource that must be

factored into decisions such as Government's proposed doubling of hotel rooms over the next five years. Agricultural use of water, in particular access to irrigation water, must be addressed in the Plan if that sector has any chance of assuming the greater role expected of it in national development plans. APUA has developed a long-term plan (through the year 2020), but it is not backed by legislation. The APUA plan is the obvious starting point for an updated Plan that would be consonant with the proposed Water Resources Act (Burchi, 1989).

- 3) A mechanism needs to be established to enable the various agencies with water interests to share information on an ongoing basis. APUA has lead responsibility for managing the country's water resources, but other groups -- the Central Board of Health and the Department of Agriculture, to name just two -- need to be part of national water planning. Recent proposals for the creation of a Water Resources Board or Council to serve as this institutionalized coordination unit would appear to be extremely timely (Burchi, 1989; EAG, 1990).

FAO presents strong arguments for housing this body outside of APUA. The thrust of the argument is that by placing the authority elsewhere, APUA would be able to focus on its principal role as supplier of municipal water, and Board decisions would be free of real or alleged bias. Decisions involving potentially competing interests could be managed by a Board whose impartiality would be ensured by its balanced representation of relevant Government and non-Government bodies. Because of the important role of this limited resource in present and future na-

tional development planning, FAO's suggestion that the Water Board be housed in the Planning Department of the Ministry of Finance should be carefully considered (Burchi, 1989).

If the dispute over the location of the Board is, in fact, the reason for the delay in its establishment, as has been suggested by those involved in the preliminary work, a compromise should be sought as soon as possible. The water allocation process may also be compromised, but at least the Board would provide an immediate forum for responsible agencies to discuss matters of common interest.

In order to be truly national, the National Water Policy must address the situation in Barbuda as well as Antigua. As noted in Sections 2.2.2 and 10.1 of the Profile, this means addressing the resource exploitation and unplanned development currently being imposed on that island.

*(2) Government needs to identify and support improved watershed management efforts.*

As part of the planning effort to develop a National Water Policy, Government should support an assessment of the country's watersheds. That assessment should consider related issues such as soil erosion and possible contamination of catchment areas used for drinking water. Much of the background work -- the draft Water Resources Act, draft Forestry and Wildlife Act, and CIDA Natural Resources Management Project proposal -- has already been done to provide a strong foundation that could be used to tackle the related issues of water resource and watershed management. Government has an excellent opportunity to show its commitment to addressing these critical issues in an integrative fashion.

In the agriculture sector, Government can also support watershed protection by reg-

ulating farming and livestock production in watersheds. In those areas where agriculture is deemed appropriate, conservation practices exist that could be promoted by the Extension Division; they are technically feasible and have been proven in the Caribbean context (Atkins, 1983). The real question is whether the social and economic environment needed to foster their development can be created in the country. For example, does the Government consider this a high enough priority to ensure that farmers and livestock owners receive adequate land tenure security to warrant land conservation investments?

## 2.3 BIODIVERSITY AND WILDLIFE RESOURCES

### 2.3.1 Overview

From the earliest colonial period to as recently as the 1960's, export agriculture dominated the land use patterns of Antigua and resulted in major changes to terrestrial habitats and the island's biodiversity. Nearly three centuries of deforestation and land clearing for intensive agricultural use have resulted in the removal or degradation of much of Antigua's original vegetation and contributed to habitat destruction and subsequent loss of species richness. Uncontrolled livestock grazing, particularly by goats, continues to have a detrimental effect on native plant communities. More recently, intensive tourism development has resulted in major bio-physical alterations to the coastline and destruction of coastal and marine habitats which represent an important component of the country's natural heritage.

Mammalian introductions have been traced to Pre-Columbian middens where Agouti (*Dasyprocta agouti*) remains have been found. It appears (Harris, 1964) that Agoutis were extirpated from Antigua by 1800. Fallow Deer (*Dama dama*) were introduced to Antigua and Barbuda from America in the seventeenth century to provide game (Pregill, *et al.*, 1988). The Indian Mongoose (*Herpestes auropunctatus*) was introduced to Antigua in the 1870's to control vermin in the plantations. The Black or Roof Rat and the Brown or Norway Rat (*Rattus rattus*, *R. norvegicus*) were inadvertent introductions, all of which altered the native biodiversity through deprivations, competition and habitat modification.

The primary negative impact on all forms of wildlife in most Caribbean islands, including Antigua, has been habitat reduction via the conversion of forested wildlands to other habitat types and land uses. Because of these human disturbances, much of Antigua's wildlife is now limited to coastal areas and offshore cays. Hunting has also reduced faunal diversity in both Antigua and Barbuda, and this remains one of the leading factors in the loss of animal life in Barbuda.

**Plants.** Some floristic surveys have been done in Antigua-Barbuda (see Section 1.2.4 of the Profile), but neither island has a comprehensive floral list. Remnant patches of pre-colonial vegetation exist in some of the more remote areas of Antigua (especially Boggy Peak and the Sugar Loaf area), but the rest of the island has secondary growth or vegetation typical of more frequent disturbance. On the other hand, Barbuda has much of its original dry forest community intact; this represents a valuable scientific resource since this eco-type has been drastically reduced in other parts of the West Indies (see also Sections 1.2.4 and 2.1.1).

**Amphibians.** Antigua and Barbuda support three and one species of amphibians, respectively (Tables 2.3(1) and 2.3(2)). Two small tree frogs (*Eleutherodactylus johnstonei* and *E. martinicensis*) are the only extant native amphibians to the country. The marine toad (*Bufo marinus*) was introduced to Antigua as a biological defense against vermin in the agricultural fields. The crapaud, a large edible frog (*Leptodactylus fallax*), became locally extinct on Antigua presumably through man's over-exploitation (Harris, 1964). Fossil remains of an extinct tree frog have been assigned to a new species, *Hyla barbudensis*.

**Reptiles.** Seventeen reptiles have been recorded (Faaborg and Arendt, 1985) from Antigua and 12 from Barbuda. An extinct lizard (*Leiocephalus cuneus*) has been recorded in middens from Antigua (Steadman, *et al.*, 1984) and Barbuda (Watters, *et al.*, 1984). The large native lizard (*Iguana delicatissima*) formerly occurred in Antigua but has been decimated due to human exploitation and predation from the mongoose (Harris, 1964). The last report of an Iguana from Antigua was over five years ago; the species may be extinct at this time (pers. commun., K. Lindsay, Assistant Forester, 1990). A tortoise (*Geochelone carbonaria*), a common species in Barbuda, is presumed to have been introduced from South America by Arawak or Carib peoples. Three geckos exist on Antigua: *Hemidactylus mabouia*, *Thecadactylus rapicauda* and *Sphaerodactylus elegantulus*; the latter two are common in Barbuda as well. Anolis lizards

include *Anolis bimaculatus* and *A. watsi*. The ground lizard *Ameiva griseivoldi*, the endemic subspecies of snake *Alsophis antillensis antiquae*, and the blind snake *Typhlops monastus* are extremely rare and local in distribution. Remains of *Boa constrictor* and *Alsophis leucomelas* (which may not be a separate species from *A. antillensis*, according to Pregil, *et al.*, 1988) were recorded from Antigua by Steadman, *et al.* (1984) and Wing, *et al.* (1968), respectively.

Sea turtles are native reptiles to Antigua and Barbuda and include green (*Chelonia mydas*), loggerhead (*Caretta caretta*), hawksbill (*Eretmochelys imbricata*), and leatherback (*Dermochelys coriacea*) turtles.

**Birds:** Faaborg and Arendt (1985) reported that 106 species of birds have been noted from Antigua and 74 from Barbuda. Extinct native land bird species include an owl (*Speotyto cunicularia amaurota*), parrot (*Amazona sp.*) and trembler (*Cinclocerthia ruficauda*); extinction was perhaps the result of habitat change (Steadman, *et al.*, 1984) and exploitation by Arawaks (Harris, 1964). Extinct and/or extirpated waterbirds include the Yellow-breasted Crake (*Porzana flaviventer*) and a seabird, Audubon's Shearwater (*Puffinus lherminieri*). An apparent resident group of Greater Flamingo (*Pheonicopterus ruber*) became extirpated from Antigua by hunting (Steadman, *et al.*, 1984). Bobwhite quail was introduced as a game species but has not become established.

Among the most important seabird colonies of the West Indies is the Magnificent Frigatebird (*Fregata magnificens*) nesting colony at Barbuda (Halewyn and Norton, 1984). In 1971 the colony was estimated to consist of about 2,500 pairs; it has been the subject of breeding behavior studies (Diamond, 1972, 1973) related to three other species of the genus *Fregata* around the world. The importance of this colony to understanding sexual dimorphism among ancestral forms of seabirds was demonstrated by Diamond (1972), who indicated breeding is prolonged and females nest every other year. It was further suggested that this colony's breeding regime, i.e., three adults (one male and two

females), could produce two young every two years, thus maximizing productivity in an area of rich food supplies, the Barbuda Bank. The absence of males during the long rearing period of the young (up to 16-18 months) on Barbuda may explain the establishment of a small colony in St. Kitts and other scattered roosting sites (e.g., Sombrero Island). Indeed, the Barbuda colony may represent a core from which other satellites may become established or re-established. During the last century, four colonies in the Puerto Rico-Virgin Islands area have been abandoned (Halewyn and Norton, 1984). No more than 25 sites may be in existence in the Caribbean today.

The Barbuda colony core has shifted in recent times (pers. commun., I. Periera, Vice President, Barbuda Council, 1990) from an accessible manglar in the northwestern corner of Codrington Lagoon to a site in the extreme northwest, adjacent to the barrier beach and interior mangroves. Whether this is in response to human disturbance or a natural change in habitat is not clear. As suggested by Halewyn and Norton (1984), this and other seabird colonies should be afforded full protection.

Barbuda's Codrington Lagoon and the satellite ponds of the island's interior provide a variety of feeding habitats and extensive pond edge. Apart from a great variety of migratory species (see Holland and Williams, 1978), which may be expected annually, Barbuda's native shorebirds include: Wilson's Plover (*Charadrius wilsonia*), Willet (*Catoptrophorus semipalmatus*), and Black-necked Stilt (*Himantopus mexicanus*). Snowy Plover (*Charadrius alexandrinus*) and Killdeer (*Charadrius vociferus*) also occur.

**Mammals.** Seventeen species of mammals have been recorded (Faaborg and Arendt, 1985) from Antigua and 14 from Barbuda. Fossil remains of three bat species have been recorded: *Pteronotus pamellii*, *Mormoops blainvilliei* and the extinct *Phyllonycteris major* (Steadman, *et al.*, 1984). A large endemic rodent-like animal, *Amblyrhiza inundata*, and a rice rat, *Oryzomys spp.*, existed on both Antigua and Barbuda (Harris, 1964). Other fossil evidence

Table 2.3(1). Terrestrial amphibians, reptiles and mammals present on Antigua.

**AMPHIBIANS**

*Bufo marinus*  
*Eleuthrodactylus johnstonei*  
*E. martinicensis*

**REPTILES**

*Caretta caretta*  
*Hemidactylus maboula*  
*Thecadactylus rapicauda*  
*Sphaerodactylus elegantulus*  
*Anolis bimaculatus*  
*A. watsi*  
*Iguana delicatissima* \*  
*Ameiva griswoldi*  
*A. antillensis* \*\*  
*Typhlops monastus*

**MAMMALS**

*Noctillo leporinus*  
*Monophyllus plethodon*  
*Artibeus jamaicensis*  
*Brachyphylla cavernarum*  
*Natalus stramineus*  
*Tadarida brasiliensis*  
*Molossus molossus*  
*Rattus norvegicus*  
*R. rattus*  
*Mus musculus*  
*Herpestes j. auropunctatus*  
*Dama dama*

\* May be extinct. \*\* May be only on Bird Island.

Source: Faaborg and Arendt, 1985; Pregill, et al., 1988.

Table 2.3(2). Terrestrial amphibians, reptiles and mammals present on Barbuda.

**AMPHIBIANS**

*Eleuthrodactylus johnstonei*

**REPTILES**

*Geochelone carbonaria*  
*Thecadactylus rapicauda*  
*Sphaerodactylus elegantulus*  
*Anolis bimaculatus*  
*A. watsi*  
*Ameiva griswoldi*  
*Typhlops monastus*

**MAMMALS**

*Noctillo leporinus*  
*Monophyllus plethodon*  
*Artibeus jamaicensis*  
*Brachyphylla cavernarum*  
*Tadarida brasiliensis*  
*Molossus molossus*  
*Rattus norvegicus*  
*R. rattus*  
*Mus musculus*  
*Trichechus manatus*  
*Herpestes auropunctatus*  
*Dama dama*

Source: Faaborg and Arendt, 1985; Pregill, et al., 1988.

(Wing, *et al.*, 1968) indicates that the West Indian Manatee (*Trichechus manatus*) inhabited both Antigua and Barbudan lagoons and shallow bays. Watters, *et al.* (1984) also report that remains of *Capra hircus* have been recorded from Barbuda.

Mammalian introductions include Agouti (*Dasyprocta agouti*), Fallow Deer (*dama dama*) to provide game (Pregill, *et al.*, 1988), the Indian Mongoose (*Herpestes auro-punctatus*) to control vermin in the plantations, and the inadvertent importation of rats (*Rattus rattus*, *R. norvegicus*).

Figure 2.3(1a/b) identifies important bio-diversity sites which should be protected on the islands of Antigua and Barbuda.

## WILDLIFE LEGISLATION

Legislation relative to the protection of wildlife outside of protected areas is found in the Wild Birds Protection Ordinance (1913) and the Turtle Ordinance (1927) (Lausche, 1986).

Several pieces of legislation include protection for wildlife in restricted areas. The Marine Areas (Preservation and Enhancement) Act of 1972 provides for the declaration of restricted marine areas in order to preserve and protect flora and fauna. Antigua has one declared marine park, Diamond Reef (or Salt Fish Tail) Marine Park, and Barbuda also has one, the Palaster Marine Park; both were established in 1973 (see Section 8, National Parks and Protected Areas). Both parks are undeveloped, unmauaged, and unpatrolled, although marked by buoys.

The Fisheries Act of 1983 authorizes the Minister responsible for fisheries to declare any area of Antigua and Barbuda waters and any adjacent land a marine reserve for the purpose of giving special protection to the area's natural beauty, flora, fauna, and habitats. No marine reserves have yet been declared under the legislation.

The National Parks Act (1984) provides for the management, protection and development of the natural, physical, and eco-

logical resources of Antigua-Barbuda. Only one national park (at Nelson's Dockyard) has been declared under this legislation; it is primarily an historical and cultural park (see also Section 8, National Parks and Protected Areas).

The Forest Ordinance Act (1941) and Forestry Regulations (1952) provide for the protection of forested lands, for the prevention of their deforestation, and for reforestation where determined to be necessary by Government. In contrast to other colonial-based forestry legislation in the region, the Antiguan ordinance and regulations are rather brief, reflecting the lesser economic potential of this resource in Antigua-Barbuda in comparison to more heavily-forested islands. Not only are the forestry regulations outdated, but they are largely not used (Lausche, 1986).

As discussed in Section 2.1, new, updated legislation has been drafted by FAO for forestry and wildlife. At the request of GOAB, the two sectors -- forestry and wildlife -- are being separated into two re-drafted acts. Since both wildlife and forestry legislation in Antigua-Barbuda is outdated and ineffective, early consideration by Government of the re-drafted acts is to be encouraged.

It appears that wildlife protection and management (other than activities falling under the authority of the National Park Authority) are under the jurisdiction of the Ministry of Agriculture, Fisheries, Lands, and Housing, but there is no specific position for a wildlife officer.

### 2.3.2 Problems and Issues

#### ENDANGERED SPECIES

Marine turtles represent some of Antigua and Barbuda's most important threatened and endangered species. Development along coastal areas has provided few measures to minimize the negative impact that night-time lighting has on hatchling turtles and nesting females. Of the four species

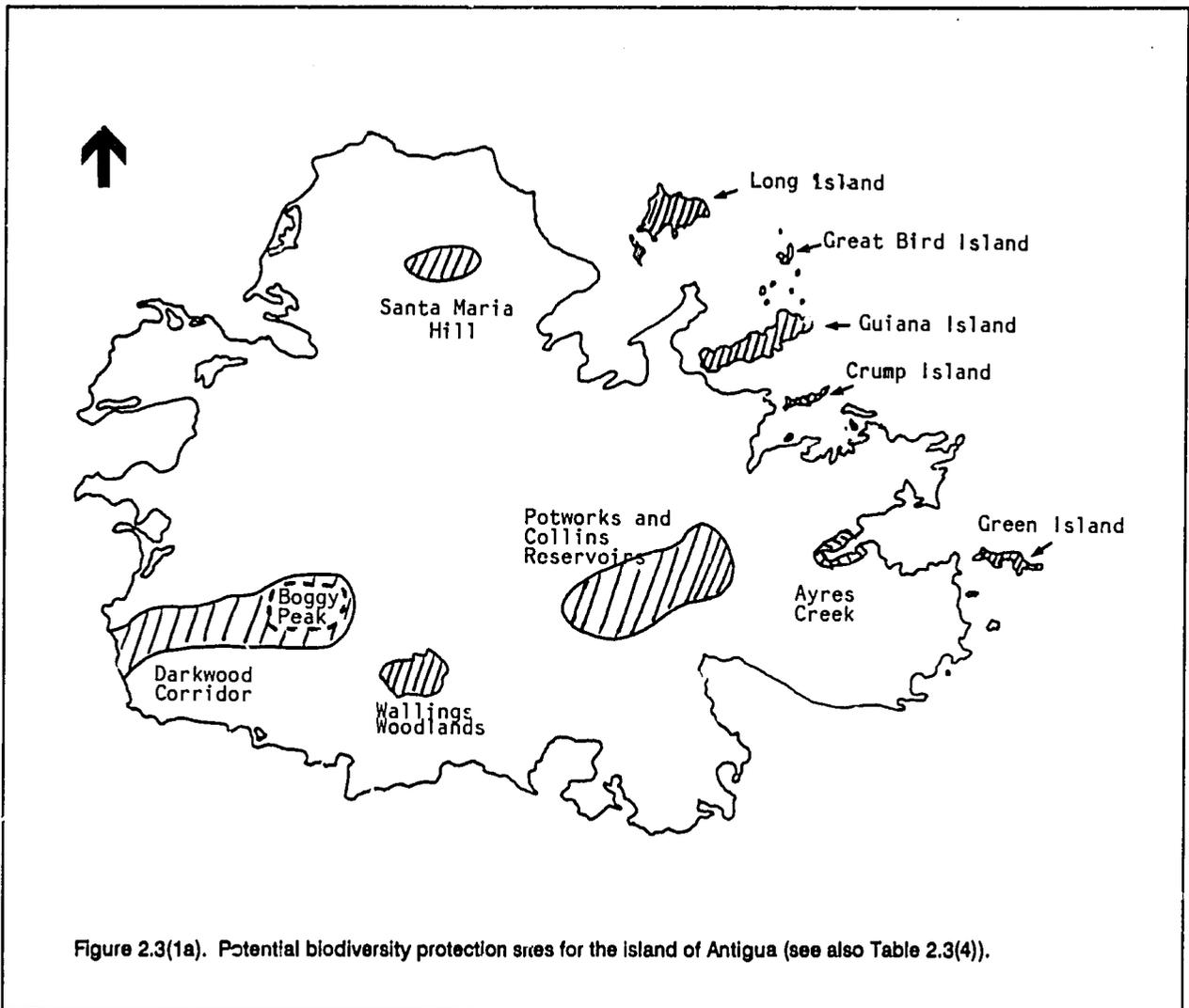


Figure 2.3(1a). Potential biodiversity protection sites for the island of Antigua (see also Table 2.3(4)).

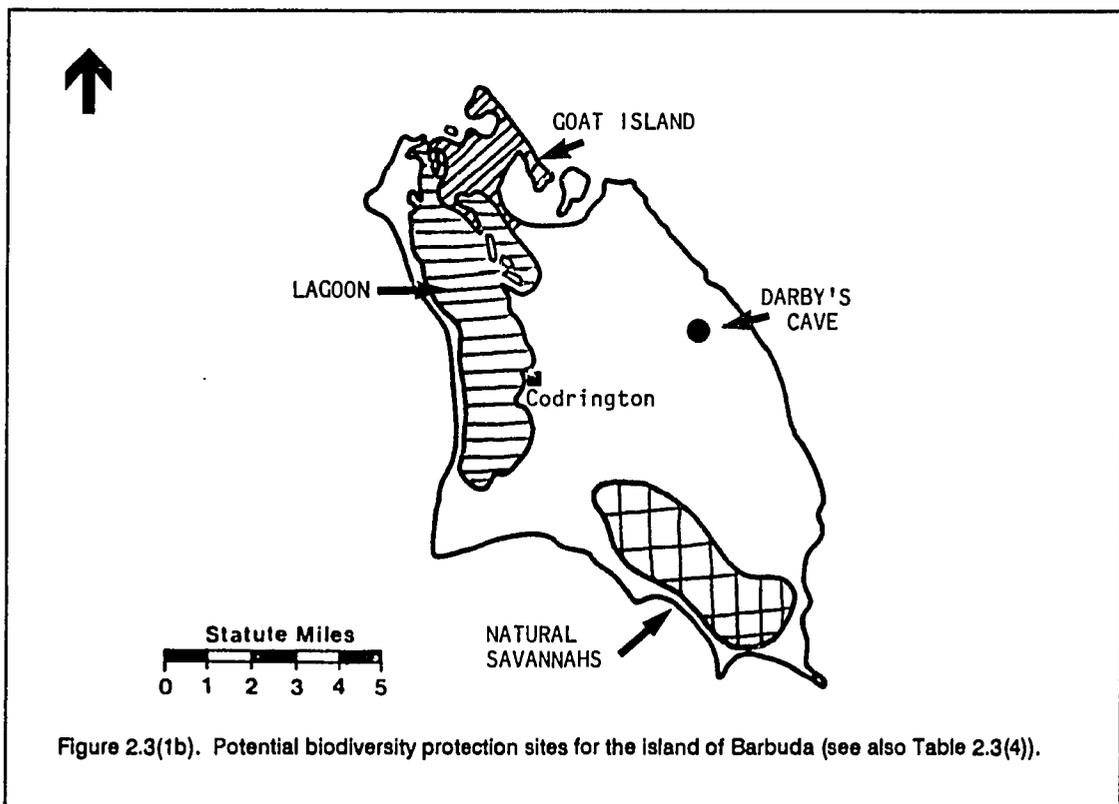


Figure 2.3(1b). Potential biodiversity protection sites for the island of Barbuda (see also Table 2.3(4)).

known to occur in Antigua-Barbuda, the loggerhead (*Caretta caretta*) is considered vulnerable; the others -- green (*Chelonia mydas*), hawksbill (*Eretmochelys imbricata*) and leatherback (*Dermochelys coriacea*) are endangered.

There are reports that poaching continues to be a serious problem at Long Island, a privately-owned offshore island in Antigua's North Sound area, and along the beaches on the neighboring mainland. Long Island's single resort hotel has incorporated "nature tourism" into the package of activities offered to guests, including visits to turtle nesting beaches. A turtle conservation and monitoring project, incorporating a turtle tagging component, is being carried out at Long Island under the direction of a professional marine biologist.

The proposed Goat Island Nature Reserve in Barbuda (see below, Section 2.3.3) also includes important turtle nesting sites. Turtle nesting has also been reported on Green Island and Sandy Island; on the following beaches in Antigua: Jabberock Beach, Pearns Beach, Rendezvous Bay, Turtle Bay and Devils Bridge Beach; and the following areas of Barbuda: Low Bay and Welcher Bay (CIDE, 1988).

The endemic Antiguan ground snake (*Alsophis antillensis antiguae*) now finds refuge only on Great Bird Island. Research should be considered to determine the feasibility of re-introducing the snake to other uninhabited cays to preclude loss of the genetic pool should some catastrophe eliminate the only population in existence. The mongoose has been blamed for the decline of the ground lizard (*Ameiva griswoldi*) on Antigua, (Faaborg and Arendt, 1985).

Migratory whales which calve in local waters of the Antigua-Barbuda marine shelf include the Humpback Whale (*Megaptera novaeangliae*). Action should be taken to identify important calving areas (this would be an appropriate project for a local NGO); it may be necessary to protect calving areas as marine reserves and restrict activities during the animal's reproductive season in local waters.

Locally threatened wildlife species in Barbuda include the White-crowned Pigeon and West Indian Whistling-Duck because foreign hunters apparently ignore local authority (pers. commun., I. Periera, Vice President, Barbuda Council, 1990). The Roseate Tern, listed by the U.S. Fish and Wildlife Service, has been recorded as nesting on the small offshore cays of Antigua-Barbuda.

Table 2.3(3) provides information on selected species considered threatened or endangered in Antigua and Barbuda.

## COASTAL RESOURCE PROTECTION

Conflicting and incompatible uses of the country's coastal environments is a development issue which directly affects wildlife habitat. Coastal areas of Antigua and Barbuda are where the majority of the country's wildlife populations occur, but this is the very area in which tourism development and population expansion has most taken place in recent decades. Because the highest concentration of human activities occurs in coastal environments, (industry, fisheries, tourism), the coastal zone must be treated as a restricted resource, and greater management controls must be implemented (Miller, *et al.*, 1989).

Wetlands and coastal habitats in the Lesser Antilles provide critical feeding and nesting habitat for many species of birds migrating along the West Indian Flyway between North and South America (CIDE, 1988). The small islands of the northeastern Caribbean are frequently the first landfall for migratory landbirds and waterfowl. The loss of these habitats, especially coastal systems such as mangroves, salt ponds, and other wetlands, could threaten the long-term survival of a number of migratory shorebird and songbird species. Over 100 migrant species are regularly recorded in the Lesser Antilles; most of these species nest in North America and overwinter in the Caribbean or South America. Declines in shorebird populations over the last two decades have revealed alarming changes in habitats.

Table 2.3(3). Vertebrates in Antigua and Barbuda considered endangered, threatened or in need of special conservation attention.

<u>Herpetofauna</u>		
Green Turtle	<i>Chelonia mydas</i>	Coastal waters, beaches
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Coastal waters, beaches
Loggerhead Turtle	<i>Caretta caretta</i>	Coastal waters, beaches
Leatherback Turtle	<i>Dermochelys coriacea</i>	Coastal waters, beaches
Ground Lizard	<i>Ameiva griswoldi</i>	Antigua
Endemic Ground Snake	<i>Alsophis antillensis antiguae</i>	Antigua (Great Bird Island)
<u>Avifauna</u>		
West Indian Whistling-Duck	<i>Dendrocygna arborea</i>	Antigua-Barbuda mangroves
Piping Plover	<i>Charadrius melodius</i>	Estuaries, mud flats
Roseate Tern	<i>Sterna dougallii</i>	Antigua
White-crowned Pigeon	<i>Columba leucocephala</i>	Barbuda
Ruddy Quail-Dove	<i>Geotrygon montana</i>	Antigua
Bridled Quail-Dove	<i>Geotrygon mystacea</i>	Antigua-Barbuda
Adelaide's Warbler	<i>Dendroica adalae</i>	Barbuda
Red-necked Pigeon	<i>Columba squamosa</i>	Antigua-Barbuda
Blue-hooded Euphonia	<i>Tanagra musica</i>	Antigua-Barbuda
<u>Mammafauna</u>		
Humpback Whale	<i>Megaptera novaeangliae</i>	Marine shelf

Source: U.S. Fish and Wildlife Service, 1990; IUCN Red Data Book, 1989; Holland and Williams, 1978.

## IMPACTS OF AGROCHEMICALS ON WILDLIFE

Antigua-Barbuda is a leading importer of agrochemicals in the Eastern Caribbean (Miller, *et al.*, 1989), but the effects of these chemicals on wildlife and the terrestrial and marine ecosystems of the country remain undocumented and therefore unknown. As discussed in Section 2.1.2, pesticide pollution resulting from the run-off of materials used by farmers in the area of the Potworks Reservoir is considered to be a contributing factor to the fish-kill recently observed there (Fernandez and Williams, 1990).

Even if standard toxicological data were available for Antigua-Barbuda, such data by themselves are frequently not sufficient to

predict the consequences of releasing toxic synthetic compounds in an ecosystem. Quantitative evaluation of the effects of agrochemicals requires a fairly detailed ecological picture which is rarely available for tropical vertebrates and which is exceedingly labor-intensive to acquire. Furthermore, the consequences for wildlife populations of exposure to sublethal levels of one or more pesticides or herbicides, often in combination with additional environmental stresses (e.g., habitat reduction or a severe dry season), cannot yet be predicted even at the single-species level.

Nevertheless, some broad statements in reference to vertebrate wildlife can be made. Birds are generally more sensitive to biocides than mammals, perhaps in part because mammals have better detoxification sys-

tems. Fish are frequently, but not consistently, more sensitive than warm-blooded vertebrates. There is also a general developmental hierarchy of sensitivity within each species. Vertebrate embryos, eggs and larvae are often more sensitive to toxicants than adults because they are less protected from the surrounding environment, have limited means for detoxifying absorbed substances, and are less able to move away from noxious substances.

### LOSS OF NATIVE WILDLIFE HABITAT

As indicated above, the primary negative impact of development on wildlife is habitat reduction via the conversion of forested wildlands to other habitat types and land uses. Exact home range requirements and minimum viable population sizes for most species are as yet poorly known; but, as declining populations indicate, it is clear that development is taking a toll on many species. The small land mass of the country means that any system of parks and protected areas will consist of small, probably isolated "islands" of more-or-less "natural" habitat surrounded by a matrix of more intensive land uses. If maintained largely as native vegetation, such reserves could perhaps include sufficient area to protect some species of wildlife which may require that particular type of habitat, but this is very much a matter of individual species characteristics.

The importance of *native* forest for promoting biodiversity is two-fold and needs to be underscored: plant diversity is increased, and many native species have valuable economic, cultural and ecological qualities. Moreover, the greater plant diversity of native forest supports the existence of far more associated species such as insects, birds, reptiles and mammals. It may appear to be easier and faster to reforest an area using one or two introduced species, and there are situations where this may be appropriate in order to quickly establish a vegetative cover to protect against soil erosion. Even in these cases, however, regeneration plans should include the eventual incorporation of indigenous plant species. A program of selective reforestation can be supplemented -- at very low cost -- by

natural avian dispersal of native plant species. Management involves protecting the regenerating area from human disturbance and grazing, as well as restricting hunting of bird species capable of seed dispersal. For example, in sub-tropical Florida, White-crowned Pigeons (*Columba leucocephala*), which are found in Antigua-Barbuda as well, have been found to be important seed dispersers of native fruit-bearing trees critical to reforestation in the Everglades National Park.

Many so-called marginal lands in Antigua-Barbuda are considered to be of minimal economic importance unless they can be profitably developed for agricultural production or tourism. Seldom is there adequate recognition of important indirect economic values, such as the clean and reliable water supply afforded by watershed protection. Developers typically show even less appreciation and understanding of non-economic values, such as the provision of wildlife habitat. It is important, therefore, that Government include such non-traditional, non-economic considerations in its assessment of and judgments about the capabilities of marginal lands and their usefulness to the state. From a biodiversity perspective, marginal lands could have considerable national value, and they require the development of appropriate management strategies.

### INTERNATIONAL TRADE IN THREATENED AND ENDANGERED SPECIES

International trade is a major threat to the survival of many wildlife species in the Caribbean (TRAFFIC (U.S.A.), 1988). Many Caribbean countries permit commercial export of wildlife, including species listed as endangered by IUCN. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) attempts to regulate wildlife trade through a worldwide system of import and export controls for listed species. CITES offers only imperfect protection to endangered species since a member country is obligated only to ensure that products from listed species do not enter *international* trade; hunting and killing of such species for *local* trade is not prohibited.

Moreover, any country is allowed to enter "reservations" at the time of ratification which allow it to continue its international trade in species which it so designates.

The Government of Antigua and Barbuda is not a signatory of CITES. Membership would offer the country access to a wealth of materials, training and expertise on species conservation and wildlife trade regulation.

### 2.3.3 Policy Recommendations

(1) *Biocides*. No information exists on the damage pesticides and herbicides (collectively referred to as biocides) have on wildlife populations in Antigua-Barbuda. GOAB could support an inexpensive, long-term monitoring effort to collect this information and correct problems as they arise. Simple quantification of data, such as the number of bird species recorded in an area, combined with other field notes, can provide invaluable information about changing patterns. Members of NGOs (like the Environmental Awareness Group) could be called upon to assist with monitoring and data collection. Other recommendations on this subject can be found in Section 2.1.3 of this chapter and in Section 3 (Coastal and Marine Resources) and Section 6 (Pollution and Environmental Health).

(2) *Research*. Natural resource data in Antigua-Barbuda are very limited, including inadequate baseline data, which makes assessment of biological diversity nearly impossible (CIDE, 1988). To support biodiversity in the face of increasing demands on wildlife habitat, particularly in coastal areas, requires at least semi-quantitative knowledge of what is required to maintain species or communities. The extent of impacts on coastal resources from a variety of human uses has most often not been documented in the country. Mapping of these areas is recommended, and inventories should be compiled of wildlife habitats and species.

More intense land capability studies should be undertaken to assess specific re-

quirements for reforestation of marginally productive land. Baseline ecological research should be undertaken to record the plant and animal communities of Barbuda's dry tropical forest, after which reforesting appropriate areas of Antigua with species transplanted from Barbuda could be considered to improve Antigua's native biodiversity. Ecological research should also be considered for reintroducing native vertebrates to small offshore islands where the endangered iguana and Antigua ground snake may have refuge from mongoose and rat predation.

For many of these research efforts, the assistance of local NGOs could be significant in collecting data and providing support for already over-burdened Government staffs. The resources of the Environmental Awareness Group in Antigua and the Caribbean Heritage Project in Barbuda might be tapped for such purposes.

The Botanic Gardens should be encouraged to develop *in situ* propagation of native plant species for reintroduction to suitable habitats, particularly on Antigua.

Seabird and shorebird breeding sites should be surveyed and populations should be monitored, particularly on the small offshore islands and Barbuda (again, assistance from appropriate NGOs could be sought to assist Government officials with this task). Seabird population dynamics around the world appear to be greatly influenced by unpredictable climatic events, and, therefore, long-term monitoring is the only method of gaining insight into the true status of seabird species in a given local area.

Areas believed to be whale breeding sites should be surveyed, and the potential for using the sites as tourist attractions should be evaluated to ensure that there would be no negative impact on the whales.

(3) *Protected areas*. Established marine parks lack staff and budget, and proposed protected areas have only marginal monitoring support, primarily by the private sector. Management plans are needed for the established marine park areas to ensure protection of wildlife and other natural resources and to

stabilize biodiversity (see also Section 8 on National Parks and Protected Areas).

Several studies and reports have recommended that portions of Barbuda be set aside as a national park or as a Biosphere Reserve under UNESCO guidelines. Barbuda is relatively species-rich and supports a wide variety of native forest species. For example, relatively untouched portions of dry tropical forest exist on the island. This is an ecosystem that has been drastically reduced in other areas of the region and should be given a high priority for conservation in the Northern Lesser Antilles. Codrington Lagoon's extensive mangrove forest and seven-mile barrier beach should be considered for nomination as a RAMSAR site (a wetland of international

importance). Wildlife species associated with this wetland are apparently enjoying population levels not encountered in other areas of the Caribbean region, including the Magnificent Frigatebird which has one of the largest colonies in the Eastern Caribbean in Codrington Lagoon. Protection afforded Barbuda by a RAMSAR designation may allow natural reintroduction of selected species (e.g., White-crowned Pigeon and West Indian Whistling-Duck) from elsewhere in the Northern Lesser Antilles where their populations are declining. Such steps would also enhance the promotion of Barbuda as a nature tourism destination (see Section 5 on Tourism).

Table 2.3(4). Potential terrestrial biodiversity sites to be evaluated for designation as wildlife reserves. (See also proposed parks and protected areas in Figures 8.1(1) and (2) and designation of important reef and mangrove areas in Figures 3.1(1) - (4)).

**ANTIGUA**

Black Ghaut-Ayer's Creek  
Boggy Peak  
Corridor from Boggy Peak to Darkwood  
Wallings Woodlands  
Potworks Reservoir  
Santa Maria Hill

**BARBUDA**

Goat Island  
Darby's Cave  
Spanish Point  
Codrington Lagoon  
Natural Savannah

**OFFSHORE ISLANDS**

Green Island (Mill Reef)  
Guiana Island (North Sound)  
Long Island (North Sound)  
Great Bird Island (North Sound)  
Crump Island (North Sound)

Source: Nicholson (1977); DeGeorges (1988); updated by the CEP Project Team, 1990.

All offshore islands under the control of the Government of Antigua and Barbuda should be set aside as multiple-use conservation reserves. Carefully planned development could be allowed, but a high priority should be given to the protection of habitat of seabird populations and to the re-establishment of populations of rare and endangered species which would not otherwise survive successfully on the main islands.

Table 2.3(4) provides recommendations of specific areas which should be considered for designation as wildlife reserves by the Government of Antigua and Barbuda.

(4) *Predator control.* An integrated pest control program should be promoted to include control of the mongoose (an important prerequisite for protection of the native fauna of Antigua-Barbuda) and greater control of feral or quasi-feral livestock, which would enhance the regeneration of native plant species and plant communities.

(5) *Improved wildlife legislation.* The laws pertaining to wildlife in Antigua-Barbuda are outdated and are currently being updated with the assistance of FAO. Among other topics covered in revised wildlife legislation, it

is suggested there be provisions regarding deliberate introductions of exotic animals. In 1989 an attempt was made to use Barbuda as a transit stop for the shipment of llamas from South America to the United States as part of a lucrative exotic pet trade. The attempt to land llamas in Barbuda was aborted due to an unprecedented outcry from the local population, which was concerned about the possible outbreak of disease affecting domestic livestock. International organizations dedicated to the protection of wildlife also voiced their concerns. The subsequent detention of the llamas on a small island off Antigua, where llama deaths occurred before they became acclimatized, led to further protests and pressure for their repatriation.

The new wildlife legislation also should address the conservation of threatened species. In the interim, i.e., until new legislation and regulations are put in place, Government should consider a moratorium on the taking of endangered sea turtle species and a ban on the hunting of Columbidae species which could assist in the dispersal of native plant species in any reforestation effort. Additionally, the Government of Antigua-Barbuda should become a member of CITES.

## SECTION 3 COASTAL AND MARINE RESOURCES

### 3.1 OVERVIEW

#### PHYSICAL FEATURES

Antigua and Barbuda are coral limestone islands that are the emergent portions of a 3,400 sq km platform, one of the largest in the Eastern Caribbean. Depth between the islands ranges from 27 - 33 m. Antigua's coastline is markedly indented with numerous embayments, rock islands, offshore reefs and sand bars. The Barbuda coastline is less varied, although reef development is also extensive, particularly on the eastern coast. Both islands have numerous white sand beaches.

Currents generally set northwest to west, although this flow occasionally reverses during periods of very light wind. Ground swells setting across the shelf to the west of Antigua tend to suspend sediments, causing turbidity as far as 3 - 4 km from shore (Rogers and McLain, 1988). Currents are primarily wind-driven, and much of the coast does not experience strong unidirectional flows that tend to flush out enclosed bays.

#### CRITICAL HABITATS

**Coral Reefs.** Coral reefs are common on the coasts of both Antigua and Barbuda (see Figure 3.1(1) and Figure 3.1(2)), having a collective area estimated at 25.45 sq km (Bacon, *et al.*, 1984). Multer, *et al.* (1986) describe major reef types on the Antiguan coast, while IUCN/UNDP (Wells, 1987) describes the location and overall structure of major reefs on both islands. Leigh (1989) and Barratt (1989) report on subjective qualitative surveys on 21 reefs near Antigua as well as Palaster Reef near Barbuda. Rogers and McLain (1988) describe marine communities in the vicinity of Lignumvitae Bay (Morris Bay) and Deep Bay. Jackson, *et al.* (1987) provide descriptions of similar communities in Runaway Bay and Dickinson Bay.

The Leigh and Barratt reports characterize Antigua reefs as "of only average quality for the region" but without apparent significant deterioration. CIDE (1988), however, suggests that coastal resources in general are under "considerable stress at present" and emphasizes the need for a detailed inventory of those resources. The scarcity of the typically dominant elkhorn coral (*Acropora palmata*) and star coral (*Montastrea annularis*) in some areas (e.g., Deep Bay and Jolly Beach) suggests sediment stress (Rogers and McLain, 1988). Despite the general absence of coral formations that would appear spectacular to many lay observers, the mixed coral/algal/sponge/soft coral assemblages described for much of the coast provide diverse habitat for many typical reef-dwelling species, including the juveniles of commercially important fishes and crustaceans.

A Reefwatch study in July 1990, a follow-up to investigations a year earlier (Reefwatch, 1989), looked at reef productivity, diversity and the effects of Hurricane Hugo. The poor visibility and elevated algal cover on reefs were linked by these investigators to the impacts of coastal developments and sediment disposal in nearby waters (other unidentified factors may also have contributed to these conditions). Most reefs exhibited poor live coral cover, with gorgonians and soft corals predominating. Hurricane Hugo in September 1989 caused widespread toppling of southern and southeastern reefs, but signs of recovery were evident (pers. commun., Reefwatch Team, July 1990).

**Seagrass Beds.** Turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*) and shoal grass (*Halodule wrightii*) are common in shallow (less than 20 m) portions of the coastal zone. The labyrinthine spaces between the leaves and rhizomes of seagrasses provide shelter for many species, including the juveniles of commercially important queen conch (*Strombus gigas*) and spiny lobster (*Panulirus argus*).

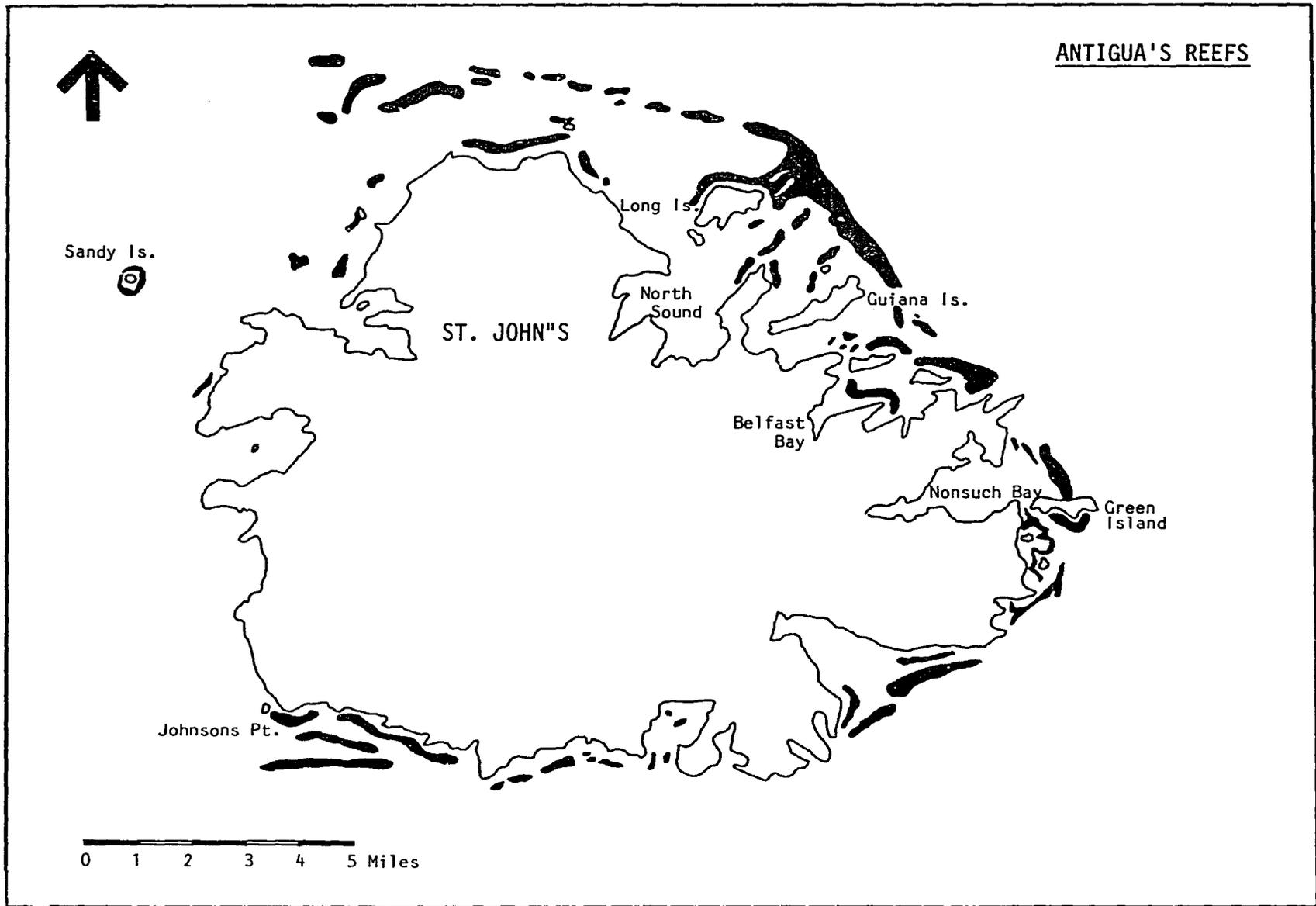
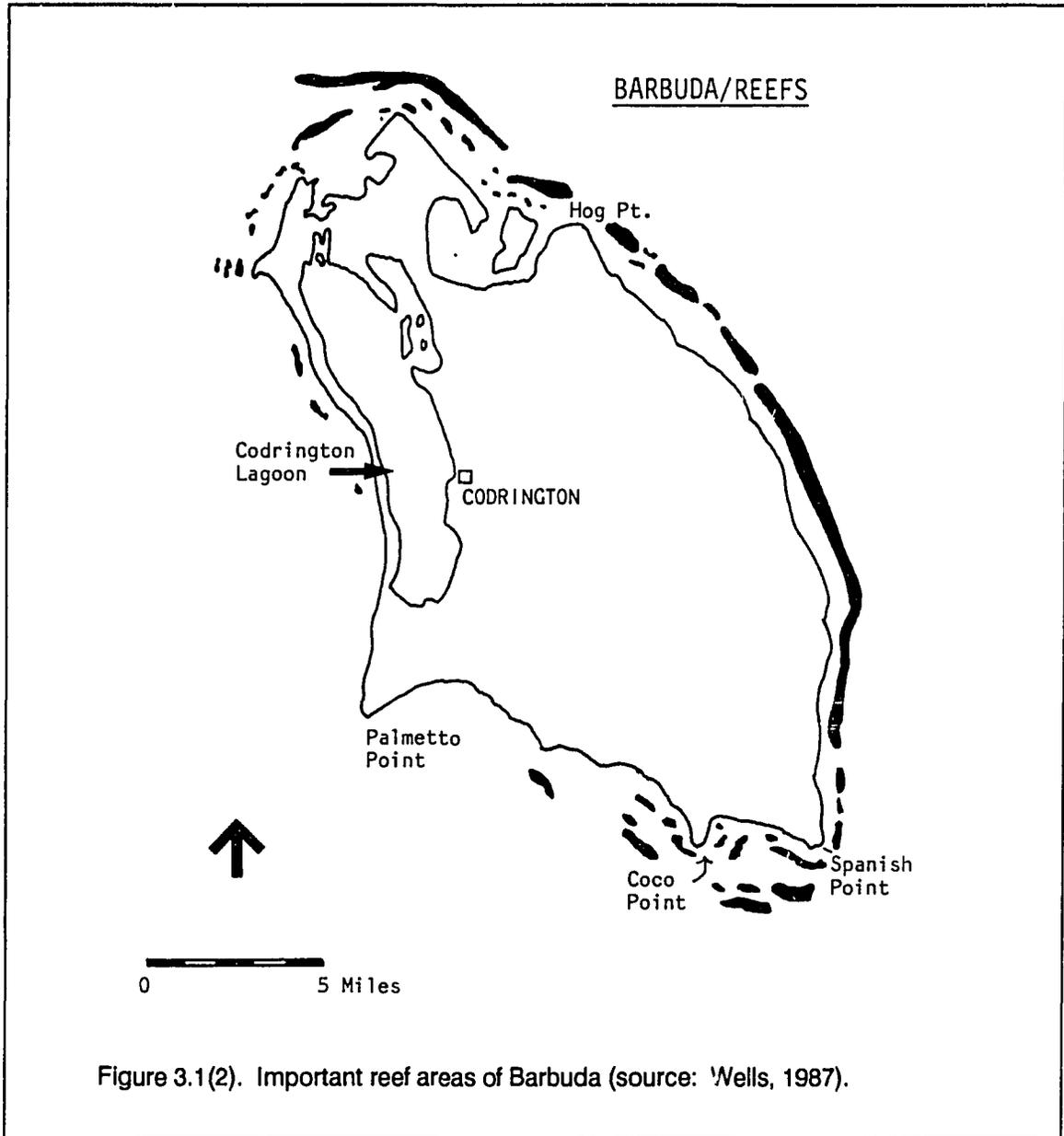


Figure 3.1(1). Important reef areas of Antigua (source: Reefwatch, 1989).



Seagrasses are themselves a source of food for some herbivores, and their surfaces provide a substrate for epiphytic plants upon which other species may graze. Seagrasses also help to retard coastal erosion by stabilizing loose substrates and by reducing current flow through the drag of seagrass leaves. Calcareous algae (e.g., *Halimeda* sp. and *Penicillius* sp.) are often interspersed with seagrasses and are important sand sources. *Halimeda* has been reported to be the major producer of white sand for Antigua's beaches (Multer, 1988).

**Mangroves.** Wetlands, primarily salt ponds and mangrove swamps, are numerous with a total area of 4,901 ha for both islands (World Resources Institute, 1987). (See Figure 3.1(3) and Figure 3.1(4).) Scott and Carbonell (1986) describe important mangrove areas that include the Parham Harbor-Guiana Bay region, and salt ponds between Runaway Bay and Lignumvitae Bay on Antigua; and Codrington Lagoon, the Bull Hole region, and the southeastern Flashes on Barbuda. Mussington (1983) described mangroves and major benthic communities of Codrington Lagoon.

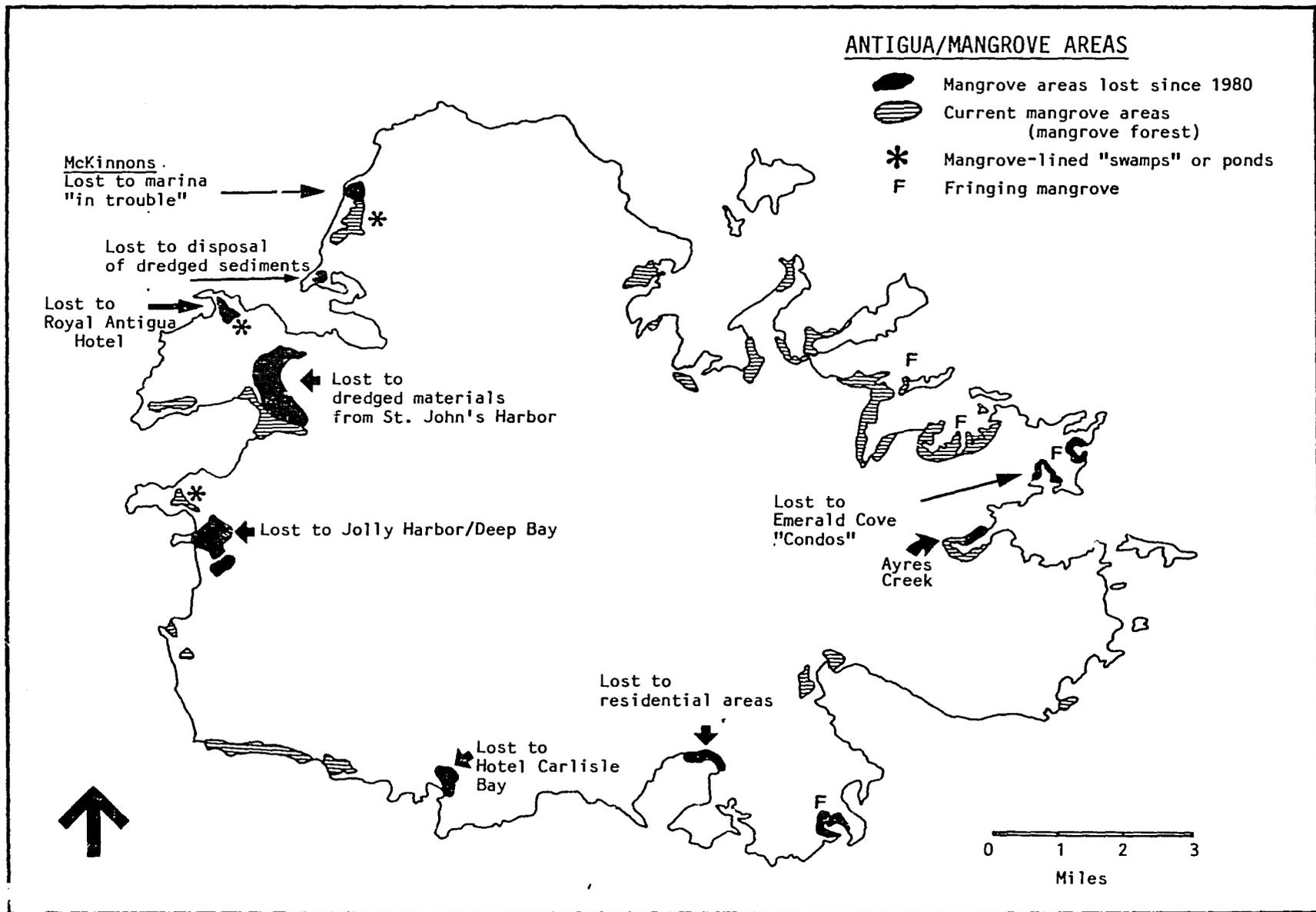


Figure 3.1(3). The mangrove areas of Antigua (source: adapted from British Directorate of Overseas Survey, 1980; DCA/Planning Office, 1976 Land Use Map of Antigua; ECANMP, 1980a; pers. observations of P. Lay, CEP Project Team, 1990).

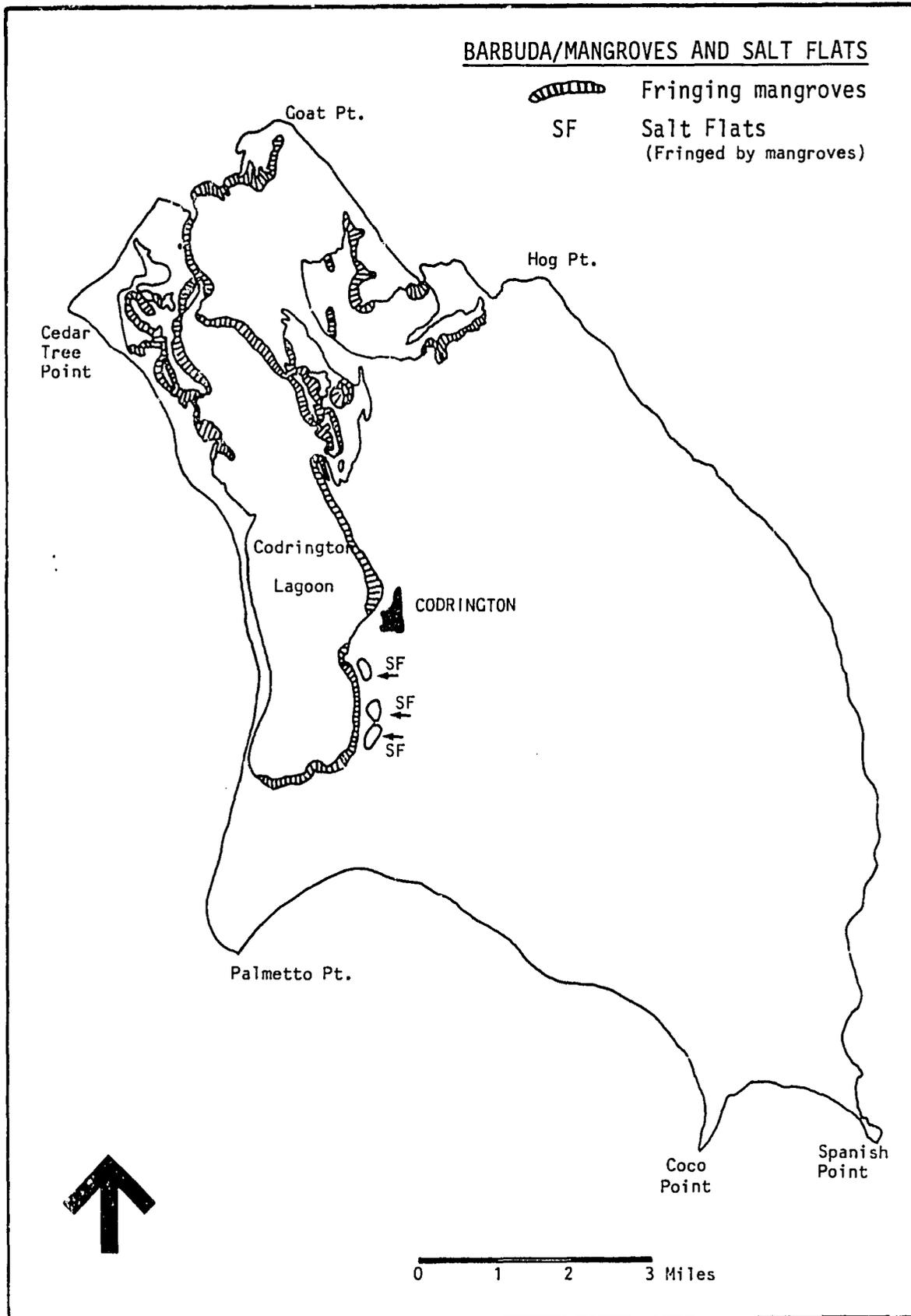


Figure 3.1(4). Mangroves and salt flats of Barbuda (source: British Admiralty Charts, 1990).

Mangroves and wetlands have come under increasing pressure from coastal development projects and land-based sources of marine pollution, but several important mangrove stands still exist (see Figure 3.1(3)). Well-developed mangrove forests are important features in the Parham Harbor, Fitches Creek and Guiana Island areas. Red mangroves (*Rhizophora mangle*) dominate in these areas, although black mangroves (*Avicennia germinans*) and buttonwood (*Conocarpus erectus*) abound. Barbuda's salt flats support large populations of white mangrove (*Laguncularia racemosa*) and buttonwood.

Large schools of juvenile mullets (*Mugil curema*), snappers (*Lutjanus* spp.) and mojarras (mostly *Gerres cinereus*) frequent these mangrove areas, along with several piscivorous fishes (jacks and barracudas) that feed on them.

## FISHERIES

The fisheries sector has been reviewed in a variety of reports (Peacock, 1973; CDB, 1979; Kreuzer and Oswald, 1978; DuBois, 1984; Anderson and Matthes, 1985; Joseph, 1985; Royer, *et al.*, 1988). Principal target species include shallow and deep demersal fishes, spiny lobster (*Panulirus argus*), queen conch (*Strombus gigas*), coastal pelagics, and deepwater pelagics. Demersal fishes are captured by arrowhead and rectangular traps as well as by handlines. Spiny lobsters are harvested by divers using wire snares or by traps. This species is considered overexploited in inshore areas around Antigua (Royer, *et al.*, 1988). Conch are harvested by free-divers or with scuba gear. Seines and gill nets are used to capture coastal pelagic fishes, but this is a minor component of the fishery. Other pelagic fishes are captured incidentally by trolled lines deployed en route to offshore trap fishing sites.

The most numerous (250 - 300) fishing vessels are 4 - 8 m long wood or fiberglass open boats powered by outboard engines and used relatively close to shore. Larger (11 - 20 m long) inboard diesel or sail-powered sloops operate in nearshore as well as deepwater demersal fisheries. Several general purpose

fiberglass fishing launches have engaged in fishing activities in recent years with varying degrees of success. Recreational fisheries are targeted primarily toward large pelagic species pursued from cabin cruisers. Royer, *et al.* (1988) list 20 landing sites in Antigua and two in Barbuda that accommodate a total of 197 vessels.

Comprehensive landing statistics are not available. Local subjective judgement suggests that there has been a decline in spiny lobsters in recent years, little if any change in conch fisheries, and a level of exploitation in inshore reef fisheries that is "a little below" maximum sustainable yield (CIDE, 1988). The basis for the latter opinion, however, is the comparative size of fish in the local catch and fish of the same species captured in Jamaican trap fisheries. Because the latter fisheries are severely depleted, fish in Antigua-Barbuda could be larger than those in Jamaica and still be over-exploited.

## COASTAL RESOURCE MANAGEMENT AND DEVELOPMENT

Much of Antigua's coast is experiencing significant alterations due to intensive tourism development efforts oriented toward a high-density, increasingly mass-market approach. These efforts include construction of beach front hotels, condominiums, and marinas and expansion of deepwater harbor facilities and cruise ship berths, as well as promotion of the country as a major yachting and scuba diving destination. The pace of tourist facilities development is so rapid that it greatly exceeds the rate at which necessary infrastructure (especially provisions for sewage and solid waste disposal) is being provided. Even less adequate are provisions to manage the consequences of intense development pressure on coastal resources.

Overall responsibility for orchestrating this development theoretically rests with the Development Control Authority, which is charged with granting or refusing permission to develop land as well as preparing a national development plan. The Authority maintains a setback requirement of 50 feet from the highwater mark for all con-

struction. Approval from the Authority is needed before development projects may be considered by Cabinet, but Cambers (circa 1988) notes that projects are often submitted to Cabinet without such approval.

Under the Marine Protection Act of 1972, Salt Fish Tail Reef (Diamond Reef) near Antigua and Palaster Reef near Barbuda were formally designated as marine protected areas in 1973. Cades Reef and Mamora Reef are informally protected as "parks" by local dive tour operators. None of these areas, however, is actively managed nor have long-term objectives for the use and protection of marine resources within the parks been determined. (See also Section 8, National Parks and Protected Areas.)

## LEGISLATION

The National Parks Act (No. 11 of 1984) provides for the creation of the National Parks Authority and for designation of any area of land or water as a national park, subject to legislative affirmation. The National Parks Act is implemented by the National Parks Authority, which is responsible to the Ministry of External Affairs, Economic Development, Tourism and Energy.

The Fisheries Act (No. 14, 1983) is administered by the Ministry of Agriculture, Fisheries and Lands. This Act requires the Chief Fisheries Officer to prepare a plan for development and management of fisheries; provide for licensing of foreign and domestic fishing vessels and fish processing establishments; coordinate regional cooperation; designate local fisheries management areas and organizations representing local fishermen as Local Fisheries Management Authorities; lease land, foreshore, and sea bed for aquaculture; declare marine reserves; authorize fisheries research; prohibit the use of explosives or chemicals for fishing; and promulgate regulations.

The Marine Areas (Preservation and Enhancement) Act (No. 5 of 1972) provides the Minister of Agriculture, Fisheries Lands, and Housing with authority to declare marine protected areas.

The Beach Control Ordinance (Cap. 298, 1957) requires that a permit be obtained from the Minister of Public Works for removal of sand, stone, gravel, or shingle from beaches or the seashore. This requirement does not apply to Barbuda.

## 3.2 PROBLEMS AND ISSUES

### COMPREHENSIVE COASTAL RESOURCES MANAGEMENT

Major concerns related to coastal resources (Table 3.2(1)) derive primarily from the consequences of explosive development in the absence of effective means for coastal zone management. Frequently identified concerns (e.g., CIDE, 1988; Rogers and McLain, 1988; Cambers, c. 1988) relate to habitat loss, water quality, and coastal erosion.

An overarching issue that touches all site- and resource-specific concerns is the difficulty of identifying economically-compelling arguments in support of alternative development approaches which deter the degradation of coastal resources. The dilemma is exemplified by the specific case of the Jolly Beach Hotel, which is not singled out as an isolated example but is rather cited as representative of many tourism development projects in Antigua. This hotel is one of the largest private employers in the country, but many of the jobs are held by immigrants. More than 90 percent of the resort's guests are on pre-paid package tours and spend little or nothing in the nearby village of Bolans. Destruction of the Jolly Hill salt pond is expected to result in periodic flooding in Bolans, as well as a decline in the local fisheries harvest. Nevertheless, from a national perspective, the economic benefits to Antigua-Barbuda of this tourism development will continue to outweigh the economic losses to the affected local communities (de Albuquerque, 1989a).

Perhaps this dilemma is partially responsible for the fact that "lack of information" is frequently cited as a primary constraint to effective coastal management, leading to calls for detailed inventories as a

Table 3.2(1). Major areas and concerns related to coastal degradation in Antigua.

LOCATION	SALT PONDS	MANGROVE LOSS	DREDGE IMPACTS	SEDIMENT IMPACTS	WASTE DISPOSAL
Dickinson Bay	X				X
Deep Bay	X	X			
Crabbs Peninsula					X
Ft. James/Flashes		X	X		X
Falmouth Harbor		X	X		
Jolly Beach Marina	X				
Jumbie Bay/Long Is.		X			
Hydes Bay, Darkwood		X			
Cocks Hill, Jolly Pond	X	X			
McKinnons Pond		X			
Willoughby Bay				X	
Sisters Island and Sand Island				X	X

Source: data from CIDE, 1988.

prerequisite to management action. However, in the case of Antigua and Barbuda, incomplete information is less of a constraint than the absence of a means to put available information to effective use.

General qualitative information on the location and extent of major habitats is already available for the country (see, among others, Harris, 1963; John and Price, 1979; Loveless, 1960; MacIntyre, *et al.*, 1985; Multer, *et al.*, 1986; Price and John, 1979). Published information, combined with documentation of local knowledge, would provide ample indication of major resource concentrations as well as local perspectives on issues related to their use.

On the other hand, there is a growing body of evidence that demonstrates the limited usefulness of monitoring and inventory efforts when these activities are undertaken without a clear understanding of how the data

will be used for decision-making and management (a recent review on this subject is provided in National Research Council, 1990). In calling for additional resource inventories, the hope may be that more information will provide compelling reasons for decision-makers to embrace effective management strategies; on the other hand, the plea of inadequate information might also be offered as a plausible reason for not taking action.

It is true that the quantitative extent of coastal resources, as well as the specific extent and cause of possible destruction, are not precisely known in Antigua-Barbuda. Detailed resource characterization is essential to an on-going program to manage these resources. But it is equally true that the importance of coastal resources is well-established, as are the adverse impacts of raw sewage disposal, excessive run-off, over-fishing, and mechanical disruption. More data are not needed to establish that these impacts must be

controlled if coastal resource values are to be maintained.

Therefore, the overriding present need is a commitment to act on the information that is already in hand, based on the recommendations of numerous local authorities and consultants who call for better management of coastal resources (e.g., Cambers, c. 1988; Rogers and McLain, 1988; Coulston, 1987; Coulston and Mussington, 1987; Llewelyn-Davies Weeks and Maxwell Stamp Associates, 1980; Robinson, 1979). Without such commitment and clearly defined objectives for management, resource inventories are unlikely to yield effective solutions to the problems and issues described below.

#### HABITAT LOSS

Dredging to create ship channels and marinas is responsible for some of the most pervasive degradation of coastal habitats. The impact of dredging and dredge spoil disposal on mangroves, coral reefs, and seagrass meadows has been well documented (Coulston, 1987; Coulston and Mussington, 1987; and Rogers and McLain, 1988). Dredging of St. John's Harbor and Dredge Bay areas contributed to increased erosion at Fort James (Cambers, 1985). Dredge spoils disposal in the Flashes has increased the potential for unknown quantities of pollutants to negatively impact coastal waters (Coulston and Mussington, 1987).

Construction of shore facilities is frequently accompanied by indiscriminate cutting of mangroves, although these systems are known to control erosion and provide nurseries for commercially important fishery species. Similarly, salt ponds are routinely modified or destroyed, even though their function of controlling sediment loading to reefs and seagrass habitat is well established. Both salt ponds and mangroves provide wildlife habitat, and the loss of these systems has been linked to the precarious status of some indigenous species such as the Antillean Wood Duck. Despite the importance of these varied functions, little value has been attached to salt ponds and mangrove swamps; fifty-three acres of productive swamp at Jolly Hill

were sold to developers for EC\$100 (de Albuquerque, 1989a). Jolly Hill Salt Pond and McKinnons Salt Pond have been dredged and filled as part of condominium and marina development. Opening salt ponds to the sea, as at Deep Bay, reduces their function as sediment traps and has resulted in severe damage to nearshore reefs and other sessile organisms from sediment transport (Jackson, *et al.*, 1986).

The 61 ha McKinnons Salt Pond was once a very important wildlife habitat, but its value has progressively deteriorated due in part to oil refinery activities from 1965 to 1975 (McEachern, 1973). More recently, the pond has been partially filled to construct the Marina Bay condominiums, resulting in loss of water exchange from tidal overflows. A combination of high summer temperatures and sewage and oil disposal resulted in massive fish-kills in June 1989 and again in July 1990 (de Albuquerque, 1989a; pers. observation, P. Lay, CEP Project Team, 1990). At present, seawater is being pumped into the pond to promote better water quality, but numerous mullets, mojarras and blue crabs (*Callinectes sapidus*) have since died.

Vast areas of mangroves and wetlands have been destroyed by coastal developments, and more will inevitably suffer the same fate. In August 1990, a major tourist development, the K-Club in Barbuda, claimed ownership of part of an extensive salt pond/mangrove swamp on that island and proceeded to block it off. Developers plan to dredge the area claimed without being required to prepare an Environmental Impact Assessment. The question of ownership of wetlands and authority to use (which often means destroy) productive natural systems in the coastal zone are critical issues which need to be addressed immediately in Antigua and Barbuda.

Recreational diving has been widely associated with degradation of popular sites (e.g., Rogers, 1987; Tilmant, 1987). In addition to destruction of living corals through direct contact by divers, anchor damage to coral reefs and seagrass beds is a frequent accompaniment of coastal tourism, as is the collection of corals, live shells, and other organisms

for curios. Although such impacts have not been widely documented in Antigua and Barbuda, the frequency with which these are identified as problems in similarly developed areas suggests the need for management to avoid similar problems.

## WATER QUALITY

Documented instances of water quality degradation are sporadic. Jackson (1985) reports discharge of sewage effluent into McKinnons Salt Pond following failure of a poorly maintained treatment plant. As indicated in the prior sub-section (see also sidebar, page 6), a massive fish-kill in June 1989 was linked to development and discharge of raw sewage into the salt pond at Marina Bay (de Albuquerque, 1989a). Despite the absence of comprehensive information on coastal water quality, however, more widespread degradation is virtually certain considering the absence of effective coastal resource management and the fact that urbanization and development of tourist facilities in coastal areas are almost always accompanied by water quality degradation.

Because the development of centralized sewage treatment facilities is not keeping pace with the need for such facilities, continued construction of hotels and condominiums is apt to be accompanied by an increasing number of individual sewage systems. Such "package plants" are notoriously susceptible to poor maintenance and improper operation by inadequately trained personnel. Without a uniform policy for sewage treatment and provisions for enforcement, point source pollution from domestic sewage can be expected to increase.

Increased non-point source pollution is also a likely result from current development practices. Of particular concern are sediment loading from construction and dredging, contaminated storm water from the growing number of impervious surfaces, and runoff-borne pesticides and agrochemicals (USMAB, 1990).

## COASTAL EROSION

Removal of beach sand for construction has resulted in severe beach erosion, particularly in the vicinity of Pearn's Bay. Although the Beach Protection Ordinance provides the means to control this practice, prosecution is virtually unheard of (Cambers, c. 1988). Recently, much of the sand used in construction on Antigua has been mined from beaches on Barbuda resulting in trenches six to seven meters deep (see also Section 4.2).

Some beachfront hotels are built too close to the high water mark and interfere with the normal movement of sand, resulting in accelerated erosion. Nichols and vanEepoel (1988) estimate that Jolly Beach is eroding a rate of 0.75 m/yr. Dickinson Bay displays a typical suite of problems associated with inadequate management of intensive coastal development. Jackson (1985) reports beach erosion that in some cases exceeds 1m/yr. Appropriate setbacks have not been applied to all structures, necessitating revetment construction which "... may have protected the property, but ... have not conserved the beach or improved aesthetic aspects" (Cambers, c. 1988).

## OVERFISHING

Peacock (1973) described a study of the spiny lobster fishery initiated to investigate an observed decline in landings in the early 1970's. Results of the study indicated that the decline was most probably due to capture of juveniles and young adult lobsters in shallow water; researchers recommended discouraging the use of scuba gear in preference to traps, re-directing the fishery into deeper areas, and enforcement of minimum size regulations. Mussington (1983) reported depletion of sea moss and spiny lobsters in Codrington Lagoon, attributed to heavy and possibly excessive exploitation.

There are no recent studies that provide clear indication of overfishing, although efforts are underway to obtain reliable landing statistics with assistance from the OECS Fisheries Desk. Even without such data, fishery stocks in other Eastern Caribbean countries

are generally acknowledged to have been severely depleted by less sophisticated fleets than that currently operating in Antigua and Barbuda. Considering the increasing demand for seafood resulting from an expanding tourist industry and more affluent resident population, over-exploitation seems a virtual certainty in the absence of effective provisions for fisheries management.

### 3.3 POLICY RECOMMENDATIONS

(1) *A comprehensive coastal zone management program should be implemented to provide overall guidance for specific development and management activities.* Oversight authority for this program should reside in one agency, although responsibility for specific components almost certainly will have to be an interministerial undertaking; procedures for better coordination of multi-agency responsibilities for the nation's coastal resources and wetlands must also be provided for. Particular emphasis should be placed upon development planning, adherence to a policy of review of all development proposals by the Development Control Authority, and requirements for Environmental Impact Assessments for all major developments in the coastal zone.

The goals of the program could include ensuring water quality for multiple uses (e.g., fisheries habitat, human contact, and waste disposal); coordinated management of the country's wetlands; port development; increased recreational opportunities; and coordinated and broad-based participation in coastal resource management. The emphasis should *not* be on regulation alone, as experience suggests that a program emphasizing education, incentives, technical assistance, cost-sharing, and cooperation will be more effective than a proliferation of rules and penalties. Major elements of this type of program include development of a system characterization (inventories), priority problem definition, action plans, and financial strategy.

It should be clear, however, that this process should not delay corrective actions that are already known. This caveat applies

particularly to the following two recommendations which are extremely urgent:

- Immediate protection should be extended to mangroves. Destruction of mangroves and degradation of their associated habitat should be absolutely prohibited.
- Procedures to control sediment loading into coastal waters should be required for all dredging and construction activities. Rogers and McLain (1988) point out that "recovery of seagrass beds and coral reefs may occur slowly or not at all following major disturbances such as dredging or disposal of dredged materials."

(2) *Provision should be made for essential infrastructure (especially sewage and solid waste management) in advance of further major development in the coastal zone (see also Section 6.3).* At least partial recovery of capital costs could be achieved through user fees, especially for developments that place high demands on such services.

(3) *A program of management of the country's sand resources needs to be put in place.* An evaluation should be made of the overall impact of sand mining on the rate of beach loss and of alternative sources of construction sand (see also recommendations on sand mining in Section 4.2.3). Best management practices (e.g., setbacks, pedestrian walkways, vegetation protection) should be required for all beachfront facilities.

(4) *Sources and extent of non-point source pollution, particularly run-off from agricultural areas, should be assessed.* Better enforcement of the Pesticide Control Act is required as is enactment of regulations to strengthen the Act. More detailed recommendations are found in Section 2.1.3, Section 2.3.3 and Section 6.3 of the Profile.

(5) *A national educational program on the importance and benefits of coastal resources should be launched by the Antigua-Barbudan Government in cooperation with*

*local NGOs*, most appropriately under the leadership of the Historical, Conservation and Environmental Commission. Components of the program should be developed and tailored to key target audiences, including Government decision-makers, hoteliers, school chil-

dren, and tourists. This is an integral part of any coastal zone management program and is particularly important in Antigua-Barbuda where a significant measure of voluntary compliance is needed.

## SECTION 4 ENERGY AND INDUSTRY

### 4.1 ENERGY

#### 4.1.1 Overview

##### FOSSIL FUELS

Antigua and Barbuda is virtually totally dependent upon imported petroleum products to meet its energy requirements. Petroleum imports are a major share of total imports, with estimates ranging from 11.5 percent (computed from 1987 data in Statistical Yearbook, 1988) to 15 percent or higher (Daniel, 1988). As indicated in Table 4.1(1), imports of all major categories of petroleum products have risen during the period from 1984 to 1988.

Petroleum consumption has risen along with economic growth, and, as of 1988, it stood at 2,000 barrels of petroleum products per day. However, some 50 percent of this consists of aviation fuels, which can be categorized as re-exports. Of the 50 percent used for domestic consumption, about half is used to generate electricity, 40 percent is used by motor vehicles and the rest is used as cooking gas (Daniel, 1988). Petroleum imports for motor vehicles especially has grown because of the increase in the number of vehicles. During the period from 1984 to 1988, the number of cars in the country increased from 10,430 to 17,437, a 66 percent increase. Buses and trucks underwent similar increases: 61 percent and 67 percent, respectively (computed from GOAB, 1989b).

An oil refinery was developed in 1965, but ceased operations in 1975 due to a severe cash flow caused by the 1973-74 oil crisis. The refinery reopened in 1982 but closed shortly after. Currently, the facility is used as a petroleum products terminal. Some interest has been shown in oil exploration in the off-shore area between Antigua and Barbuda, but there are no plans for this activity at the present time (Daniel, 1988).

##### ELECTRICITY

**Supply.** There are three electricity generating stations in Antigua -- Friar's Hill, Crabbs, and Cassada Gardens, all connected to a national grid. Antigua Public Utilities Authority (APUA), the Government agency responsible for electricity, has increased generating capacity from 13 MV in 1976 to some 20 MV today (see Figure 4.1(1)).

There are nine distribution feeders, most of which are extended beyond design limits, causing low voltages at the feeder extremities. A 69,000 volt ring circuit has been built around part of the island, with seven substations that distribute at 11,000 volts (see Figure 4.1(2)). This 69 kV Transmission Line Project is projected for completion in 1990. The new system will enable the 11 kV feeders to carry smaller, more appropriate loads, and the ring will eventually make it possible to feed many areas of the island from two directions, rather than just one. Customers should receive improved quality of voltage levels and increased reliability. Part of the projected improvements would be attributable to an estimated 10-15 percent decrease in transmission losses, i.e., 13.6 - 14.4 percent losses rather than the current 16 percent loss (APUA, 1989a; pers. commun., M. Woodroffe, General Manager of APUA, 1990).

All APUA electricity generation is based on fossil fuels, using either diesel or Bunker C, which is approximately half the price of diesel and has almost the same calorific value. However, it requires greater temperatures to use and, therefore, the generators that use it are more expensive. APUA has boilers that are able to use any waste lubricating oils as fuels. Currently, however, the wastes from the smaller residential- and hotel-owned diesel generators are not fed into the APUA system.

Table 4.1(1). Imports of major petroleum products (In barrels) and their percent share of imports mix.

Category	1984	%	1985	%	1986	%	1987	%	1988	%
Gasoline	147,355	18.06	146,388	17.38	172,844	19.37	179,709	18.39	180,535	17.00
Diesel	167,788	20.57	184,072	21.86	203,077	22.76	261,154	26.72	215,102	20.25
Jetfuel/AvGas	420,190	51.51	427,468	50.76	425,140	47.64	450,542	46.09	450,080	42.38
L.P.G	24,270	2.98	29,932	3.20	31,033	3.48	26,189	2.68	36,924	3.48
Fuel oil	56,085	6.88	57,228	6.80	60,274	6.75	59,858	6.12	179,407	16.89
TOTALS	815,688	100.00	842,368	100.00	892,368	100.00	977,452	100.00	1,062,048	100.00

Source: OECs, unpublished data from Economic Assessment Section, St. John's, Antigua.

**Demand.** Officially recorded demand, measured as peak load, increased from about 7.5 MW in 1976 to around 17 MW in 1988 (see Figure 4.1(1)). Currently, the official peak load is 18 MW, but unofficially it is believed to be closer to 20-21 MW (pers. commun., M. Woodroffe, General Manager APUA, 1990). Over the last five years, there has been an average increase in electricity consumption of about 10 percent per year (APUA, 1989a). Put in another way, the current rate of increase means that the amount of electricity consumed would double approximately every five years. For perspective, doubling time in the U.S. and Europe was 7-10 years before the oil crisis of the 1970's, and it has increased considerably in the wake of that crisis. Such rapid growth in demand would tax the most sophisticated, well-endowed electricity power supply systems; it is a severe strain on APUA. The Authority can meet current demand in Antigua but will not be able to do so for long if demand continues to increase (pers. commun., M. Woodroffe, APUA, 1990). Table 4.1(2) shows the current electricity consumption pattern in Antigua.

**Barbuda.** APUA operates one generating facility on the island. There are three generators capable of producing about 600 KW. Typically only the largest of these is used in order to meet the approximate 300

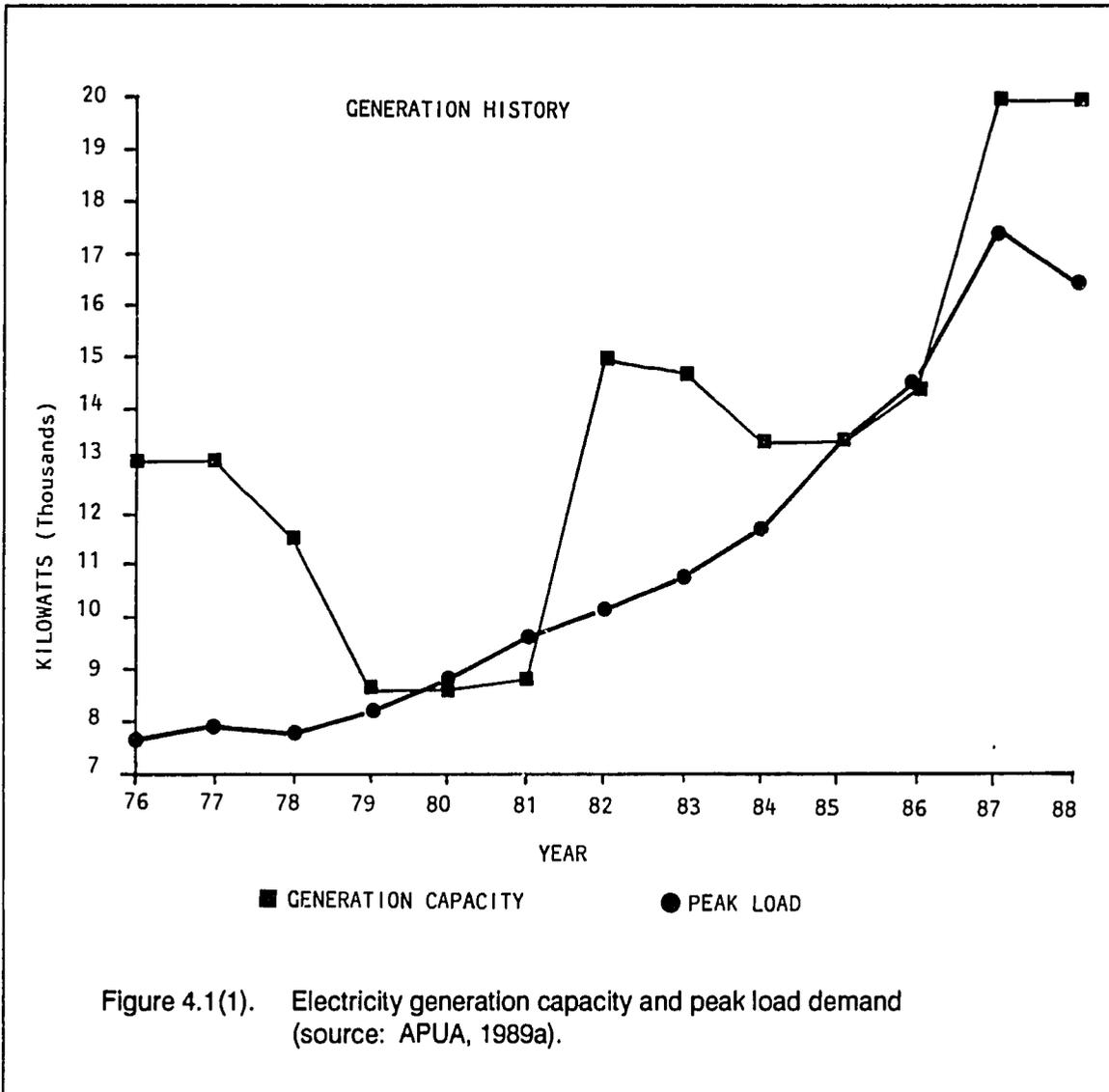
KW demand. Tourism developments on the island maintain their own generating systems. For example, the K Club development has four generators, two producing 195 KW and two more producing 255 KW -- an output 300 KW higher than the maximum output of the APUA facility on the island.

Waste oil from the APUA system in Barbuda is stored in barrels, and most of this is given away to individuals who use it as a spray to kill vegetation. There are no provisions to ship this waste oil, or the waste oil from the hotel generating facilities, to APUA boilers in Antigua which are capable of using waste lubricating oils as fuels.

#### CONSERVATION AND NON-PETROLEUM ENERGY SOURCES

**Conservation.** There does not seem to be any official national energy conservation policy. If there is one, it is not widely known; none of the individuals interviewed by the CEP research team from APUA or the private sector knew of it.

Energy sources other than fossil fuels have not been well developed or even widely explored in Antigua and Barbuda, although there is reason to believe that the use of some



of these -- solar, wind and charcoal, in particular -- have potential to contribute to meeting the country's energy needs.

**Solar Energy.** Solar energy has been used in a variety of ways throughout the world. In the Eastern Caribbean, small-scale solar units have been used as water heaters, water pumps, desalination devices, and crop driers. Only the first of these has had any success in Antigua and Barbuda. Until recently, two companies split this market. The largest solar company in the country, Nubec, has sold some 600 water heaters since 1985. Solar water heaters are installed in the majority of hotels, as well as many residences. In general, the units substitute for electrical water heaters but also for LPG (liquid

propane gas). Solar water heaters often are more expensive initially to purchase and install, but less expensive to operate. The pay-back time for solar water heaters is estimated to be 18 months for the larger units sold to hotels and approximately 30 months for individual residences (pers. commun., J. Becker, Engineer for Nubec, 1990).

The environmental conditions to exploit solar energy in the country are good -- year-round high solar radiation, with less than eight percent variation around the mean monthly hours of sunlight (Daniel, 1988).

**Wind Energy.** There are no commercial wind-generated energy operations, or even pilot projects, in Antigua and Barbuda at

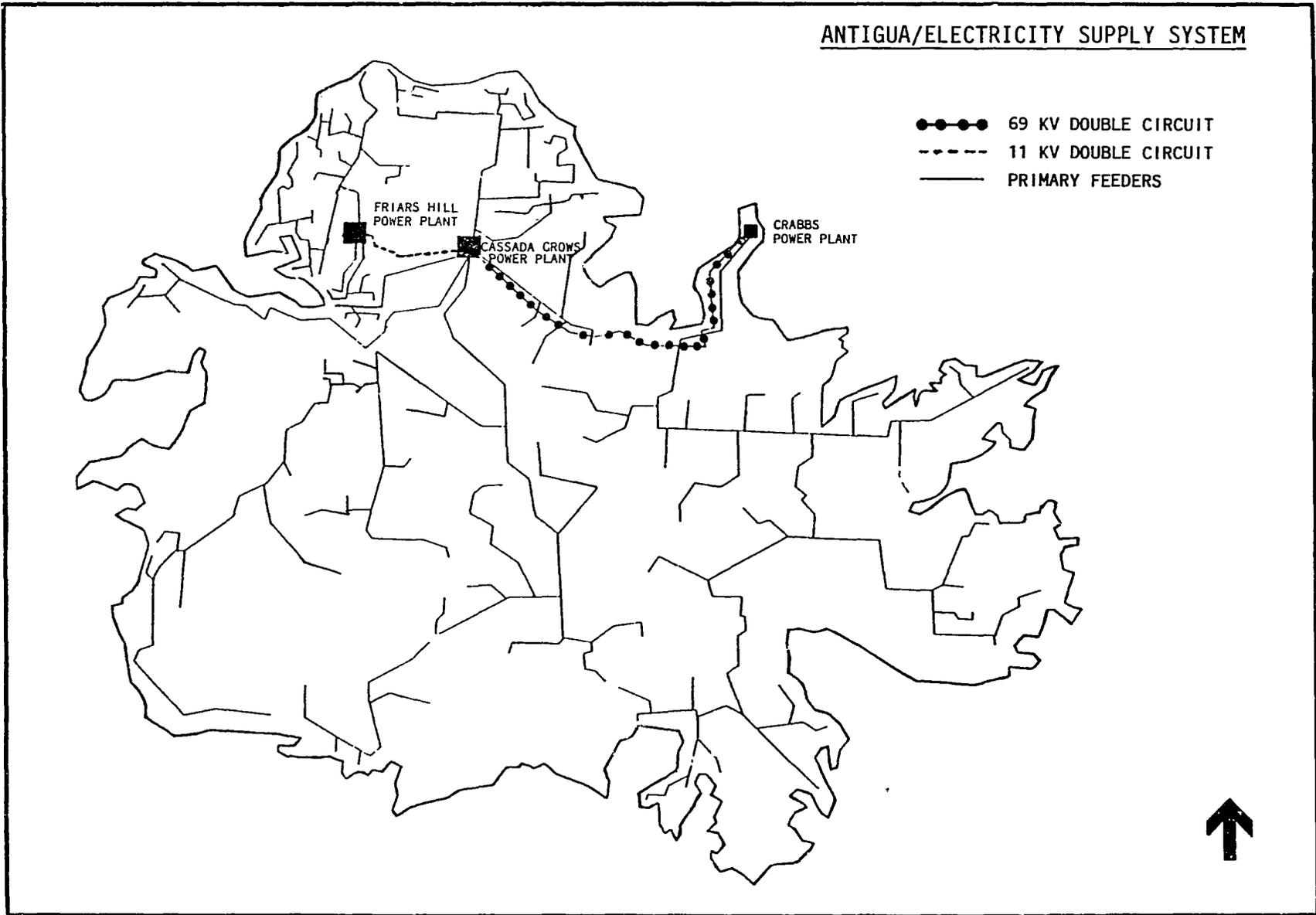


Figure 4.1(2). Primary electrical supply system for the island of Antigua.

Table 4.1(2). Selected data on electricity consumption, 1984-1988.

Category	1984	1985	1986	1987	1988
Domestic	17,302,800	18,907,776	21,046,512	22,570,240	25,156,092
Industrial	7,136,100	3,675,972	3,620,784	3,469,788	3,077,676
Commercial	22,157,856	26,365,116	27,687,324	24,470,808	21,676,956
Hotel	--	--	--	8,071,752	7,699,812
Agriculture	--	--	--	--	126,720
Government	--	--	--	3,283,570	3,707,434
<b>TOTALS</b>	<b>46,596,756</b>	<b>48,948,864</b>	<b>52,354,620</b>	<b>61,874,158</b>	<b>61,444,690</b>

Source: Electricity Department, Antigua Public Utilities Authority, as cited in GOAB, 1989b.

the present time. The recently terminated USAID-funded project was considered to be a failure, but it does not appear to have been well-chosen as a pilot. It used a vertical axis wind turbine, which is well-suited to high speed, variable winds but which requires at least 12-14 knots to generate electricity economically. Mean wind speed for Antigua and Barbuda is at or below that minimum: in 1988, the monthly average was 13.1 knots; in 1987 it was 10.8 knots (GOAB, 1989b). There are, however, wind turbines that are much more efficient at these lower wind speeds, and they are designed for the more constant and unidirectional winds typical of Antigua and Barbuda (pers. commun., J. Becker, Engineer for Nubec, 1990).

**Charcoal.** Charcoal production is estimated to be about 1,200 tonnes/year, employing an estimated 100-125 full-time and 100 part-time charcoalers, and with a annual revenue of approximately EC\$1.5 million (Chalmers, 1990; Daniel, 1988; McHenry and Gane, 1988). It should be noted, however, that all reports consulted warned that the data on this topic are particularly weak and unreliable. Nearly 18 percent of residential energy use is derived from charcoal. An estimated 20 percent of households are dependent on charcoal as their only cooking fuel, with about 75

percent using it as a backup source or for cooking certain meals. Charcoal is usually retailed by the "tin", a 2.5 - 3 gallon container (Daniel, 1988).

#### 4.1.2 Problems and Issues

##### FOSSIL FUELS

Antigua and Barbuda's dependence on fossil fuels is a cause of concern for two related reasons. First, regardless of the source of energy -- oil, geothermal, etc. -- it is risky not to have any options in the event of difficulties with the major source of energy. The theory that diversity begets stability in regard to ecosystems may be debated among some ecologists; but when applied to national economies, there does not seem to be any debate -- it is risky for a developing country to rely on one source of foreign exchange earnings, one source of energy, etc. Secondly, the risk to Antigua and Barbuda is compounded because the country's main source -- petroleum -- is totally under foreign control. The price and availability of oil can fluctuate widely, as was dramatically illustrated less than 20 years ago. Yet for several reasons,

accessibility and cost among them, Antigua and Barbuda's foreseeable energy future is tied to petroleum.

From an environmental perspective, the use of fossil fuels to generate electricity does not pose a local problem. Some air pollution does result, and Antigua and Barbuda is contributing its share to global effects of fossil fuel combustion, but local air quality is largely unaffected because of the constant winds that cleanse the islands. Some waste oil from the APUA electricity generators in Antigua is disposed of by converting it into fuel for further power generation.

The danger always exists of an oil spill from tankers transporting or unloading oil. A proposal to locate an oil storage and refueling tank at one of three possible sites -- Urlings, Fishers Point or Crabbs -- poses a serious threat of contamination and pollution of reefs and beaches in proximity to the site. Leakages, which are almost inevitable, would degrade these areas over time; in the event of an oil spill, habitat destruction could be much quicker and more extensive. The absence of adequate oil spill contingency planning procedures and in-country capabilities for oil spill clean-up increase the necessity for a full environmental impact assessment and review before GOAB moves ahead with plans for this proposed project.

## ALTERNATIVE ENERGY SOURCES

**Wind-generated electricity.** One of the main problems limiting this activity is that it has not been tested or adapted adequately for Antigua and Barbuda. To do so would require funds that may not show a return on investment at least in the short term. The Caribbean Wind Energy Assessment and Evaluation Project of OECS, which is just in the start-up phase, should remove some of the uncertainty for entrepreneurs exploring this venture in the Eastern Caribbean. The target islands are the British Virgin Islands, Grenada and St. Vincent; Barbuda has been chosen for a limited site survey (OECS, n.d.).

Assuming that wind energy is assessed to be a viable option under at least

some conditions, the most likely scenario would require that the electricity generated be fed into the APUA national grid (OECS, n.d.; pers. commun., J. Becker, Engineer for Nubec, 1990). This would require that the Government assume a critical coordinating role and make a commitment to the wind energy industry that might include subsidies during the initial stages.

**Charcoal.** Charcoal is produced from wood because it has a higher calorific output per unit weight than wood. However, a great deal of the potential energy value is lost during the conversion process, due primarily to kiln and processing inefficiencies. The conversion efficiencies can be improved substantially, without dramatically altering the current production systems. In traditional earth kilns, it is difficult to restrict combustion to only that portion of the wood required to generate sufficient heat to char the remainder. Modern, low-cost, portable metal kilns can improve efficiency from around 15 percent to 40 percent by providing better control of the pyrolysis process (Jennings, 1979; Daniel, 1988). Efficiencies can be improved significantly even in traditional earth kilns by drying the wood to a greater extent and more uniformly. A recent OAS study (1987) found that in the Eastern Caribbean, firewood generally is stacked for only a few days before it is put, insufficiently dry, into a charcoal kiln.

The wood collected as fuelwood and used for charcoal production often consists of Acacia shrubs and other species considered of low value. Furthermore, charcoal production is often a byproduct of land clearing activities. In these cases, the activity is beneficial since the biomass would otherwise be burned on the site to dispose of it, but instead it can contribute to meeting energy needs while generating income for the charcoaler. Charcoal production in Antigua seems to be operating on a sustainable basis, and there is no evidence that the use of trees for this purpose is creating any environmental problems. An exception would be if the trees were being cleared from watershed areas, leaving behind bare ground. It has been suggested that this might be occurring, but as discussed in Section 2.2 (Freshwater Resources and Watersheds), there are no quantitative data, or even

reliable qualitative surveys, to indicate that such a problem exists.

#### 4.1.3 Policy Recommendations

Antigua and Barbuda would improve its balance of trade position by reducing its imports of petroleum, but it is not known to what extent this can, or should, be pursued. There has not been an analysis done of the energy sector in many years; in the absence of such an assessment, there is little foundation for exploring import reduction options.

*(1) Government needs to prepare an assessment of and policy for the energy sector.* GOAB should consider preparing an assessment of the energy sector and could seek donor support for the undertaking. In 1983, Antigua and Barbuda endorsed the CARICOM Regional Energy Action Plan, which had as its primary objective:

To alleviate within the shortest possible time, the adverse effect of the energy crisis on the Caribbean economies, while laying the basis for a more coordinated and rational development of the energy resources of the region (quoted in OECS, n.d.).

The assessment proposed in this CEP would enable the GOAB to move toward this objective; relative to environmental concerns, a national energy policy would:

- 1) Encourage energy conservation, and
- 2) Support private sector involvement to improve and develop energy alternatives that already have shown promise in the Caribbean context.

*(2) Antigua-Barbuda needs to support the development and use of alternative energy sources.* It is not possible for the country to substitute non-petroleum energy sources on a very large scale, at least for the foreseeable future, but there are opportunities for devel-

opment of alternative energy sources which both the public and private sectors need to more vigorously pursue.

- As discussed in Section 2.1 (Agriculture and Forestry), there are options available to improve and expand agroforestry practices in the country. Two new initiatives in agroforestry -- the Pan American Development Foundation's Agroforestry Project and the regional Tropical Forest Action Plan -- identify fuelwood production as a key component of proposed activities.
- Charcoalers should be encouraged to use more efficient metal kilns. Support could be given to local craftsmen to produce the kilns. Charcoalers could be assisted through a combination of extension services, a licensing strategy, and marketing support.
- GOAB needs to explore the feasibility of a wind energy system that could feed into the national electricity grid.

## 4.2 INDUSTRY

### 4.2.1 Overview

The industrial sector, narrowly defined to include manufacturing activities alone, is very small in Antigua and Barbuda, contributing only slightly over 3 percent of GDP in 1988. However, when viewed more broadly to include mining and quarrying (2.3 percent of GDP), the hotel and restaurant industry (15.8 percent of GDP), construction (13 percent) and road transport (4.2 percent), this sector assumes a far more important role in the economy (see GOAB, 1989b and Table 1.5(5); the reader is also referred to Section 5 for a discussion of the tourism industry).

### MANUFACTURING

The performance of the manufacturing sector from 1982-1988 was considered weak, after a 20 percent per year growth earlier in the decade (ECCB, 1989b) -- this despite Government investments to build industrial parks and factory shells and to provide fiscal incentives and tax holiday periods.

The sector is characterized by import substitution production and enclave-type manufacturing for extra-regional markets. According to the World Bank (1985), the contribution of the various sub-sectors to manufacturing employment was as follows:

Garment/Textiles	47%
Food and Beverages	21%
Fabricated Metal Products	20%
Fabricated Wood Products	12%.

In 1982, five firms, or nine percent of the total, produced 52 percent of the output, while half the industries -- those consisting of fewer than 10 employees -- produced just 11 percent of the output. While several of the companies that were responsible for the above statistics remain the same, there has been considerable change as well. Several companies left Antigua-Barbuda after exhausting their tax breaks (GOAB, 1990b). As displayed in Table 4.2(1), one major clothing factory closed, and stove and refrigerator assemblies

have decreased considerably. The largest manufacturers currently operating in Antigua are listed in Table 4.2(2).

In an effort to attract new industries, the Government is considering a proposal to establish a free zone. The free zone, modeled after similar zones in other parts of the world, would offer a package of financial incentives guaranteed by Government for a period of 50 years (GOAB, 1990b).

The manufacturing sector is constrained by limited domestic demand and a bias for foreign goods, instability of regional markets, scarcity of raw materials, and labor shortages. As also noted in Section 5 (Tourism), laborers in the tourism sector earn far more than those in industry, and it is difficult therefore for industries to attract and retain good workers (GOAB, 1990c; pers. commun., B. Meade, Industrialization Commissioner, 1990; B. S. Young, Antigua Manufacturers Association, 1990).

### SAND MINING

Although only a small industry in terms of contribution to GDP, sand mining represents one of the most pressing environmental threats to Antigua and Barbuda. The current situation is alarming, and the difficulty in obtaining reliable data about the quantity involved and which beaches are being used does nothing to mitigate environmental and socio-economic concerns. Government employees and private citizens contacted as a part of the CEP project, regardless of their sectoral interests, shared concern over the fact that much of the sand mining activity is illegal and/or unregulated. The issue of sand mining is mentioned, therefore, in several sections of the CEP, in particular, in Sections 1 and 3.

### BUILDING AND ROAD CONSTRUCTION

The contribution of the construction sub-sector to GDP increased from 6.8 percent to 13 percent during the period 1984 to 1988. Production of construction materials, such as crushed stones, concrete blocks and concrete increased on the order of 50-75 percent during

Table 4.2(1). Production of selected commodities in Antigua-Barbuda, 1985 - 1988.

COMMODITIES	UNIT OF QUANTITY	1985	1986	1987	1988
<u>Quarrying</u>					
Crushed Stones	Tons	82,457	508,695	82,274	129,175
Concrete Blocks	No.	1,494,892	2,085,000	1,905,217	2,607,800
Concrete	Cu. Yd.	19,846	38,750	37,981	35,133
<u>Food and Beverages</u>					
Aerated Soft Drinks	Liters	2,468,059	2,509,441	2,546,401	224,311
Rum and Alcohol	Liters	277,679	352,740	331,074	464,036
Wines and Vodka	Liters	38,041	220,582	204,938	147,500
<u>Chemical Products</u>					
Paints	Liters	567,750	807,004	820,396	935,876
Oxygen	Hecto-Liters	611,418	--	5,484,595	6,670,346
Acetylene	Hecto-Liters	7,968	--	1,761,048	1,730,470
Nitrogen	Hecto-Liters	89,210	--	17,134	163,627
<u>Textile</u>					
Clothing	Dozen	401,071	3,928,000	497,050	245,000
<u>Paper Products</u>					
Toilet Tissue	Rolls	1,429,000	1,786,000	1,747,000	1,265,000
<u>Selected Manufactured Products</u>					
Mattresses	No.	7,634	5,372	6,962	7,032
Mattress Bases	No.	3,328	2,894	3,016	3,046
Stoves	No.	2,780	2,464	900	200
Refrigerators	No.	1,392	1,240	1,000	700
Hot Plates	No.	--	2,015	--	--
Freezers	No.	--	1,072	40	--
Fans (Electrical)	No.	9,033	7,250	14,350	13,560
Gas Lamps	No.	1,783	738	750	1,010
Blenders	No.	313	780	250	576
Mixers	No.	--	--	500	100
Vacuum Cleaners	No.	--	600	80	181
Irons (Dry)	No.	--	--	--	1,000
Galvanized Sheets	Tonnes	751	--	1,215	1,480

NOTES:

- (1) 1988 data is provisional.
- (2) One major clothing factory closed in 1988.
- (3) 1985 figure for "stoves" includes stoves and hot plates.
- (4) 1985 figure for "refrigerators" includes refrigerators and freezers.

Source: GOAB, 1989b.

Table 4.2(2). The largest manufacturing companies in Antigua-Barbuda in 1990.

Chemical Products:

Leewind Paint

Food and Beverages:

Antigua Distillery  
 Exotic Products  
 Antigua Winery  
 Bryson's Bottling  
 Trans Caribbean Marketing

Textile:

Sealy Mattress Co.  
 Sewn Products  
 Eagle  
 ILC

Paper Products:

Chala Paper Products  
 Antigua Packaging  
 Ambar Paper Product

Furniture:

Piggott's Woodworking  
 Etinoff Enterprises  
 Bryson's Woodworking  
 Plastic Foam and Furniture

Metal Products:

Nubec Solar Water Heaters  
 Henderson's Galvanized Siding

Source: Ministry of Trade, Industry and Commerce, unpublished data.

this period (GOAB, 1989b and Table 4.2(1)). This sub-sector will remain extremely active at least for the next 5-10 years given current projections for hotel and residential construction and road rehabilitation.

try's other major boating activity -- Sailing Week, an event acclaimed throughout the region (pers. commun., R. Nicholson, owner of Nicholson Charters, 1990).

**YACHT CHARTER INDUSTRY**

There are six major marinas in Antigua, five of them located in the southern part of the island centered around English Harbor and one on Crabbs Peninsula. Together, they provide approximately 150 slips, while additional boats can anchor in the surrounding bays. Four marinas are either under construction or in the planning stages. The marinas at Jolly Beach and Emerald Cove and the Nelson's Dockyard National Park marina in Falmouth Harbor each have the capacity to single-handedly double the total existing marina capacity in the country.

About 150-200 boats arrive at English Harbor for the annual boat show held each year in late November. Numerous yachts remain in Antigua-Barbuda waters from that time until about June 1, the end of the coun-

**4.2.2 Problems and Issues**

**MANUFACTURING**

The most recent study examining industrial pollutants in Antigua and Barbuda -- in fact, the only comprehensive report on this topic -- is Arthur Archer's 1984 report. At that time, in his preliminary study for PAHO, Archer identified distillery wastes from sugar and molasses and wastes from abattoirs as important land-based sources of marine pollution. The situation has changed considerably in the intervening years, and Archer's 1984 study may have lost much of its value. The brief discussion that follows is based on interviews only.

*Antigua Distillery.* Wastes -- 90 percent water and 10 percent yeast and

other solids -- are allowed to run-off untreated into the sea (pers. commun., Manager, Antigua Distillery, 1990).

*Bryson's Bottling.* Untreated liquid wastes go directly into the gutter. Previously, the now defunct recycling system neutralized and chlorinated used water so that it could be used again to rinse bottles. The bottles themselves are recycled (pers. commun., C. Browne, Production Manager, 1990).

*Trans Caribbean Marketing.* Currently, the company only distributes imported meats. It has plans to establish an abattoir (pers. commun., C. Watt, Manager, 1990).

*Leewind Paints.* New recycling system pumps wash water into a tank where it is flocculated before being reused in the paint manufacturing process. Some of the solids accumulated can also be used in the manufacturing process. No information was available on how the mineral spirits in this solvent-based system are disposed of (pers. commun., G Joseph, Technical Director, 1990).

*Textiles.* For the most part, textiles are simply assembled, not produced, in Antigua. Wastes consist of scrap materials and should not pose any particular environmental problems (pers. commun., J. Warner, Manager, Sewn Products, 1990). The largest company, Sealy, does manufacture but seems to have adequate controls on the process, i.e., cotton dust from the garmenting operation is collected in a vacuum system; furniture spraying is done in booths specially designed for this purpose (pers. commun., B. S. Young, Antigua Manufacturers Association, 1990).

*Antigua Plastic Foam and Furniture.* Foam is used for stuffing mattresses, sofas, etc. Excess pieces are shredded and used to stuff other items such as pillows (pers. commun., A Hadeed, Manager, 1990).

This brief overview of selected industrial wastes suggests that it may be worthwhile to explore ways to minimize pollution impacts from several of the companies, e.g., the distillery and the paint factory. At the same time, it should be noted that relative to other more industrialized countries, the small size of this sector in Antigua-Barbuda has shifted the emphasis of concern from industrial pollution to residential and tourism-related pollution issues.

## SAND MINING

Sand mining from beaches is one of the most pressing coastal problems in Antigua, and the situation is even worse in Barbuda. Until the mid-1980s, the Public Works Department (PWD) designated beaches for sand mining, did the actual mining and then sold the sand to the public. This resulted in severe erosion of several beaches, most notably Pearn's Bay and its environs (Cambers, circa 1988). The PWD is no longer involved in sales, but the practice of sand mining continues. A drive through virtually any part of Antigua reveals stockpiles of sand in fields and behind homes. It is common knowledge that no questions are asked about the origin of this sand, and the biggest constraint to obtaining a private stockpile is considered to be logistical -- i.e., securing access to excavating and transporting machinery -- rather than fear of prosecution for illegal removal of sand from a beach.

To some extent the problem of sand mining in Antigua has been "solved" by exporting the problem to Barbuda. As noted in the sidebar on page 108, this does not represent an acceptable solution.

## BUILDING AND ROAD CONSTRUCTION

As also discussed in Section 6 (Pollution and Environmental Health), most of the solid wastes generated by building construction are disposed of privately. In the absence of licensing for private operators, or adequate monitoring by the Central Board of Health, much of the privately-collected wastes ultimately are deposited in illegal dump sites.

## SAND MINING THREATENS BARBUDA

Barbuda's coastal environment, where small, isolated cliff-wrapped beaches contrast with miles of long, coral-pink sandy stretches, is one of its richest resources.

In 1979 the Government of Antigua and Barbuda entered into an agreement with the Red Jacket Mines Company for the mining of sand in Barbuda. Over the years, the company has changed ownership, but it is still a matter of considerable discontent locally that the Barbuda Council has not been able to collect the money to which it feels it is entitled based on earlier agreements. The Barbuda Council has brought court action (thus far unsuccessfully) against the present sand mining company (SandCo), complaining that the island is reaping few benefits from the sale of its sand. The Barbuda operation is reportedly one of the largest, if not the largest, sand-mining operation for export in the Eastern Caribbean (Thompson, 1990).

Sand is bulldozed and trucked to barges which transport it to Antigua and to American and French Caribbean territories. It was reported that in 1989 at least 20,000 tons/month were exported; the monthly average for the first five months of 1990 was 29,360 (Barbuda Council and SandCo records). Neither the Council nor the mining company seems certain of actual figures, but this of course only increases local concerns about these activities. Adding to the problem is the fact that while three studies (with conflicting conclusions) have been carried out to assess the environmental impact of the sand removal, no formal, standardized Environmental Impact Assessment -- along the lines of the EIAs required for major coastal projects in the neighboring U.S. Virgin Islands -- has yet to be implemented. Parts of the coastline have eroded to the extent that some houses at the abandoned Dulcina Resort are now on the verge of collapsing into the sea. There is also a danger that the island's major freshwater aquifers are being contaminated with salt water infiltrating the water system as a result of sand mining. A 1987 study commissioned by the Public Utilities Authority reported that groundwater at Palmetto Sands no longer meets acceptable water quality standards (pers. commun., V. Yearwood, Hydrologist, APUA, 1990). Reefs and underwater sand banks are Barbuda's natural defense against the sea, while its reefs are responsible for the reputation Barbuda enjoys as one of the best fishing banks in the Caribbean. It is likely that the removal of sand in large quantities from one area will ultimately cause the collapse of the undersea topography in other areas.

Another problem is the fact that materials -- wastes and construction residues -- are transported in open, overloaded vehicles. A significant amount is lost en route, posing a serious health risk.

### YACHT CHARTER INDUSTRY

The primary environmental issue associated with this industry is one shared with many other development activities in Antigua and Barbuda -- namely, the loss of coastal

habitats with associated environmental consequences. The quickly disappearing mangrove systems are an especially critical problem, and all efforts should be made to minimize this loss (see also Section 3 of the Profile).

Yachts and other pleasure craft are frequently cited as major polluters of marine and coastal waters because (unless the vessel has a holding tank) the human wastes from passengers are flushed directly into the sea. Undoubtedly, this is a contributing factor to marine pollution problems, particularly in

semi-enclosed bays. However, the untreated sewage effluents and waste water from hotels and residences and leachate from nearby residential settlements contribute to excessive nutrient loading of adjacent embayments greatly in excess of any similar pollution loading from moored or anchored yachts.

### 4.2.3 Policy Recommendations

*(1) Up-to-date quantitative data on industrial pollutants is needed in order to take appropriate steps to reduce pollution loading of coastal waters.*

Archer's (1984) estimated quantities of industrial pollutants in Antigua-Barbuda are seriously in need of an update, if only to reflect new industries and to adjust for the growth of outputs by those industries with more significant waste streams -- some as effluents and some as solid waste. Unfortunately, other than Archer's (1984) preliminary report produced for PAHO (which also includes useful volumetric estimates of domestic sewage and solid waste streams), no more recent study has been done to determine waste generation by industries or to assess the effects of industrial pollutants on the coastal environments of the country.

To effectively reduce the pollution loading of coastal waters and embayments, it is important to quantify (both vector and volume) non-point (generalized) sources of pollution (such as widely-spread pesticides and fertilizers) and point sources of pollution (such as commercial and industrial as well as residential waste streams). Once the volumetric dimensions are established, it is possible to build a pollution control strategy designed to reduce, if not eliminate, the stream of troublesome polluting chemicals, sewage and other waste materials. Toxic wastes require a more sophisticated analysis to establish their breakdown products and interaction with other waste and bottom sediments.

It is time for Antigua-Barbuda (and other Eastern Caribbean states) to begin to undertake such actions. According to Archer (1984), CARICOM countries should develop

a regional code of practice for industrial waste disposal to marine and coastal environments to ensure the protection of coastal ecosystems and amenities. Countries in the region should consider taking this one step further. It would be worthwhile for them to cooperatively set standards on the degree to which effluent and all other forms of industrial pollution must be treated before disposal, and on methods of disposal as well. In the absence of such standards, additional industrial development in the Caribbean may create a "polluter's haven" in any given island, affecting not only existing industries and the quality of life in the polluted country but also in nearby islands that are seeking to maintain better environmental conditions.

As an interim measure, Government should commit itself to a policy of providing development permits as well as subsidies, tax benefits and other forms of support only to industries which are relatively non-polluting. Government should begin to identify resources to put in place a monitoring program of existing industries. Those discharging toxic and/or high-BOD wastes into the environment need to be targeted and required to treat their wastes and clean up already polluted areas. A system of fines should be considered for violators.

*(2) An assessment of available sand deposits needs to be carried out, and a program of management for the country's sand resources put in place.*

GOAB resource managers need to assess available sand deposits in both Antigua and Barbuda and make judgments as to where continued sand removal will have the least detrimental impacts and is most compatible with current site utilization. Because of the risk which current sand mining poses to the environmental health of the island of Barbuda, a formal Environmental Impact Assessment should be carried out to determine the feasibility of continued sand mining at the present large-scale level of operation which is directed at commercial exportation.

It is likely that until a substitute for sand has not only been identified but has

demonstrated technical and monetary capability for widespread local use for construction, sand will continue to be removed from the beaches. To better manage and control exploitation of the resource in the near-term, GOAB must make difficult decisions to earmark priority areas where sand removal will be *absolutely prohibited* and areas of lesser concern and stress where *regulated* sand re-

moval will be carried out at some determined and managed level.

At the same time, every effort must be made to identify and develop alternative sources of construction aggregate. One possibility is to determine the feasibility of large-scale, deepwater, offshore dredging (Chambers, circa 1988).

## SECTION 5 TOURISM

### 5.1 OVERVIEW

Tourism has replaced sugar production as the lead economic sector in Antigua and Barbuda and has dominated the economy in the post-World War II era. During the last 30 to 40 years, Government has periodically pursued a policy of heavy investment in the tourism industry. Investment in air and sea port infrastructure in the 1960's facilitated jet airline and cruise ship services to the country at a time when sugar was going into full decline.

Government borrowed heavily to provide the basic infrastructure needed to service the tourism sector. The debt burden increased again to finance more recent improvements for airport facilities and for construction of the Ramada Renaissance Royal Antiguan Hotel and the Heritage Quay shopping, condominium and cruise ship complex. Government's debt jumped from 36.4 percent of GDP in 1984 to 68.4 percent in 1986 and was estimated to be 75.7 percent in 1988 (CDB, 1988; Weston, 1990; see also Section 1.5.2 of the Profile).

Government's plan to double hotel rooms by the mid-1990's raises important questions about the country's capacity to manage the industry in harmony with the environment. Growth in some areas outpaced the availability of basic water and electricity services in the 1980's, and road conditions remain poor. Demand for choice beach and shoreline property has led to the demise or major transformation of sensitive environmental systems, most importantly, the country's wetlands. This trend could well continue at least for the next five years as Government strives to meet its tourism growth objectives.

Effective management of tourism requires careful attention to the potential impacts of the industry on the country's landscape. Scarce land lost to the construction of tourism infrastructure is one concern; others include environmental change as a result of yachting, scuba diving and other tourist recreational activities.

### VISITOR ARRIVALS

Of the various indicators that can be used to gauge the performance of the tourism sector, visitor arrival data is the most frequently publicized. Growth in stay-over and cruise ship passenger tourist arrivals indicates steady and impressive performance in these sub-sectors. The former grew from 57,197 in 1976 to 189,079 in 1989, and the latter from 32,385 to 207,909 in the same period. Growth in yacht visitors is less significant but still shows a substantial increase (Table 5.1(1)).

### TOURISM EXPENDITURE AND INCOME

Annual reports from the Caribbean Development Bank (1987 and 1988) indicate a doubling of tourist expenditures between 1983 and 1986. The 1986 figure of US\$156.2 million increased another 19.5 percent to US\$186.7 million in 1987. Weston (1990) provides figures that indicate tourism's economic strength relative to other sectors, e.g., it earns 80 percent of total foreign exchange and its direct and indirect contribution to total GDP is 60 percent. No labor force survey has been done for many years, but estimates are that tourism employs some 15 percent of the labor force directly and perhaps as much as one-third of the labor force indirectly.

Estimates of tourism expenditures vary depending on the source. Weston's (1990) figure of EC\$387 million (US\$146 million) for 1988 represents a significant decline from the CDB figure of US\$186.7 million for 1987. This is confusing given the 30 percent increase of cruise passengers in 1988 over 1987 and the eight percent increase in stay-over tourists for the same period. If both the Weston and CDB figures are accurate, it would mean that per capita visitor expenditure in 1988 was much less than in 1987. Such discrepancies raise some question about the reliability or interpretation of tourism data sources, at least those consulted for the Environmental Profile.

Table 5.1(1). Visitor arrivals, 1986-1989.

Category	1986	1987	1988	1989
Stay-over				
Air	149,322	159,207	176,893	175,500
Sea	9,366	14,028	10,274	13,579
Subtotal	158,688	173,233	187,167	189,079
Cruise Ships	122,613	153,542	199,810	207,969
Yachting				
Windjermmer	4,394	7,480	9,804	8,611
Yachts	10,356	13,064	19,822	14,540
Subtotal	14,750	20,544	29,686	23,171
<b>TOTALS</b>	<b>296,051</b>	<b>347,319</b>	<b>416,663</b>	<b>420,199</b>

Source: GOAB, 1989c.

Table 5.1(2) indicates that the estimated average daily expenditure for hotel/guest house visitors is seven times higher than that for cruise ship visitors. Amselle's (1987) projection that average daily expenditure for cruise ships and hotel visitors will increase by 53.5 percent and 40 percent, respectively, by 1992 seems rather optimistic (particularly in view of some of the discrepancies among data sources as indicated above). In fact, because of external influences, the industry can be very fickle, and all projections must be treated with some caution. For example, Amselle (1987) projected US\$216.6 million in tourism expenditure for 1988, but the preliminary figure provided by CDB was US\$186.7 million.

Real possibilities exist for increasing the per capita expenditure of all visitors through promotion of scuba diving, day cruises and other forms of outdoor recreation. *Scuba Diver Magazine* in a 1987 subscriber

survey estimates that on an average trip of 7.3 days, scuba divers spend about US\$1,598. The average income of the scuba diving traveller is US\$54,600, and the assumption is that these tourists have more disposable income for travel than the average non-diver. Based on the estimates of persons taking day cruises in Antigua (see Table 5.1(3)), the yearly expenditure for this recreational activity is about US\$1.43 million (at an average of US\$57 per person/trip). The value of this revenue to local cruise boat operators cannot be ignored.

#### TAX REVENUES FROM TOURISM

Tourism tax revenues are generated from a variety of sources, including a hotel (head) tax of EC\$2.50 - \$10.00 per night depending on room rate, a 5 percent Government tax based on the total hotel bill, a 1 percent Guest Levy also based on the total hotel bill, and an embarkation tax. Revenue from

Table 5.1(2). Estimated average daily expenditure and length of stay for visitors to Antigua and Barbuda.

Type of Visitor	Daily Expend. US\$	Avg Length Stay Days/Nights
Cruise Ship and Windjammer	19.00	1.0
Yacht	38.00	10.0
Air (Hotel/Apartment/Guest House)	134.62	7.8
Air (Private Residence)	30.50	14.0

Note: \* 1986 estimate.

Source: Amselle, 1987.

Table 5.1(3). Estimates of persons visiting day cruise destinations, 1990.

Day Cruise Destinations	No. of Boats	Total Capacity Boats	No. of Trips Per Week	Avg No. of Persons Carried Per Week	No. of Persons Carried Per Year
Bird Island	5	227	14	332	17,264
Maiden Island/ Exchange Island	1	52	2	40	2,080
Cades Reef	2	40	6	72	3,744
Cruise Around Island	1	65	1	40	2,080

Source: Compiled from figures provided by operators of day cruise boats.

these taxes grew 31 percent between 1985 and 1987 (Table 5.1(4)). Revenue from the 5 percent Government tax (guest tax) grew by 16 percent yearly between 1986 and 1988, reflecting the growth in stay-over arrivals. Assuming that tax revenues are efficiently collected, this could mean that average stay-

over tourist expenditure has remained relatively steady in recent times.

Government makes available very generous concessions to the hotel developers by waiving taxes on a range of imported items and on business income for a minimum of five years (these items are, however, subject to a

Table 5.1(4). Selected tourism tax revenues (EC\$ million), 1984-1989.

Year	Hotel Tax <sup>1</sup>	5% Gov't Tax <sup>2</sup>	Embarkation Tax	1% Guest Levy <sup>3</sup>
1984	1.98	4.43		
1985	2.84	6.07	1.46	1.15
1986	2.89	6.92	2.03	1.40
1987	3.35	8.03	2.15	1.56
1988	3.97	9.29		
1989	3.80	9.44		

Notes: <sup>1</sup> Hotel Tax is EC \$2.50 - \$10.00 per head per night, depending on room rate, paid by hotel to Government.  
<sup>2</sup> Government Tax is guest tax charged on every item of hotel bill.  
<sup>3</sup> Guest Levy is 1% charge on every item on hotel bill.

Source: *Antigua and Barbuda Estimates*, 1987, 1988, and 1989, GOAB, Ministry of Finance.

customs services tax of 2.5 percent). There is no personal income tax in the state, and as some tourism developments find ways to "roll over" or extend the company's income tax waiver, this source of GOAB tax revenue is negligible.

#### SOCIAL IMPACTS OF TOURISM

Tourism reportedly employs about 15 percent of the labor force (Weston, 1990), although the figure may be higher. Hotel employment, using an employee to room ratio of 1:1, is about 2,925 persons. The relatively attractive wage rate of the industry is attributed by some (e.g., Weston, 1990) for the country's failure to fully revitalize agriculture; a similar view is held by the local manufacturing/industrial sector (pers. commun., B. S. Young, Manufacturers Association, 1990). The average monthly wage of a front desk clerk is about 15 to 20 percent higher than the salary of bank tellers. Semi-skilled persons working on yachts at Nelson's Dockyard earn

up to 1.5 times more than their counterparts in construction.

Tourism creates a demand for labor that is met in part by migrant workers from within the region. The situation is not dissimilar to the experiences of the U.S. Virgin Islands (USVI) in the 1960's and 1970's and the British Virgin Islands and St. Maarten in the 1970's and early 1980's. In St. Thomas, USVI, a rapidly expanded population coupled with accelerated tourism development have dramatically overtaxed basic infrastructure and educational services in that American territory during the last two decades. It appears that similar conditions are being recreated in Antigua.

#### SPATIAL DEVELOPMENT TRENDS

Antigua has a uniquely indented coastline with several protected bays and attractive beaches. The indentations create more linear shoreline space than is normal for

a country of its size and increases overall tourism development potential and the value of shorefront lands. There are some approximately 2,900 hotel/guest house rooms in Antigua. They are scattered throughout the island, but three important resort areas readily stand out: Dickinson Bay/Runaway Bay; the Deep Bay/Galley Bay area; and Jolly Beach. These major resorts contain a total of 1,492 rooms (Table 5.1(5)), roughly equally divided among the three (Antigua Hotel and Tourist Association, unpublished data for 1989).

Wetlands are the major natural feature of the environments in which these resorts are being developed. In each case, wetland alteration has occurred through dredging or land-filling; the transformation of these ecosystems is so drastic that they virtually can no longer be considered wetlands. Jackson (1985) cited a projected total of 2,953 rooms/units proposed for Dickinson/Runaway Bay, which includes an area extending from Fort James north to Blue Waters. A major ongoing development at Jolly Beach will create 1,860 two-bedroom villas and 70 marina berths for large yachts (pers. commun., F. Biegler, Proj. Mngr., Jolly Harbor Proj., 1990).

Environmental problems such as beach erosion, marine pollution and flooding, associated with tourism development at Dickinson/Runaway Bay, have been cited in a number of studies (Deane, 1975; Jackson, 1985; and Jackson, *et al.*, 1987). Similar problems exist in other localities and can be expected to worsen dramatically, in light of major tourism development proposed by Government over the next five years, unless timely interventions are made in policy, planning and development control.

The tourist industry is the main factor responsible for the relatively higher property values on the north coast of Antigua, from Fort James in the west to Dutchman's Bay in the east. It is one of the principal agents of change affecting residential growth and expanding urbanization in that coastal stretch, as well as in the English Harbor/Falmouth area in the south of the island. Tourism in the southern area is based on a mix of yachting, hotel accommodations and tourist visits to

historic Nelson's Dockyard, the scenic Look-out, and other attractions.

Nelson's Dockyard National Park (see also Sections 8 and 9) is the nucleus of tourism-related development in the southern part of Antigua. Long-term plans call for the site to be developed as a world class tourism destination (DPA Group, 1985). English Harbor/Falmouth is the major center for yachting in the country, although compared to comparable yachting areas in the Eastern Caribbean its actual at-berth capacity is small. Total berths in the area, including stern-to docking in Nelson's Dockyard, is 108. The National Park Authority (NPA) is in the process of inviting tenders (developers) to build a 150 berth marina in Falmouth Harbor (pers. commun., E. James, Parks Commissioner, NPA, 1990).

Table 5.1(6) indicates the relative importance of yachting and related activities to the English Harbor area. Eighty-seven percent of yacht passengers arriving at Antigua-Barbuda's five ports-of-call were recorded at Nelson's Dockyard. St. John's Harbor, including the Deep Water Harbor and the newly created Heritage Quay Berth, receives 98 percent of all cruise ship passengers. Urban tourism, characterized mainly by cruise ship activity, is facilitating the upgrading of St. John's and with it the stimulation of shopping and nightlife. Unfortunately, it also exerts stress on weak urban services and aggravates existing congestion and traffic problems.

## BARBUDA

Despite its excellent beaches, Barbuda remained unaffected by the hotel building boom experienced by Antigua in the 1960's and even more recent expansion in the early- to mid-1980's. The construction or proposed construction of a number of new hotel rooms in the past three years spells the emergence of more aggressive tourism expansion for this island. The total number of hotel rooms currently is 54 (11 at Sunset View and 34 at Cocoa Point). However, some projections (based on projects already in the

Table 5.1(5). Hotel rooms at three major resort areas, Antigua.

Area	No. of Rooms
Dickinson/Runaway Bay	556
Deep Bay/Galley Bay	436
Jolly Beach	500
<b>TOTAL</b>	<b>1,492</b>

Table 5.1(6). Sea visitor arrivals at various ports, 1989.

Ports of Call	Cruise Ships	Pass.	Yachts	Pass.	Windjammer Cruises	Pass.
St. John's Deep						
Water Harbor	302	197,271	122	1,513	49	3,978
Nelson's Dockyard	13	1,200	2,752	12,653	44	4,633
Crabs Marina	-	-	101	374	-	-
Heritage Quay	10	6,646	-	-	-	-
Barbuda	24	2,852	-	-	-	-
<b>TOTALS</b>	<b>349</b>	<b>207,969</b>	<b>2,975</b>	<b>14,540</b>	<b>93</b>	<b>8,611</b>

Source: GOAB, 1989c.

developmental stage) indicate that this level could rapidly increase to 300-400 rooms within a couple of years time. The island lacks basic infrastructure to handle this kind of expansion, and therefore, at the present time, each development project will be responsible for providing such services as power and sewage disposal. However, no monitoring system is in

place to regulate or control these private-sector activities.

Additionally, rapid expansion of tourism in Barbuda would place severe stress on the island's very small labor force which could not meet construction demands or support the developments when completed; housing already is limited (see also sidebar on

page 176). Land tenure rights will undoubtedly limit some speculation and easy access to land for development, while infrastructure constraints may work against rapid expansion.

Barbuda currently attracts a moderate day visitor traffic of tourists vacationing in Antigua. Day visits will increase once the natural attractions on the island are developed and tours become better organized. In time, Barbuda should generate significant business from car rentals, restaurant sales and the marketing of souvenir items in connection with day trips and in some cases overnight stays.

It is not likely that Barbuda will become a major stay-over destination in the near future. Rather, tourism *could* evolve at a pace and style appropriate to its natural resource base, small population and infrastructure limits. A strategic plan to develop a nature-based tourism marketing strategy or tourism facilities for an up-scale market (i.e., fewer tourists but higher revenues per room) would have considerable merit.

The issue of tourism "style" is one which confronts all Eastern Caribbean islands, including Barbuda. Development projects or development approaches catering to the "mass tourism" market can significantly impact on many aspects (e.g., physical, biological, socio-cultural) of island life, particularly small, relatively undeveloped islands like Barbuda. But, as has been well documented (e.g., McElroy and de Albuquerque, 1989), often the economic benefits of mass tourism are illusory, the result of a failure to account for the social costs to the community and the environmental costs to the ecosystem.

## 5.2 PROBLEMS AND ISSUES

### INADEQUATE DEVELOPMENT POLICY AND CONTROLS

Without clearly articulated land use policies and environmental controls, Government's development goals for the tourism sector could have far-reaching consequences

for the environment. Weston (1990) states that a decision has been made by Government to double hotel rooms to 5,000 by the mid-1990's. Stay-over tourist arrivals by air are targeted at 278,000 by 1992, up from 175,500 in 1989, with projections by the turn of the century reaching 300,000. Cruise ship arrivals are set at 340,000 by 2000, up from 207,969 in 1989.

Such rapid expansion will exacerbate existing problems with basic services and infrastructure, e.g., water, electricity and roads. Until there is a strategic physical development plan to match economic growth targets, basic infrastructure is likely to lag behind demand. Physical development planning is also necessary for the efficient use of beach and shoreline lands (that are becoming increasingly scarce) and for a cost-effective distribution of infrastructure services.

To be profitable hotels require an average yearly occupancy rate of about 60 percent. CDB (1987 and 1988) indicates that overall room occupancy averaged 65.3 percent through the years 1983 to 1986, reaching a high of 71.5 percent in 1985. Amselle (1987) warns that rapid expansion could result in declining occupancy rates, as low as 41 percent by 1992. This projection is based on Government's target of 11,000 beds (5,000 rooms) by 1992 and air arrivals totaling 212,200 visitors staying an average of 7.8 nights. Amselle (1987) uses a figure of 212,200 arrivals, rather than the 278,000 arrivals targeted by Government for 1992, because his analysis identified constraints in the availability of airline seats and a shortage of local labor. A recession in target markets could also be a factor in reducing arrivals.

In pursuing its expansion plans, Government may be inadvertently changing the nature of tourism. Room rates of the middle and higher priced hotels in Antigua and Barbuda make the country relatively more of an "up-market" destination than most other destinations in the region. Rapid expansion could result in a gradual move toward "mass tourism" and a drop in average room prices, along with a reduction in per capita tourist expenditure and Government tourist tax revenue.

## INSTITUTIONAL ISSUES

Tourism's overall economic dominance and influence on physical development makes it necessary to have an institutional structure that both provides for long-term planning for the industry and rationally manages the industry's use of and impact on the environment.

Integral to this structure should be collaboration between (1) Government agencies responsible for tourism planning and marketing, physical and land use planning and environmental management and (2) formalized consultations between GOAB agencies and private sector agencies involved in tourism.

Government agencies having some responsibility for tourism were listed by Jackson (1985) and are briefly summarized:

- *Ministry of External Affairs, Economic Development, Tourism and Energy*: economic and tourism planning, investment promotion, review of proposed tourism projects, and development of historical resources.
- *Antigua and Barbuda Department of Tourism*: tourism promotion and marketing.
- *Ministry of Agriculture, Fisheries, Lands and Housing*: processing of applications for lease or purchase of publicly-owned lands for tourism development.
- *Ministry of Public Works and Communications/Public Works Department*: road construction and maintenance, drainage, beach protection, and sand extraction control.
- *Development Control Authority (DCA)/Physical Planning Office*: physical planning, land use planning, and development control.
- *Antigua Public Utilities Authority (APUA)*: production and maintenance of water and electricity, maintenance of sewage treatment plant at McKinnons.
- *Central Board of Health (CBH)*: solid waste disposal, environmental health.
- *Antigua and Barbuda National Park Authority (NPA)*: development and management of national parks.

Two other institutions with important functions relative to tourism are the *St. John's Development Corporation*, which is responsible for the upgrading of downtown St. John's and the management of Heritage Quay, and the *Antigua Hotel and Tourism Association (AHTA)*, which is involved with promoting the interests of its members.

A number of structural and functional weaknesses in these existing institutional arrangements have been identified.

(1) Lack of collaboration in planning between the Economic Planning Unit and the Physical Planning Office means that tourism expansion is not necessarily linked to an officially-accepted physical development and land use strategy. The technical and administrative capacities of both bodies are currently not adequate to undertake such an integrated planning mandate.

(2) The objective of making the 12 square mile Nelson's Dockyard National Park a world class tourism destination is being pursued without collaborative mechanisms that could draw on the resources of other GOAB agencies. The planning expertise of the Economic Planning Unit and the Physical Planning Office and the tourism marketing experience of the Department of Tourism could be of valuable assistance to the National Park Authority.

(3) The mandate of the St. John's Development Authority to facilitate growth in urban tourism has already effected important

improvements in St. John's. However, it is being pursued without the involvement of the Physical Planning Office, which is needed to avoid conflicting demands on urban services by tourists and the resident population.

(4) There is no easily identifiable lead agency with responsibility for tourism amenity planning or for enhancing the general landscape of the country, both of which are vital to effective marketing of Antigua-Barbuda as a unique destination in a compet-

itive market. The natural resources of Barbuda lend themselves to the promotion of the island for nature tourism.

(5) Tourism in Antigua-Barbuda developed through the mutually supportive investment efforts of the public and private sectors. However, formal mechanisms to facilitate collaboration between both sectors in policy and planning are lacking. In 1989 the AHTA commissioned a strategic plan (see below and Figure 5.2(1)), which outlines the

PROJECTED ENVIRONMENT IN 1995 - 1998  
[Excepts from AHTA Strategic Plan, 1989]

- The manufacturing and off-shore banking industries have grown. However, tourism is still #1.
- The worldwide economy has experienced a slump in recent years (since 1989).
- The environment is a major issue in the U.S. and Antigua-Barbuda.
- The 2,600 rooms back in 1989 have grown (conservatively) to 5,000. 75% of new construction has been in condos. Three major brand name chains are now on island. Jolly Beach approaching 2,000 units.
- Cruise ship docking capacity has doubled. Passenger counts now up to 360,000/year.
- The airport terminal is severely congested. A national airline is likely.
- The utility situation has gone from bad to worse despite modest improvements. Sewage on beaches [is] a common occurrence.
- Taxation of industry has been escalated in a variety of forms. Shipping and air freight logistics are severe (and costly).
- Government and union wages have doubled.
- Importation of labor now at 50% of industry's work-force. Influx of immigrants is causing damaging social-economic problems related to the visitor's experience and to the traditional Antiguan-Barbudan family (i.e., school system stressed, housing shortages, drug related crime at unimaginable high!).
- Unplanned expansion in Antigua-Barbuda is the root to major problems.
- World travel is up! Marketing direct to the value sensitive retail consumer is the new challenge. He/she can shop destination options electronically (and visually) from his/her home.
- Asian and European visitor demand and investments have grown in Caribbean.

A VISION OF 1995 - 1996

- AHTA is gaining recognition as a CHA [Caribbean Hotel Association] role model.
- Pace of growth is in harmony with Government's resources and tourist arrivals.
- Private sector is a partner with Government on major tourism policy development.
- Have a separate minister of tourism and a functioning Tourist Board.
- Have an on-going and effective marketing plan.
- Tourism employees look forward to industry's regular newsletter.
- Airport is being expanded.
- AHTA is providing a continuous training program.
- Have had a continuity in long-term direction, year to year, Board to Board, since 1989.

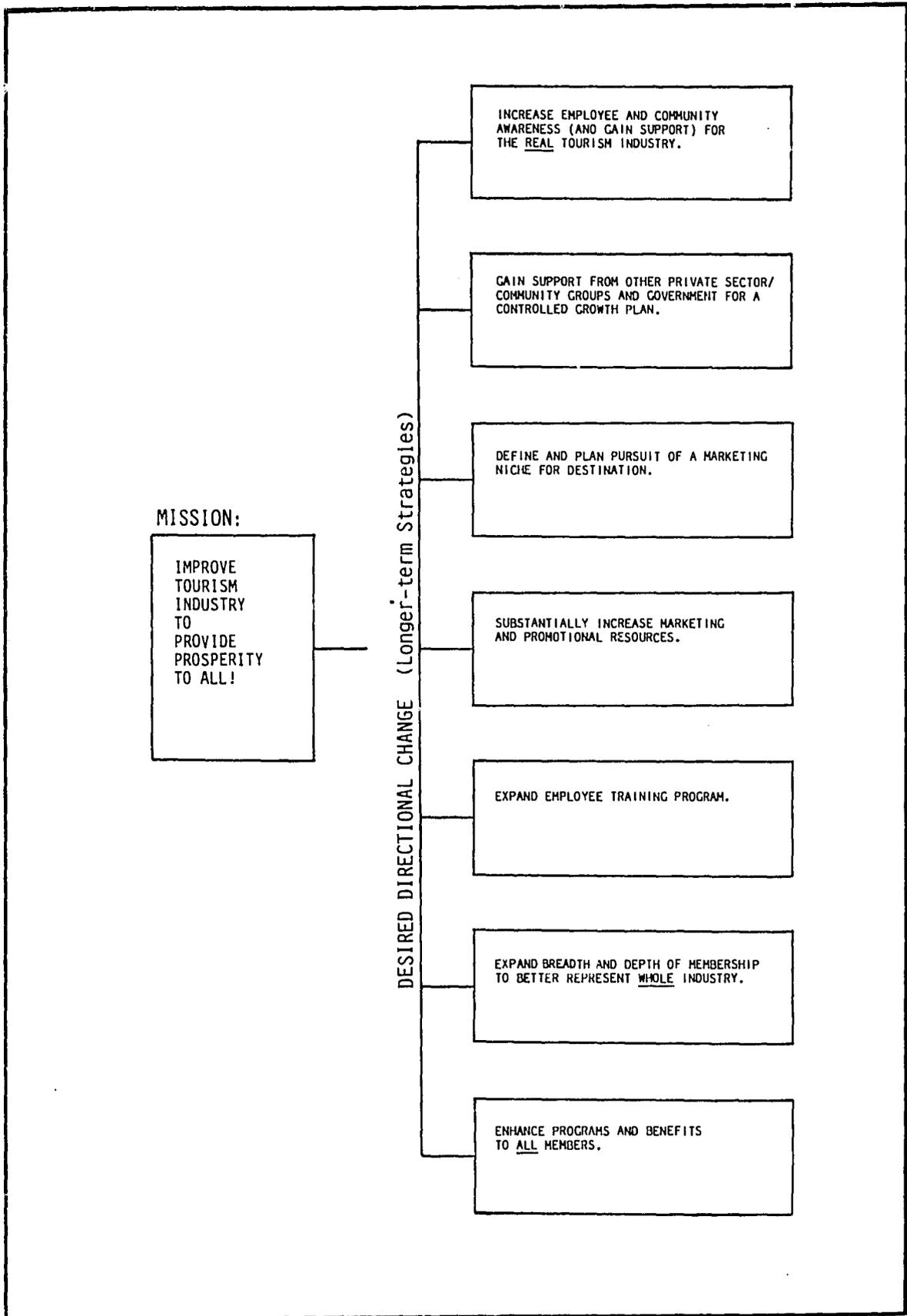


Figure 5.2(1). Overall mission statement and long-term strategies of the Antigua Hotel and Tourism Association (source: AHTA Strategic Plan, 1989).

opportunities and constraints for future tourism development in the country. The AHTA planning effort was not done in collaboration with Government, nor was it seriously considered by Government, an indication of the need for improved coordination and consultation between the public and private sectors.

## ENVIRONMENTAL ISSUES

Impact on coastal and marine habitats, including beaches, during the construction phase of tourism infrastructure is a major tourism/environment issue. Location and siting of structures and dredging and filling activities occur in the absence of effectively enforced development control procedures. The compounded effect of degrading or altering several wetlands on the west coast, along with the effects of a number of large dredging projects, could be a decline in coastal water quality which would, in turn, be detrimental to the well being of the tourist industry as well as the health of the country's population. Development impacts could be minimized through the application of coastal planning guidelines and the introduction of impact assessment procedures.

Other environmental concerns relate to the operation and management of tourism facilities and the lack of control mechanisms for GOAB monitoring of industry use of commonly-held natural resources. Problems derived from inadequate management of sewage and kitchen wastes at the Dickinson/Runaway resort area have already been documented (Jackson, 1985). The choice of waste treatment and disposal systems and the efficiency with which they are maintained are critical not only to the environment but to the future of tourism itself. At full capacity, the 556 hotel rooms in the area generate close to 100,000 gallons of waste water daily. A publicly-owned sewage plant treats less than 40 percent of this total and is plagued with frequent breakdowns (Jackson, *et al.*, 1987).

Scuba diving, snorkeling, glass bottom boat tours to view reefs, and cruises to offshore islands are recreational activities that draw stay-over visitors, cruise ship passengers

and yacht charterers. In a study of the cruise ship industry by OAS/CTRC (1988), the cruise lines servicing the region pointed to the need for improved development of regional attractions to ensure better patronage by cruise passengers.

The utilization of natural areas as attractions in Antigua and Barbuda is largely unplanned and unmanaged. Failure to develop attractions results in potential revenue loss, and the absence of proper management results in degradation of resources that could have been avoided. The shallow reefs at Bird Island are subjected to intensive, unmanaged use by some of the estimated 17,000 tourists that visit the offshore island yearly (See Table 5.1 (3)).

Scuba and glass bottom tours and day cruises represent small-scale enterprises making important contributions to overall tourist expenditure. Management of the resources on which they depend is vital to long-term sustained use. Maintenance of the natural attractions and roads that facilitate land-based tours need similar consideration.

## 5.3 POLICY RECOMMENDATIONS

*(1) A reassessment of hotel expansion plans is needed.*

Environmental considerations and labor and infrastructure constraints suggest the need for scaling down Government's room expansion plans. A review and reassessment of the 5,000 room target set for 1992 should occur through a consultative process, involving the public and private sectors. The consultative review process should consider and make recommendations on:

- Procedures to reduce the impact of new development projects on coastal resources;
- A room expansion target that corresponds to a realistic schedule and financing plan for upgrading

water and electricity services and roads;

- Options for financing the upgrading of sewage waste management as a means of reducing pollution risks to bathing waters adjacent to tourism resorts;
- An appropriately-sized municipal sewerage system to serve the Dickinson/Runaway/Paradise View area.

*(2) The current tourism marketing emphasis for Antigua and Barbuda needs to be re-examined, and a strategic marketing plan/strategy, linked to environmental considerations, should be put in place.*

Major room expansion plans of the Caribbean Hotel Association (CHA) member countries, including Mexico, will stiffen the competition for tourists. Antigua and Barbuda should strive for competitive advantage through a strategic marketing plan which is linked to an environmentally-enhanced destination. Some elements of the strategy should include:

- Emphasis on up-market properties while maintaining diversity in the mix of tourism accommodations. The plan should underscore the relatively higher importance of increased tourism expenditure over increased arrivals in the matrix of growth indicators.
- Marketing of Antigua-Barbuda as a twin island destination, with Barbuda packaged as a nature tourism resort island.
- Establishment of an investment program for the development of natural attractions to enhance the destination, as an integral component of tourism promotion and marketing.

*(3) Strategic planning for the continued development of urban tourism is required.*

Urban tourism has the advantage of stimulating crafts, music and nightlife and improving amenities in the country's capital city, St. John's. Such gains could be quickly lost if too large a tourist itinerant population creates over-congestion and erodes urban services. This will happen in the absence of strategic plans for hosting cruise ship tourists if passenger arrivals reach 340,000 -- as is targeted for the year 2000.

Recently, taxi drivers expressed dissatisfaction over the number of cruise ships being berthed at the new Heritage Quay pier in relation to those berthing at the Deepwater Harbor. They claim to get much less business from the former because passengers are more inclined to walk around St. John's than to take an island tour. Ground tours for cruise ship passengers have always been an important source of income to taxi drivers and a significant portion of overall cruise passenger expenditure. Thus, while berthing at Heritage Quay encourages cruise passengers to shop, it could do so to the detriment of tour traffic. It seems that a long-term cruise ship berthing plan that focuses on this and other related concerns is needed, particularly in view of future cruise passenger arrival targets set by GOAB. The plan should consider:

- The expansion of parking facilities in downtown St. John's to relieve congestion recently exacerbated by the increase of taxis serving cruise ships; and
- The development of Falmouth Harbor as a cruise ship port for smaller vessels and possibly the development of Parham Harbor as a third cruise ship anchorage.

*(4) Institutional measures which create a more cohesive, coordinated approach to tourism development need to be considered by both the public and private sectors.*

Antigua and Barbuda is at a critical cross-road in its development, where a wrong

turn could have a critical erosive effect on the quality of life for years to come. Improved management of the environment is essential to sustain a competitive tourism industry. This requires strengthening the institutional structure for effective management of the industry. Suggestions to this effect are already provided in this chapter, but are briefly summarized as follows:

- Integration of economic planning and physical/land use planning so that tourism development is linked to carrying capacity considerations, to enhancement of the country's natural resource base, and to an appropriate and achievable level of infrastructural development;
- Establishment of collaborative/coordination mechanisms to tap the resources and expertise of all relevant agencies in pursuing the overall objective of making

Nelson's Dockyard National Park a world class tourism destination;

- Institutionalizing collaborative planning between the St. John's Development Corporation and the Physical Planning Office in the development of urban tourism;
- Responsibility for preparation of a plan for the development of natural attractions and the enhancement of the landscape assigned to a task force comprising representatives from the Department of Tourism, the AHTA, the Forestry Division in the Department of Agriculture, and other relevant agencies and institutions;
- Creation of a formalized consultative process between the public and private sectors in the planning, monitoring, and evaluation of the tourism industry.

## SECTION 6 POLLUTION AND ENVIRONMENTAL HEALTH

### 6.1 OVERVIEW

#### SOLID WASTE

Solid waste management increasingly is becoming an important worldwide environmental issue. The global issues are exaggerated on small islands with limited "waste" land and, in the case of Antigua and Barbuda, are compounded by the dependence of the country on tourism. As noted by the country's Solid Waste Manager, tourists will not spend money to go to the Caribbean "just to see garbage sitting on street corners, or to smell burning garbage dumps -- they can do this at home for nothing" (Michael, 1990a).

Antigua has regularly scheduled collection routes covering the entire island. Additional pick-ups are arranged by contacting the Solid Waste Unit, Central Board of Health (CBH), Ministry of Labor and Health. Antigua has five official solid waste disposal sites: a major facility at Cook's Dump, southwest of St. John's; a second large facility at Burma, adjacent to V.C. Bird International Airport; and smaller secondary sites at Old Road on the south coast, Bethesda in the southeast, and Freetown in the east. However, as indicated in Figure 6.1(1), there also are numerous, sizeable *ad hoc* dumps.

Barbuda has three public dumps, all of which are located in or near salt flats that are covered in high tides. Waste water from the dump has been reported to leach into the adjacent salt flats and even into the Lagoon. These areas also have extensive fringing mangroves which are beginning to show some signs of stress. The two largest disposal sites are near the island's hospital, and there are concerns about the spread of vector-borne disease. *Ad hoc* dumping also takes place in Barbuda as it does in Antigua.

The Solid Waste Unit has a fleet of 20 vehicles: 10 compactors, 7 flatbeds, 2 skip loaders and 1 tractor. In addition to this, it employs five privately owned trucks. Private, unlicensed individuals collect the solid wastes

of many businesses and hotels, as well as construction wastes.

The National Litter Act of 1983 is the most recent legislative attempt to deal with waste disposal and control. The principal legislation for waste management, the Public Health Ordinance (1957), is very outdated; it does stipulate that it is illegal to discharge septic tank effluent in drains without using a disinfectant.

#### SEWAGE AND OTHER DOMESTIC LIQUID WASTES

As displayed in Table 6.1(1), sewage is disposed of through sewage treatment plants, septic tanks, pit latrines and pitless latrines (i.e., the "bucket system"), while an estimated 8-9 percent of the population does not have access to any type of facility (Silva, 1990; Archer, 1988). There is no sewerage system in any part of the country, even though this had been recommended for St. John's at least as early as 1966 (WHO, 1966, cited in PAHO, 1985). When and if any sewerage systems are developed, the Antigua Public Utilities Act stipulates that APUA would be the responsible body for establishing and operating government facilities (PAHO, 1985).

**Sewage Treatment Plants.** The numerous sewage treatment plants scattered throughout Antigua primarily service private tourist facilities. Most hotels have their own plants, but many of these are malfunctioning and/or overloaded (PAHO, 1985, updated through personal observation and interviews with members of the Environmental Awareness Group and the Hotel and Tourism Association).

**Septic Tanks and Pit Latrines.** The majority of residences and many commercial buildings use septic tanks (Archer, 1988). In St. John's, effluent from septic tanks is discharged either directly, or through a seepage

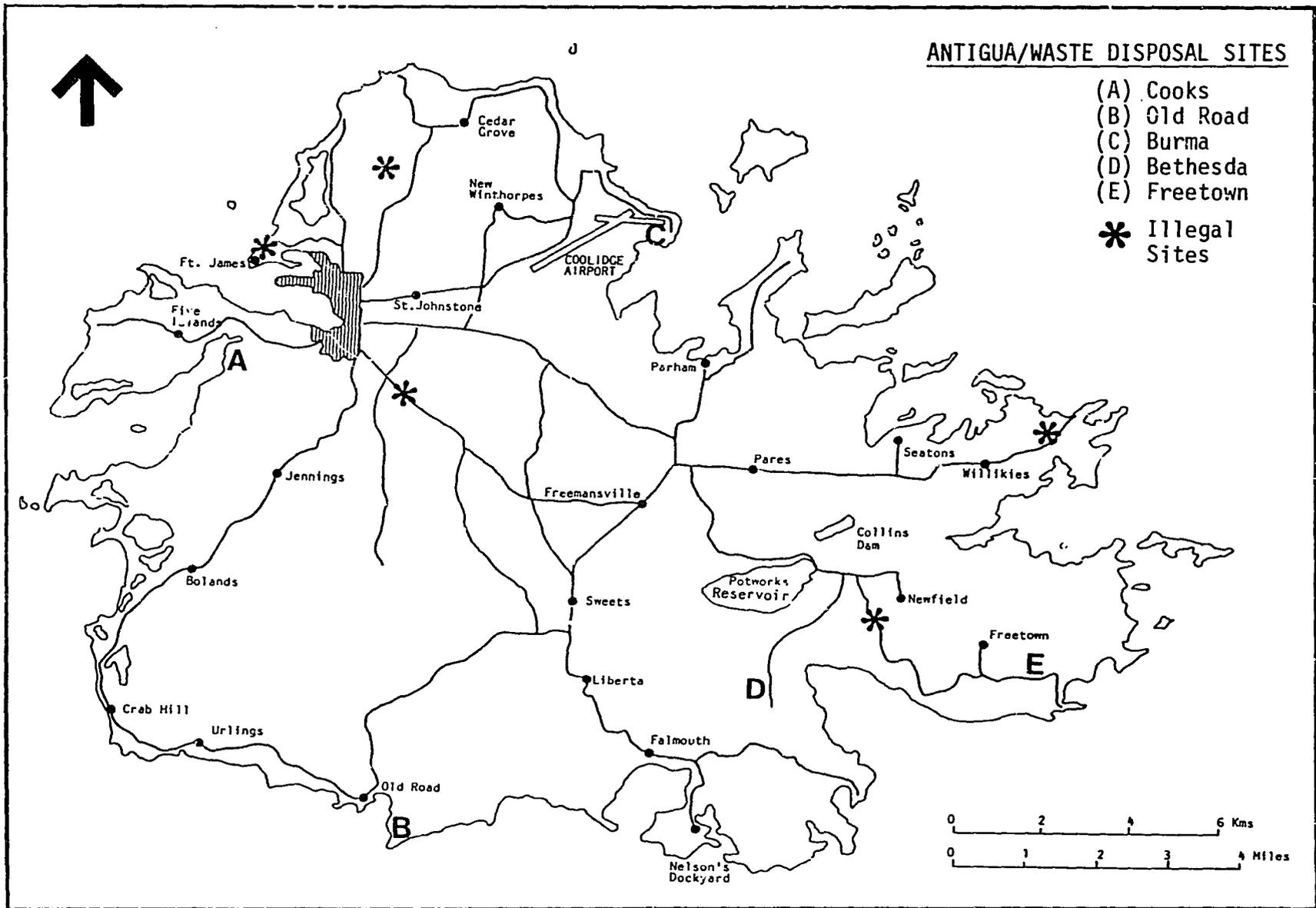


Figure 6.1(1). Official and unofficial waste disposal sites (source: L. Michael, Solid Waste Manager, GOAB).

Table 6.1(1). Percentage of sewage disposed of by the five primary disposal categories.

	RESIDENTIAL	TOTAL (including hotels)
Sewage Treatment Plants	0	6 *
Septic Tanks	60	40
Pit Latrines	30	24
Pitless Latrines	1-2	30 **
No Sanitary Facilities	8-9	

\* A more recent survey reports 16-20% (pers. commun., D. Matthey, CBH).

\*\* Archer (1988) combined data for those only having access to pitless latrines with those having no access to sanitary facilities.

Source: Residential data from Silva, 1990; data for "Total" from Archer, 1988. Total refers to all of Antigua, i.e., residential and non-residential, and therefore includes hotels and other businesses.

pit, to street gutters and other open drainages. This effluent has received only primary treatment at best. Gray water -- sink, bathing water, etc -- usually is piped directly into the gutters and open drainages en route to the bay (PAHO, 1985). Pit latrines, employed more in rural than urban areas, are used in about one-quarter of the residences.

**Bucket System.** The Central Board of Health operates the "night soil" or bucket system used in poorer parts of St. John's; human wastes are stored in buckets that are collected between 10 PM and 5 AM, Monday to Friday. Uncovered buckets are transported to Cook's Dump where the wastes are buried. The bucket system is only in operation in St. John's, where it handles an estimated one to two percent of wastes (Jackson, 1988; Silva, 1990).

The Public Health Ordinance (CAP. 236, 1957) states that it is illegal to discharge unclean septic tank effluent if it could create a health risk (and presumably the same applies to sewage disposed of through other meth-

ods), but no agency is responsible for monitoring this risk potential.

CBH provides technical assistance for the design, installation and maintenance of sewage disposal systems when requested but does not do so in a regulatory capacity. For the problematic St. John's area, the primary remedial action is to encourage the use of chlorinators to disinfect septic effluent. The Development Control Authority, in the Ministry of Agriculture, is responsible for ensuring that building permits for all new construction includes sewage plans.

CBH, in conjunction with the Caribbean Environmental Health Institute (CEHI) in St. Lucia, has been monitoring sewage levels in four locations since the beginning of 1990: Dickinson Bay, Jolly Beach, English Harbor and the St. James Club area (pers. commun., D. Matthey, CBH and D. Shim, CEHI, 1990).

**Public Health.** The two common disease indicators of unsanitary sewage/ex-

creta disposal problems are typhoid and infant gastroenteritis (PAHO, 1985). According to the findings presented by the participants at a 1985 workshop hosted by the Pan American Health Organization (PAHO), 60 percent of the annual gastroenteritis cases reported are from the population of St. John's (PAHO, 1985). For 1988, there were 829 gastroenteritis cases and 0 typhoid cases reported (GOAB, 1989b).

## **AGROCHEMICALS, HAZARDOUS AND TOXIC WASTES**

**Agrochemicals.** Agrochemicals are used widely in Antigua, e.g., 56 percent of crop farmers use pesticides, 35 percent use herbicides, and 54 percent use chemical fertilizers. Minimal use was recorded for Barbuda (OAS, 1984a).

A. Pesticide Control Act was passed in Antigua and Barbuda in 1973, as part of a British-supported effort to develop such legislation in several Eastern Caribbean states. The Act called for the establishment of a Pesticide Control Board and empowers it to enact regulations for the approval, distribution and use of pesticides. The Board met from 1978 to 1984 but has been idle since. Draft regulations were prepared and sent to the Legal Department for review and processing, but they have never been enacted. Currently, there is no list of pesticides approved for use in Antigua and Barbuda, no records or control of imports, and no controls on distribution or disposal (Lausche, 1986; DeGeorges, 1989b). A 1985 study identified 7 varieties of fungicides, 14 varieties of herbicides, 18 varieties of insecticides, acaricides and nematocides in use in Antigua (Hammerton, 1985, cited in Betz, 1989). According to a draft report to USAID which examined pesticide management in Antigua and Barbuda in 1989, several of the pesticides in use are classified as USEPA-restricted (DeGeorges, 1989b). This same study identified the Ministry of Agriculture's testing laboratory as one of the best equipped and staffed in the Eastern Caribbean, on a par with CEHI's operated under CARICOM auspices in St. Lucia.

**Hazardous and toxic wastes.** In addition to agrochemicals, there are other hazardous wastes and toxic materials that could present a problem in Antigua and Barbuda. Currently, there is no legislative or management system for dealing specifically with hazardous or toxic materials. An attempt to site a toxic waste plant in Barbuda was averted only by a concerted public outcry, stimulated through timely and watchful press coverage. Although the amount of wastes involved at the present time is small, among those of concern are hospital wastes, certain highly flammable and toxic industrial chemicals, and wastes from photo-processing and dry cleaning facilities.

## **INDUSTRIAL WASTES AND OIL POLLUTION**

Section 4 of the Profile provides a broad overview of industrial pollutants in the state. In the most recent comprehensive report on the subject, Archer (1984) identified distillery wastes and wastes from abattoirs as important land-based sources of marine pollution. A distillery located in the St. John's Harbor area and the Cove continues to dump untreated waste into adjacent waters, resulting in severe stress to marine life from high BOD (Betz, 1989). Concerns about discharge of relatively high levels of mercury have also been raised by the Government's Plant Protection Officer. Livestock processing wastes have in the past caused marine environmental problems from high BOD and COD, according to Archer (1984). Since Archer's study, there has been a decline in abattoir activity, although a major wholesaler is planning to increase its meat processing capacity in the near future.

Antigua's western coastline is a major area of concern as it has been intensely developed, receives large amounts of land-based sources of marine pollution (CIDE, 1988), and is largely indented with numerous enclosed bays with only weak current and wave activity.

In the past, the operations of an oil refinery resulted in damage to mangroves in McKinnons Pond and nearby coral reefs. The

refinery was most recently reopened in 1982 but closed shortly thereafter. There are new plans to build a transshipment facility to off-load large tankers and transfer petroleum products to smaller vessels. Proposed sites include Fisher's Point and Crabbs Peninsula (pers. commun., E. Weston, Ministry of Economic Development, 1990). Both these areas have important nearshore reefs, and the Crabbs site also has extensive mangrove forests. The proposal for an oil transshipment facility should require preparation of a formal, standardized Environmental Impact Assessment while the project is still in a feasibility/pre-planning phase; it also points to the need for more aggressive oil spill contingency planning in the state prior to approval of this or any similar project.

A two million GPD desalination plant at Crabbs continues to discharge huge amounts of hyperthermal and hypersaline water in the surrounding coastal waters (CIDE, 1988). Thermal pollution, along with hypersaline conditions, has resulted in extreme stress to local benthic communities and destruction of important seagrass beds. This area presently has well-developed mangroves and coral reefs and is potentially very vulnerable to massive habitat destruction.

## 6.2 PROBLEMS AND ISSUES

The problems that arise from the spreading effects of pollution in Antigua-Barbuda place at risk not only the country's environmental health but its socio-economic viability as well. Antigua and Barbuda's land base, landscape, and key natural resources are being degraded faster than need be as a consequence of wide-spread, inefficient waste management practices. Furthermore, the quality and supply of potable water, perhaps the country's scarcest, single most critical resource, continues to be jeopardized by the threat of expanding groundwater pollution. A second important resource, coastal reefs and seagrass systems that lend stability to beaches, support fisheries, and contribute substantially to the tourism industry, are diminishing in scope and deteriorating in quality in the face

of expanding, ever-more pernicious forms of land-based marine pollution. The risks to tourism, in particular, of degraded water (potable and marine) and degraded landscapes -- to say nothing of diminished vegetation in an extremely dry environment -- are both palpable and highly visible. Tourism's 60 percent contribution to the country's GDP would drop dramatically in the event of an outbreak of typhoid, hepatitis or some other infectious, water-borne disease. An oil spill, or any spill of similarly toxic materials, would have precisely the same effect, in the absence of any effective spill containment strategy.

There are some noteworthy commonalities in the issues that affect each of the pollution problems discussed in this chapter. Perhaps most important is the low priority that these issues receive within Government, evident in the absence of a national-level plan (or plans) to manage waste streams and in the inadequate levels of budgetary support allocated for these activities.

The low priority assigned pollution issues by Government actually is symptomatic of a larger related problem, for it reflects a lack of awareness -- by Government, the business community and the general population -- about the importance of pollution control and the problems *and costs* associated with poor resource management, particularly in critical sectors such as tourism. One public official recently summed it up succinctly when he told an OECS audience that, "In our small countries of limited land and fresh-water resources, indifference to the quality of solid waste management is a cavalier attitude and luxury we can ill-afford" (Michael, 1990b).

Another facet of the same problem which confronts Antigua and Barbuda is the inadequate state of legislation available to address ever-more exotic chemicals and waste materials which present increasingly complex pollution control problems. Penalties, for example, are usually low, do not act as a deterrent, and rarely are appropriate for the amount of environmental damage done by careless or even deliberate polluters. While it is true that laws alone cannot solve the problem, they are a necessary, but not sufficient, condition for success.

## SOLID WASTE

(1) *Comprehensive Planning.* Solid waste management receives too low a priority from the Government, which has ultimate responsibility either directly or through control of the private sector. Despite repeated and, in some cases, 20 year old recommendations made by various consultants and local Government officials regarding the need for a national solid waste plan, none exists today (McEachern, 1973; McEachern and Towle, 1973; Archer, 1984 and 1985; Michael 1990a). However, it would be ill-advised to develop a plan that was not promptly followed by a widely-accepted recognition within Government of the need to explore the options laid out in the plan and -- most critically -- to devise new funding strategies to deal with the problems identified. It is extremely important to identify new sources of revenues to confront solid waste disposal and management issues, e.g., through collection fees, tippage fees at the dump sites, and severe penalties for illegal waste disposal prejudicial to community health and ecosystem viability.

(2) *Site Consolidation and Management.* The five official solid waste disposal sites in Antigua need to be consolidated into one or two improved sites. Michael (1990a) argues that given the high cost of operating a modern landfill -- with a track-type loader, compactor, and the dump trucks needed to transport wastes to it -- it would be more cost-effective for each island (Antigua and Barbuda) to concentrate operations at one main site, with a possible, reduced-scale secondary site to lower transportation costs. Proper supervision and equipment must be provided for each primary, consolidated site.

## SEWAGE AND OTHER LIQUID WASTES

(1) *Community Health Issues.* As is often the case with the collection of solid waste, private collectors handle much of the cleaning of septic tanks; similarly, sewage treatment plants are privately operated and unsupervised by public health agencies. The residues from cleaning septic tanks are often dumped *ad hoc* along roadsides in the rural areas where they are a threat to public health.

Nearshore marine communities already are showing severe signs of pollution, and this can only be expected to worsen unless ameliorative actions are taken (see Section 3.2, Coastal and Marine Resources).

(2) *Poorly managed disposal techniques.* The bucket system is recognized to be a poorly managed disposal technique that can pose serious health risk problems for the night-soil workers. CBH announced its intention to terminate the system over two years ago, but has only succeeded in reducing the number of buckets involved (Jackson, 1988; Silva, 1990). The reduction, of course, could also signify that informal or illegal means for disposing of human excreta and other waste have expanded among users of the night-soil buckets.

## AGROCHEMICALS

(1) *Biocides.* Since there is a fairly widespread use of pesticides, herbicides, and fungicides (collectively referred to as biocides) among farmers, livestock holders, and landscape managers in Antigua-Barbuda, this poses a significant health risk for those who apply these chemicals under even the most controlled conditions. Unfortunately, these risks tend to be greater because of mis-handling of the products in the absence of reliable, current information regarding biocide applications. In addition to the direct risk facing the pesticide user as well as neighboring communities or ecosystems down-wind or down-stream, other groups are often placed at risk due to indirect exposure to the biocide or its break-down compounds. In the absence of proper procedures for safe disposal of pesticide containers, too many people are placed in contact with discarded pesticides and pesticide containers. A much larger population is also exposed to groundwater contaminated by carelessly handled biocides.

(2) *Agrochemical fertilizer.* The excessive application of various chemical fertilizers can result in what is known as nutrient pollution of adjacent streams, groundwater, and coastal ecosystems. Misdirected dosages of many fertilizers accelerate the growth of various kinds of algae which, if uncontrolled,

can pollute water supplies and injure other organisms.

(3) *Pesticides Legislation.* Although Antigua-Barbuda has a Pesticide Control Act dating back to 1973 which set up a Pesticide Control Board (PCB), regulations have never been developed and, as a consequence, there is no list of approved pesticides. In 1989, Antigua-Barbuda imported 41 different pesticides, three of which were on the USEPA cancelled list and nine of which were sufficiently toxic to be on USEPA's restricted list. The lack of regulations prevents the PCB from controlling the type, brand, quantity, storage, distribution, and use of pesticides in Antigua. Furthermore, the Board has virtually no quantitative data on the volume and composition of pesticide importation (DeGeorges, 1989b).

### 6.3 POLICY RECOMMENDATIONS

#### GENERAL RECOMMENDATIONS

(1) *Antigua-Barbuda needs to develop a National Waste Management Plan and Strategy.*

A national strategy to deal with the disposal and management of wastes should focus on the following requirements:

- the need to update and harmonize pollution control legislation and regulations and to provide a framework for follow-up actions;
- the need to raise public awareness about pollution issues and their costs to the country; and
- the need to identify new sources of funding transferring some of the rising costs of collection and disposal site management to waste generators including commercial, industrial and developmental enterprises as well as new and expanding residential communities.

The latter item perhaps needs amplification. Pollution control and waste management are customarily seen as a drain on the public treasury. However, given the high costs of modern technology and the high volumes of waste generated in consumer-oriented economies, pollution control and waste management can be turned into revenue-generating activities by the simple procedure of establishing prices for all facets of waste disposal. Once this is done, segments of the process can be privatized. Possible options include: charging a levy to all hotels for waste collection and treatment services; selling franchises to private waste collectors for designated collection routes; charging industrial and commercial users for waste collection and disposal; and billing polluters for cleanup and restoration costs.

(2) *The legislative framework for waste management needs to be improved and updated.* Necessary changes include: (a) a review and update of the Litter Act of 1983 to identify disposal sites and improve provisions dealing with management, licensing, permitting, and registration of private waste collectors; (b) a complete revision of the 1957 Public Health Ordinance, including drafting of standards for sewage disposal systems; (c) authorization for the CBH to approve, control, and monitor waste disposal systems, including septic tanks and package sewage treatment plants.

(3) *A campaign -- targeted to decision-makers, businesses and the general population -- is needed to raise awareness about pollution issues and what they cost the community and the economy over time.* One of the best opportunities for educating the public on pollution issues, as with all environmental education initiatives, is through the schools and youth groups. A serious effort to educate the public and promote new behavior will require a well-conceived and supported campaign. Information about pollution control standards must be widely disseminated, and violators must be prosecuted.

(4) *A national pollution assessment should be implemented.* The quantitative and systemic aspects of environmental pollution in Antigua-Barbuda are not sufficiently well

documented to permit the proper development of remedial or regulatory measures. It would therefore be appropriate to assemble an interdisciplinary team to conduct a national pollution assessment. Such an effort should establish the basic dimensions of each waste stream, identifying and quantifying sources and causative agents, volumes, flow rates, destinations, impacts, and projections, covering:

- point (i.e., industry) and non-point (i.e., agriculture) sources;
- pesticides, herbicides, and agrochemical inputs;
- industrial chemicals (e.g., imports, storage, use, risk, disposal, impacts);
- interaction, i.e., aggregates and additive effects;
- bio-accumulation effects (over time).

The national profile could use the workbook methodology laid out in WHO Publication No. 62, "Rapid Assessment of Sources of Air, Water and Land Pollution," as a preliminary framework (this manual was used by Archer, 1984).

## SOLID WASTE

(1) *A fee schedule for various waste collection and disposal services should be established and implemented.*

(2) *Sufficient authority should be vested in the Central Board of Health to regulate private solid waste collection. Authority should include licensing, training and regulating private collectors and haulers of waste and the power to rescind franchises if collectors do not perform satisfactorily (Michael, 1990a).*

(3) *The number of Government solid waste disposal sites need to be reduced, and management and operation of consolidated sites needs to be upgraded. The ultimate ob-*

jective is to reduce or eliminate the number of informal/illegal dump sites. A warden and litter control system with severe penalties for major industrial and commercial violators may be necessary to redirect community malpractices regarding the discarding of waste on public property.

(4) *The public and private sectors need to explore alternative means of disposal. For example, a pilot program to compost domestic sewage sludge and the organic component of solid wastes could be established. The composted product could be used as a source of rich, high nutrient organic soil for agriculture and landscaping. A related benefit would be a reduction in the volume of unusable "wastes"; i.e., an extension of the life of Antigua and Barbuda's landfills (Michael, 1990b). The economics and feasibility of recycling some wastes also need to be explored. This may require a can and bottle charge on imported items in order to guarantee the availability of funds to ship recycled products back to the originating destination (Michael, 1990b).*

## SEWAGE AND OTHER LIQUID WASTES

(1) *A sewerage system should be developed for St. John's. The most cost-effective and ecologically sound sewage disposal option needs to be identified and then implemented for the St. John's urban area and, secondarily, for the English Harbor/Falmouth Harbor area where the semi-enclosed embayments and a low flushing rate increase the level of marine pollution. Taking into consideration existing technological and financial constraints, the most feasible option is likely to be preliminary treatment combined with a long outfall which discharges into deep water in an area of strong currents. Disposal systems should be designed to be easily upgraded to a higher level of treatment should this prove to be necessary later.*

(2) *Better oversight for the use of septic tanks needs to be provided. For those areas where septic tanks are feasible (that is, where there is sufficient land and adequate water supply), they are the recommended treatment. CBH should be vested with the authority and*

resources -- staff and funding -- to ensure that septic tanks are constructed to standard specifications. The Development Control Authority's approval process for building applications should incorporate CBH technical expertise in the review process to ensure that all construction plans include appropriate waste disposal systems. A performance monitoring program for septic tanks and soakaways should be started, first focusing on larger-scale non-domestic, commercial and industrial sites.

(3) *Ventilated improved pit latrines need to be provided in areas where septic tanks are not suitable.* For many households, particularly in the poorer, high density sections of St. John's, septic tanks are not an option. In these cases, ventilated improved pit latrines offer satisfactory control of pathogens, insect vectors, and odors. Solids have to be removed every one to two years, but this operation only requires simple equipment (PAHO, 1985).

(4) *The night-soil bucket system needs to be terminated.* The 1985 Workshop on Wastewater Management (PAHO, 1985) recommended that the bucket system be abolished. To do so would require support from Government to ensure that the poor of St. John's, the primary users of this technique, will be provided an affordable alternative. The issue -- and recommendation -- is not new and only requires the full commitment of Government to take appropriate action.

#### **AGROCHEMICALS, HAZARDOUS AND TOXIC WASTES**

(1) *The Pesticide Control Board needs to be reactivated and strengthened.* The Pesticide Control Board needs to be immediately reestablished as an operational body, and, equally important, supporting regulations to the Pesticide Control Act need to be vetted and gazetted as soon as possible in order to give the PCB authority for monitoring and regulating pesticide use in the country (Henry, 1990). Among other responsibilities, the Board should develop a list of approved pesticides, excluding those banned or setting special use requirements for those restricted; USEPA's pesticides list (or some other suit-

able agency's classification system) should be used for establishing a basis for Antigua-Barbuda's approved pesticides list. The Board should be responsible for requiring pesticide distributors to report quantities sold and major users to report quantities applied to their crops.

(2) *The capability of the Ministry of Agriculture's analytical laboratory needs to be upgraded to include pesticide monitoring.* Antigua, along with St. Lucia, Grenada, and Dominica, has a new but inoperative gas-chromatograph which could be used for monitoring pesticide residues in food crops and in tissue samples from persons exposed to pesticides. The urgency of establishing a pesticide evaluation capability in the form of an operational pesticide monitoring laboratory has been remarked on by several consultants.

(3) *Steps need to be taken to regionalize agrochemical regulation and management.* Given the limited resources of the OECS countries, coupled with their close affiliation through the OECS framework, careful consideration should be given to earlier recommendations to regionalize agrochemical control and management. For example, Antigua already has a good laboratory and trained staff, but it is short on operating funds. It may be more cost-effective to maintain the laboratory if the volume of work increased and analyses were done for other countries on a fee basis.

(4) *In response to a request from farmers during Pesticide Awareness Week in 1989, the Ministry of Agriculture should develop a Pesticide Certification Program that would provide training on the safe use of biocides.* Agricultural extension agents and representatives of local NGOs and farmers organizations should be trained to certify farmers in the safe use of biocides. Training programs should emphasize the use of visual instructional methods (e.g., videos rather than lectures) and should make a concerted effort to involve the children of farmers through schools and youth clubs. Pest control operators who spray buildings and the environment to control insects should also receive training in the safe use of biocides (DeGeorges, 1989b).

In conjunction with this program, agricultural extension agents could develop the necessary expertise to assist farmers in adopting practices that require less use of more expensive and potentially harmful chemicals. Agricultural practices that rely more on organic farming methods could be environmentally and economically advantageous. They tend to make more efficient use of limited water resources because the improved soil structure holds water better (OTA, 1988). Integrated Pest Management programs -- whereby pests are controlled through a program of biological and cultural practices supplemented by judicious use of chemicals -- can also reduce the use of pesticides. This approach was proposed by the Director of Agriculture in a recent workshop on Integrating Conservation and Development (Henry, 1990). Collectively, these low-input techniques could produce agricultural goods more attractive to both the local population and to tourists who have expressed concern about overuse of chemicals (EAG, 1990).

(5) *Cooperative action is needed by CARICOM members in the area of hazardous and toxic waste disposal.* The disposal of hazardous wastes and toxic substances is a situa-

tion where it is not only critical but appropriate that the CARICOM member states act in a unified and coordinated manner. A regional solution is probably the only one capable of protecting all countries -- large and small -- in the region. As industrialized countries increasingly attempt to "export" their hazardous and toxic wastes to the developing world, it is possible that CARICOM members will be played one against another in an attempt by industrialized countries to escape the more excessive regulatory regimes at home. CARICOM countries need to explore and identify common approaches which will protect all by establishing standard criteria and setting uniform standards for the permitting of various kinds of offshore waste disposal activities in the region (Michael, 1990b). This issue could require the cooperation and participation of CCA and CEHI, among others.

(6) *An oil and hazardous materials spill contingency plan should be prepared and implemented.* Additionally, legislation is needed to require proper disposal of waste automotive oil and other hazardous materials, and facilities to accomplish this must be provided.

## SECTION 7 LAND USE, PLANNING AND DEVELOPMENT CONTROL

### 7.1 OVERVIEW

Organized physical planning and development control were introduced to Antigua and Barbuda in the 1970's by a United Nation's Development Program (UNDP) Physical Planning Project for the Eastern Caribbean. Since then, the country's performance in land use planning and development control has had mixed results. Systemic weaknesses are primarily responsible for the limited effectiveness of the Development Control Authority (DCA) and the Physical Planning Office (PPO), the Government bodies mainly responsible for development control and planning.

Notwithstanding these weaknesses, however, an institutional structure for land management does exist and could be upgraded with some effort. At the same time, the effects of rapid tourism growth and a disorderly process of urbanization point to the urgent need for improving land use planning and development control functions in the country.

#### LAND CAPABILITY

Land use planning provides a framework for the rational use of land in accordance with its physical and productive capacities. There is no known attempt at a systematic analysis of land capability for Antigua and Barbuda prior to the 1960's. Hill (1966) did a comprehensive soil survey of Antigua, while Vernon, Lang and Hill (reported in Hill, 1966) carried out a similar survey of Barbuda. On the basis of these surveys, a land capability system was devised and later described in a report entitled *Soil and Land Use Surveys Antigua and Barbuda* (Hill, 1966).

Almost two decades later, Ahmad (1984), an OAS consultant, built on this work by describing the land capability classes and producing a land capability map. Ahmad was asked to adapt his land capability system to the I to VIII class format used by the U.S.

Department of Agriculture (see also Section 1.2.3 of the Profile).

Essentially, lands are grouped into the eight classes on the basis of soil type and environmental limitations to mechanized agricultural use. Limitations do not exist for Class I lands, which are very good for cultivation, but limitations increase progressively through Class VIII lands, which are considered not suitable for cultivation. The system highlights the importance of retaining non-agricultural lands (i.e., those lands with the severest limitations for agriculture) for other uses such as wildlife habitat, water conservation, recreation, and undeveloped landscape.

One of the shortcomings of using the land capability system to plan future land uses is the absence of fully assigned values for non-agricultural uses. Policy makers may be easily misled into assuming that non-agricultural lands are of low value because they are not "productive" and that therefore there is little or no loss to the country if they are developed. Such decisions ignore the fact that non-agricultural lands may be extremely valuable in an undeveloped state, for example, as a wildlife refuge which protects habitat and biodiversity while perhaps simultaneously attracting nature tourism revenues.

Table 1.2(2) shows that just over 40 percent of the lands in Antigua are grouped in Classes II and III, i.e., land which can be cultivated with moderate to strong limitations. Class IV and V lands, representing an additional 22 percent, are suitable for tree and orchard crops and pasture.

#### CURRENT PATTERNS OF LAND USE

Ahmad's (1984) land classification work formed part of a larger OAS effort that also included the development of a Geographic Information System (GIS) for the country (Wirtshafter, 1987). An attempt by

OAS (1990) to provide a comparative analysis of land use data derived from available sources for 1961, 1964, 1975 and 1985 indicated there were major inconsistencies in categories or classifications used and therefore also in the end product of the analysis. The results of the GIS data from the 1985 OAS survey are simplified in Table 7.1(1).

Nevertheless, despite the discrepancies, all data point to a significant decline in acreage used for sugar cane from 22,371 acres in 1964 to a few hundred acres by 1975. Much of the former sugar land is now used to graze livestock, especially by landless cattle owners. According to OAS (1990), grazing of unimproved pastures now occurs on some 17,000 acres. Uncontrolled grazing in scrub lands hinders forest regrowth and is a major reason for the dominance of Acacia scrub lands in sections of Antigua. Goats, which are particularly destructive to vegetation, number more than 9,000 in Antigua and 200 in Barbuda

(GOAB, 1989b).

OAS mapping for Antigua was done at scales of 1:25,000 and 1:50,000. A land use map prepared earlier by DCA was done at a scale of 1:50,000 and was apparently revised in 1977. It was reproduced in a more simplified form in 1980 (see Figure 7.1(1)) by the Eastern Caribbean Natural Area Management Program (ECNAMP) as one of a series of resource data maps prepared for Antigua (ECNAMP, 1980a).

OAS also produced a land use map for Barbuda, at a 1:50,000 scale (Ahmad, 1984). Residential settlement is confined to Codrington, occupying only about 269 acres. The large dry forest area of the limestone highlands (19,521 acres) remains largely untouched by development. Swamps and mangroves occupy 9,214 acres, attesting to the relatively undeveloped state of Barbuda.

Table 7.1(1). Land use in Antigua, 1985.

Category	No. of Acres
Agricultural - Crop	5,501
Agricultural - Livestock	
Improved pasture	2,364
Rough grazing	16,907
Mixed scrub and rough grazing	6,981
Woodland	
Volcanic areas	15,190
Limestone hills	8,455
Rural Areas	1,819
Urban Areas	4,808
Industrial Areas	381
Tourism - Hotels, Golf Courses	1,133
Recreational and Historical Areas	714
Airports and Military Installations	935
Dams and Reservoirs	635
Swamps, Mangrove, Beach Sand	2,164

Source: OAS, 1990.

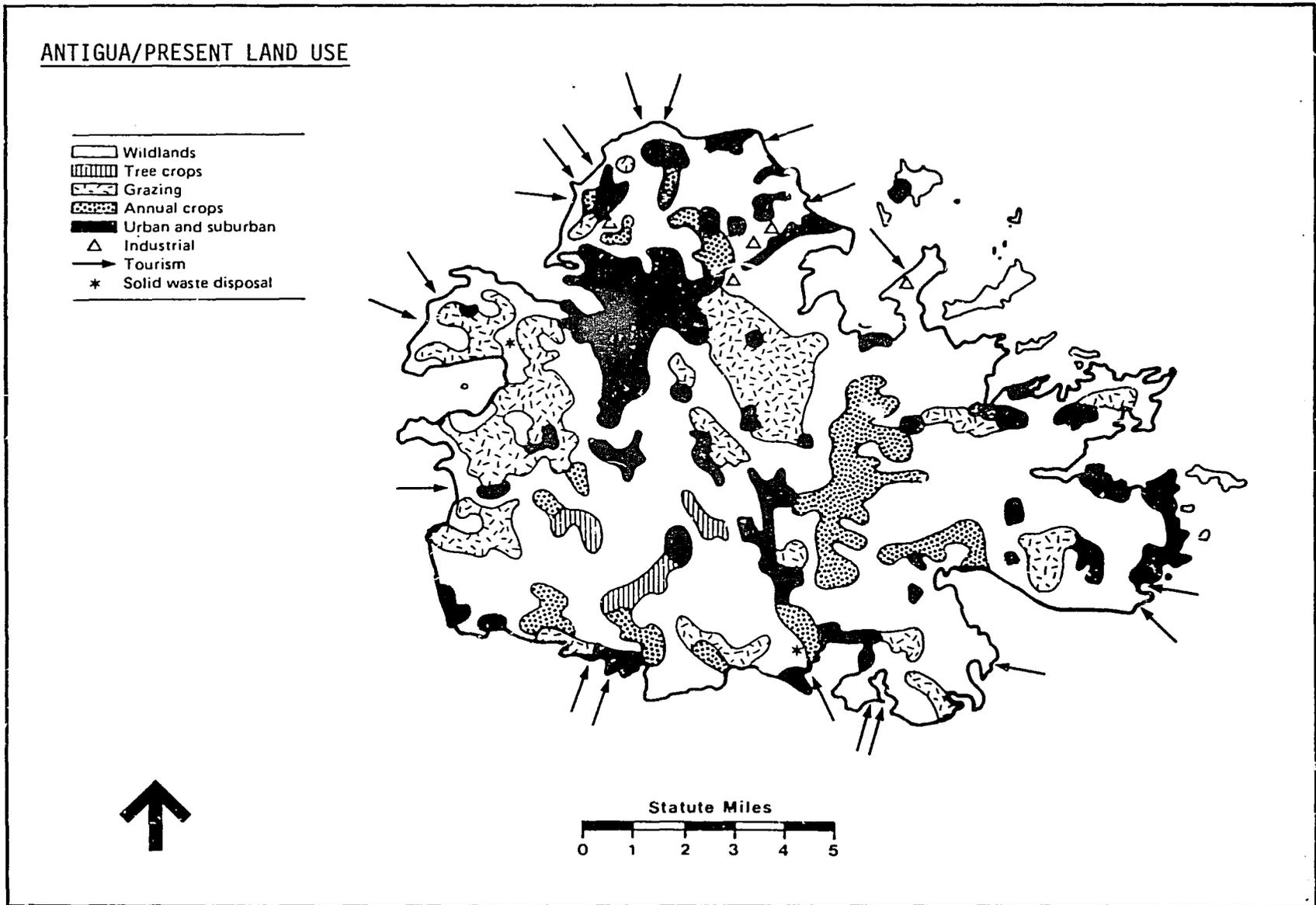


Figure 7.1(1). Antigua land use from physical development plan prepared by the Planning Office, 1977 (source: ECNAMP, 1980a).

The OAS data indicate that less than one percent of land in Barbuda is occupied by human settlement and other structures, compared to roughly 12.5 percent in Antigua. Residential and tourism growth were key factors influencing land use patterns in Antigua in the 1980's. Village expansion schemes are noticeable in several communities. Several settlements previously considered rural are becoming increasingly urban.

Unfortunately, urban expansion in Antigua and Barbuda has taken place without sufficient emphasis on urban planning; the result has been a pattern of disorganized growth. In addition, Government development authorities often fail to provide residential lots to potential homeowners in a timely manner, which has resulted in squatting on state lands.

## DEVELOPMENT CONTROL

Development control is the responsibility of the Development Control Authority (DCA), created by the Land Development (Control) Act No. 15 of 1977. The law provides for the preparation of a National Physical Development Plan, which should in turn provide the policy framework for development control decision-making. A draft plan was prepared in 1976 with the assistance of UNDP but was not approved by Government and is not in force.

The DCA is a regulatory body with a weak public image due, in part, to its inability to effectively enforce the law it is charged with implementing. Penalties for contravening the law are weak, and staffing deficiencies prevent effective surveillance and enforcement. Deliberate circumvention of the DCA's authority occurs. In practice, major tourism development applications are approved by Government before being reviewed by the DCA.

The number of building applications submitted to the DCA yearly has been increasing since 1982, following a sharp reduction from 1981 (See Table 7.1(2)). The mean value of the applications for new buildings and extensions fluctuated between 1981 and 1988. However, while the mean value for 1981 was

about EC\$45,000, that for 1988 was over EC\$200,000. Inflation may be partly responsible for a higher mean value of development projects in 1988. However, the major reason for the difference is that the size of the average development for 1988 was larger than that for 1981.

The larger size of development projects means that more time is required to review development applications and inspect buildings once construction has commenced. On the basis of the data provided in Table 7.1(2), it can be assumed that the demands on the staff of the Physical Planning Office (which serves as the staff of the DCA) and on the DCA Board, relative to the review and monitoring of development applications and development projects, have grown steadily between 1982 and 1988. There was not, however, a corresponding improvement in the capacity of both bodies to deal with the increased work load; the result has been a weakened development control process in the state.

Records are not kept on the percentage of applications actually approved with construction carried out. The non-computerized information system maintained by DCA does not allow easy access to stored data. In 1988 the DCA reviewed an average of 91 applications per month, a load considered too heavy for its small technical staff. Development surveillance is carried out by two Building Inspectors.

The structure and function of the DCA resemble those of similar agencies in the OECS. It is a statutory body responsible to a Government Minister, in this case, the Minister of Agriculture, Fisheries, Lands and Housing. An ideal (or even appropriate) composition for the DCA Board would be one which provided for the widest possible inter-agency review of development applications, in order to determine and respond to the potential demands placed on health and basic infrastructure services by proposed projects and to evaluate the impacts on prime agricultural lands, key resources and sensitive environmental areas. Unfortunately, the DCA Board does not have such broadly-based representation.

Table 7.1(2). Number of building applications and estimated value, 1981-1988.

Year*	Number of Applications	Estimated Value (EC\$)
1981	919	41,313,055
1982	457	43,727,463
1983	557	60,402,960
1984	585	49,527,617
1985	816	61,964,649
1986	879	80,656,500
1987	1,022	163,223,200
1988	1,096	221,886,699

Note: \* Time lag of up to 2 years between application for building and commencement of building.

Source: Development Control Authority.

The Central Board of Health (CBH), the Public Works Department (PWD) and the Physical Planning Office (PPO) are represented on the DCA. Noticeably absent are the Department of Agriculture and the Antigua Public Utilities Authority (APUA). There is no effective coordinating mechanism to protect prime agricultural land from expanding urbanization or to ensure that the supply of basic infrastructure services keeps pace with expanding demands from approved development projects. Other bodies whose representation on the DCA Board could improve land use in Antigua and Barbuda are the Lands Division in the Ministry of Agriculture and the St. John's Development Control Corporation.

The DCA relies on the Physical Planning Office for the technical and administrative support needed to carry out its functions. The PPO is headed by a Chief Town and Country Planner, who sits on the DCA Board but reports to the Permanent Secretary in the Ministry of Agriculture, Fisheries, Lands and Housing. DCA meetings are held monthly but are not well attended. A thorough review of major development appli-

cations does not occur in the absence of key technical inputs from relevant agencies. For example, the technical presence of the CBH at DCA meetings is needed to confirm that adequate sewage pollution control measures will be employed by proposed projects.

Decisions are guided by the Land Development and Building Guidelines prepared in 1976. These guidelines provide standards for plot coverage, building density, height and setback, parking, road alignment and width, septic tank design, etc. Plot coverage and setback provisions are most difficult to enforce in St. John's and shorefront resort areas because of their comparatively higher land values.

A major weakness in the development control system is the lack of procedures for analyzing the environmental impact of development projects. The law does not prescribe the use of environmental impact assessment (EIA) reports, and the DCA itself has never attempted to make it a requirement of its application review process. Three EIAs on tourism-related projects were commissioned by the Ministry of Economic Devel-

opment in 1986-87 and one by the Ministry of Agriculture in 1987. None of the EIA reports were reviewed by the DCA, further evidence of the irregularities and lack of standard procedures in the development control process.

The larger institutional structure for land management in Antigua and Barbuda includes several other agencies besides the DCA (see Table 7.1(3)). Unfortunately, there is an overlap and in some cases duplication of responsibilities among these agencies. For example, the Central Housing and Planning Authority (CHAPA) at one time functioned as the Government's main residential land delivery agency, facilitating low income housing as well as the sale of land to other income groups. In recent times, the Ministry of Agriculture, through its Lands Division, has assumed responsibility for the sale of Government lands for residential purposes in some areas. The importance of CHAPA as a land delivery agency has consequently diminished, although it maintains a staff of about thirty persons. If there is any effective cooperation or coordination between CHAPA and the Lands Division, it is not clear. The land delivery system is made even more complex and inefficient because parliamentary representatives are involved in the endorsement of lot sales to various individuals. For all of these reasons, Government-owned lands are too often developed in a very disorganized, *ad hoc* manner.

The National Parks Authority has the power to control development in the country's only declared national park, Nelson's Dockyard National Park. Figure 7.1(2) provides a summary of the development review process that should be followed -- but is not -- with respect to development activities within the Park's boundaries. In fact, the NPA does not exercise effective control of development in any area of the Park except within Nelson's Dockyard itself (see also Section 8, National Parks and Protected Areas).

The Physical Planning Office was intended to function as a separate entity from the DCA, although it was envisioned that its staff would process development applications for review by the DCA in enforcing the provisions of the Land Development (Control) Act.

The stipulation in the Act that a development plan for Antigua-Barbuda should be prepared by the DCA as a "policy guide" for land development and control is somewhat in conflict with the intended responsibilities of the PPO which was set up as the agency directly accountable for long term physical and land use planning. The result is that there is little or no distinction between the DCA and the PPO. At present, the PPO is solely occupied with development control matters, at the expense of long-term planning.

The St. John's Development Corporation was established by Government in 1986 and charged with responsibility for overseeing the revitalization of downtown St. John's through urban renewal and development schemes. It also has responsibility to assist with the improvement of waste management infrastructure in St. John's but currently does not have the capacity to do so because of staffing and budgetary limitations. Current plans call for street improvements and reorganization of traffic patterns, conservation of buildings of historical and architectural interest, revitalization of the Market Esplanade, improvement of parking, and creation of pedestrian-priority streets.

## INTEGRATED FORWARD PLANNING

Most development planning completed for Antigua and Barbuda has been done with the assistance of international or regional agencies. The small staff of the PPO operates with technical limitations and has been more involved with routine building control functions.

UNDP provided fairly comprehensive assistance in physical planning in the 1970's as part of its Physical Planning Project for the Eastern Caribbean. The DCA and the PPO were created as a result of the UNDP project, and a Draft National Physical Development Plan, the Territorial Plan T1, was prepared but was not approved by the Government. A major limitation of the Plan is the limited treatment of both the opportunities and constraints for development associated with the country's natural resource base. As an example of the inadequate focus on resource

Table 7.1(3). GOAB agencies with land management functions.

AGENCY	FUNCTIONS
Development Control Authority (DCA)	Development application review and approval; development surveillance.
Physical Planning Office	Land use and physical planning; development control administration and technical input to DCA.
Land Division, Ministry of Agriculture	Planning and allocation of Government lands for residential, agricultural and other land use purposes; administration of GOAB land leases and rentals.
St. John's Development Corporation	Upgrading of downtown St. John's through urban renewal and implementation of other development projects (e.g., Heritage Quay, a tourism shopping, accommodations and cruise ship berthing complex).
National Parks Authority (NPA)	Development and management (including development control) of national parks, at present limited to Nelson's Dockyard National Park; a development application process is displayed in Figure 7.1(2), but it is not used.
Antigua and Barbuda Port Authority	Development and management of lands at St. John's Deepwater Port.
Central Housing and Planning Authority (CHAPA)	At one time functioned as Government's primary residential land allocation agency, but some of its functions have been assumed by the Lands Division, Ministry of Agriculture; also implementation of low income housing schemes.
Ministry of Trade, Industry and Commerce	Management of Industrial Estates at Coolidge and Cassada Gardens which formerly were the responsibility of the Industrial Development Board; functions transferred to newly created Ministry of Trade, Industry and Commerce in July 1990.

issues, the Plan designated 4,985 acres (OAS calculation) as "unproductive" land. The so-called "unproductive" land included areas which had some environmental potential (e.g., as wildlife habitats, fresh water catchments). From an environmental perspective, land is never unproductive.

A report, *Antigua The Environment*, was prepared in 1976 to supplement the Territorial Plan T1. The report sets general land use guidelines for conservation and development of the Fort James/Dickinson Bay and the English Harbor/Falmouth areas.

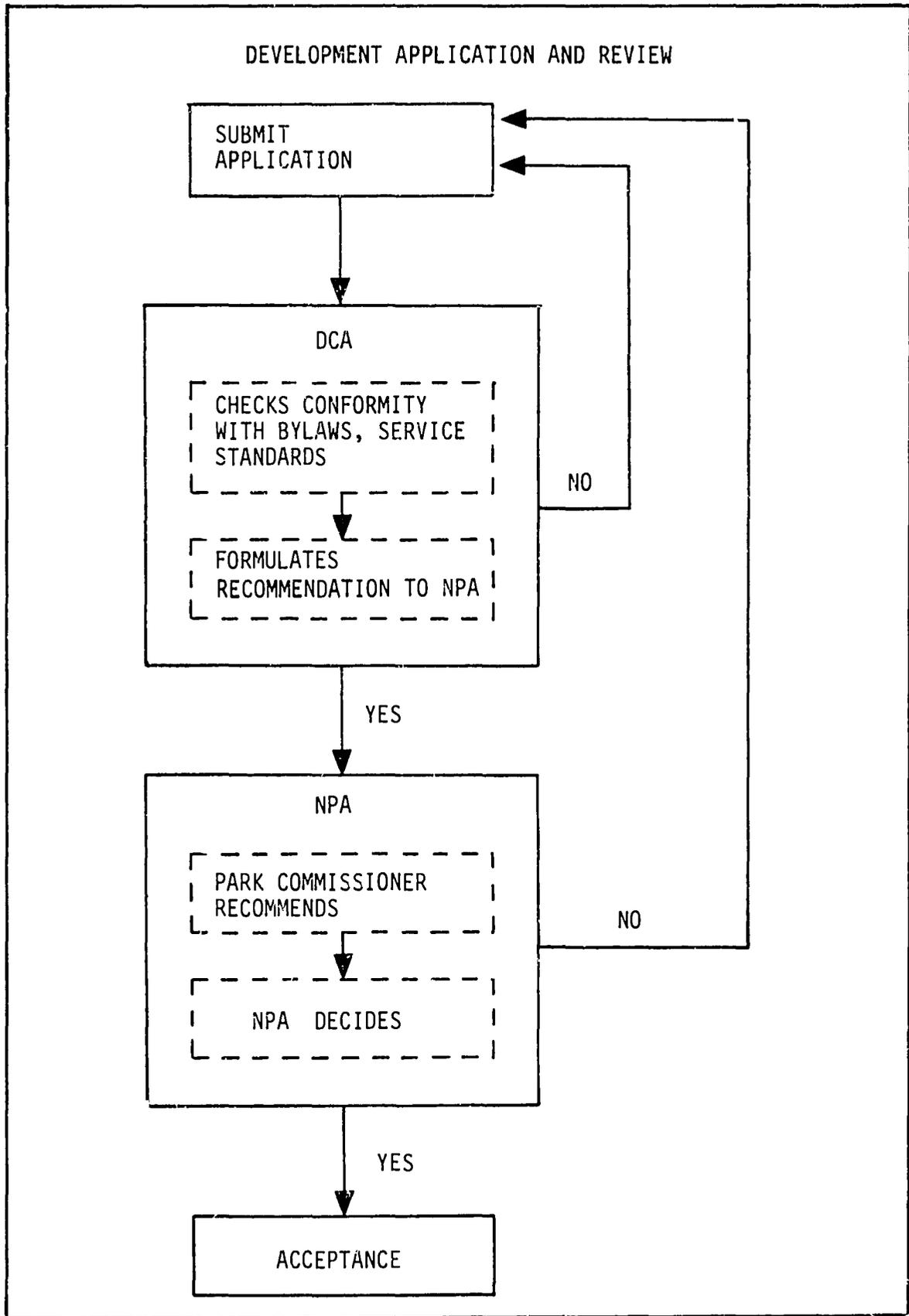


Figure 7.1(2). Hypothetical process for review of applications for development projects within the Nelson's Dockyard National Park (source: DPA Group Inc., 1985).

No attempt to upgrade the national physical development plan has been made since the work done in the mid-1970's, although the PPO was recently advised by the Minister of Agriculture to do so. The PPO, with assistance from the OECS Natural Resources Management Project (NRMP) is undertaking Phase 1 of a Land Use Management Scheme, which includes the mapping of existing land use information at scales of 1:2,500 and 1:5,000 for Antigua and Barbuda. The list of land use categories has been expanded beyond that used for the Territorial Plan T1, with more attention paid to natural resources. It is expected that these large-scale land use maps will facilitate development control and that composite 1:10,000 maps will be prepared to provide the basis for evaluating future land use proposals.

CIDA, in providing assistance to the National Parks Authority through the DPA Group, Inc., has mapped land uses in its preparation of a Draft Plan for Nelson's Dockyard National Park, an area which covers approximately 12 square miles. Volume I of the Draft Plan (Park Development Plan) sets out a land use framework for integrating conservation and development in the Park, and Volume II (Park Management Plan) details the policy framework to guide future land use for the Park. The Plan was approved by Government, but the NPA currently lacks the institutional capacity to implement its provisions.

OAS, as a part of its Natural Resources Assessment for Agricultural Development (NRAD) Project, focused much of its work in Antigua-Barbuda during the 1980's on land use planning as it relates to agriculture. The NRAD project commenced in 1984 and was motivated by the need to ameliorate problems identified as constraints on further development of the agriculture sector. The project provided invaluable inputs to future land use planning in the country by generating data from studies on land capability, land use, water resources, and human settlements. Data have been converted into a GIS system, and applications could help to optimize the economic potential of the agricultural sector. The project's final report presents a basis for

development of a national policy and strategy for agriculture (OAS, 1990).

OAS also provided technical support for upgrading the St. John's area through its St. John's Revitalization Project. Its efforts assisted Government in the establishment of the Heritage Quay waterfront development project and in the creation of the St. John's Development Corporation. GOAB secured additional financing for the Heritage Quay project, for extension of the St. John's Harbor deep-water basin, and for creating new waterfront lands by landfilling.

## 7.2 PROBLEMS AND ISSUES

### GOAB PLANNING COORDINATION

The current approach to planning, which isolates the various departments, agencies, and statutory bodies involved in GOAB planning activities, is not a cost-effective strategy for utilizing external technical assistance and funding or for achieving national planning objectives. External support has facilitated a number of important forward planning initiatives, but there is no formal institutional mechanism to allow sharing of technical assistance benefits, support, and expertise across departmental or ministerial lines. The Physical Planning Office, for example, was only peripherally involved with the OAS projects (for the agricultural sector and for St. John's revitalization) and with CIDA planning activities on behalf of the Dockyard National Park. The CIDA project in particular provided an excellent opportunity for shared training in land use planning and in park development and management -- skills which could have benefited PPO staff. However, due to the manner in which the project was structured, the sole potential beneficiary of the training was the National Parks Authority which, unfortunately, did not have the local staff to take full advantage of the opportunity afforded by CIDA's assistance.

Similarly, more substantive involvement of the PPO in the OAS Revitalization Project for St. John's would have enhanced its

urban planning capacity and set the stage for more effective cooperation between the St. John's Development Corporation (SJDC) and the national physical planning agency. The Corporation has no significant technical capacity of its own, but, with suitable coordination mechanisms in place, SJDC could utilize not only the planning skills of the PPO staff but also the engineering expertise of the Public Works Department in carrying out its mandate for St. John's.

A lack of both formal and informal coordination links between the Economic Planning Unit (EPU) in the Ministry of Economic Development and the PPO (in the Ministry of Agriculture) is an important illustration of structural weakness in the national planning machinery. The failure of the EPU to coordinate economic development planning so as to provide for input from other GOAB agencies was underscored by participants at a recent (March 1990) CCA/IUCN-sponsored workshop on conservation and development (carried out under the local auspices of the Historical, Conservation and Environmental Commission and the Environmental Awareness Group). In a summary of views expressed at the workshop, the draft report on the proceedings states that plans and projects are completed by various ministries in relative isolation and that effective "coordination could be achieved by strengthening the overall coordinating, planning and implementation capacities of the Economic Planning Unit" (Jackson, 1990).

#### **SQUATTING AND UNPLANNED SETTLEMENTS**

Squatting on Government (Crown) lands in Antigua-Barbuda dates back at least three decades and is the result of a number of interrelated factors. In the first place, Government is the largest land owner in the country, and it is attempting to sell certain lands to individuals for private residences. Would-be land buyers are often frustrated by the sluggish nature of the public land delivery system but, at the same time, are either reluctant or incapable of purchasing land on the private market where prices are higher. Some turn to squatting as a last resort and are usu-

ally "rewarded" in their illegal actions by gaining access to land because penalties for squatting are rarely applied.

The major environmental problem related to squatting in rural areas has been the loss of productive Class II and III agricultural lands. Additionally, these unplanned settlements impose a financial burden on the Government which is expected to provide basic infrastructure services for such developments.

In urban areas, the problems posed by unplanned settlements are mostly related to public health issues. In the densely-populated slum neighborhoods of Grays Farm and Green Bay in St. John's, several houses may exist on one privately-owned parcel. Congestion leads to unsanitary conditions, particularly where privy and pail or bucket closets are used for excreta disposal (PAHO, 1985; Michael, 1990b). Archer (1988) draws a link between such conditions and the high incidence of gastroenteritis reported for Grays Farm in 1987. Out of a total of 1,207 gastroenteritis cases seen and reported at the Holberton Hospital for that year, 386 (32 percent) were from Grays Farm.

The deplorable slum conditions of sections of Grays Farm and Green Bay are not likely to be relieved anytime soon because the area offers perhaps the cheapest possible rents to migrant workers. In fact, the community could experience further urban decay because the new coastal road linking St. John's to resorts in the Deep Bay section bypasses the area.

#### **UNCONTROLLED COASTAL DEVELOPMENT**

Recent tourism developments have caused major changes or alterations to coastal wetlands at Jolly Beach, Deep Bay, the Cove and McKinnons Pond. The Cooks salt flat has been used to deposit spoil from the dredging of St. John's Deepwater Harbor and the Deep Bay salt pond. The accumulated effect of these developments is a substantial physical change in Antigua's west coast environment. However, underlying ecological impacts are

not as easily discernible or understood as simple observation of physical change, one reason being that the lack of baseline data makes it difficult to measure ecosystem change.

Degradation of several important wetlands just within the last four years points to systemic weaknesses in planning for and control of coastal land uses. Construction of buildings in the active beach zone and ineffective provisions for waste management have led to beach erosion and the deterioration of coastal water quality, as evidenced in the Dickinson Bay area. The fate of the remaining wetlands in Antigua is questionable. There is no wetlands policy, and it is not clear which Government agency has direct responsibility for this resource. Unless appropriate institutional mechanisms and policies for the protection and management of wetlands are put in place very soon, it is quite possible that most coastal wetlands will be destroyed within a short period of time. It is not the private sector alone which has been involved in activities which have degraded wetland areas. For example, in 1987 the Government filled a section of the mangrove swamp at Falmouth Harbor with the intention of developing what was called an "aqua marine park". Community objections were raised against the project, but not for environmental reasons. Rather, persons living adjacent to the swamp felt they should be given rights to reclaim and develop the coastline. The aqua marine park project has been put on hold, but the larger issue of conflicting priorities for the future of the mangrove swamp has not been resolved.

### **BUILDING ON SLOPES**

Building on slopes has increased in Antigua, but the country's relatively gentle topography reduces the extent of the problem when compared to the Windward Islands or the Virgin Islands. In a sense, hillside construction is a rational approach to land utilization in Antigua since the use of marginal lands for housing helps to preserve the more fertile flat lands for agriculture.

In practice, however, the indiscriminate clearing of lots with bulldozers leaves bare soils exposed to wind and rain. Cutting

roads to new subdivisions against land contours also creates soil instability that leads to erosion. Although erosion caused by land-clearing activities on hillsides has not been directly linked to damage of marine resources, this may already be occurring and certainly will be a problem in the future if such practices continue.

Building on slopes should not be discouraged. Rather, effective guidelines are needed to limit the removal of forest cover and to reduce the amount of soil removed from construction sites. In cactus/scrub vegetation zones, the problem could be addressed through the establishment and enforcement of development control guidelines, coupled with more extensive public education efforts. Guidelines could be prepared for inclusion in a modest soil conservation manual that could be made available to architects, engineers and developers. Improved soil conservation practices in construction could be encouraged by use of the manual, and its guidelines would need to be enforced and monitored by DCA.

### **7.3 POLICY RECOMMENDATIONS**

*(1) Update the National Physical Development Plan.*

The national physical development plan should be updated, using a consultative process involving all relevant agencies whose functions relate to land use and land management. The DCA is required by law to prepare a National Physical Development Plan, but coordination of the planning process, the writing of the plan document, and preparation of land use maps should be the responsibility of the Physical Planning Office, working on behalf of the DCA. Furthermore, the PPO, in its capacity as technical staff for the DCA, should be responsible for the coordination of all physical and land use planning initiatives at the national level, with the involvement of other agencies as appropriate. Finally, in order to have a real impact on planning and development control practices, the National Physical Development Plan would need to be submitted to Government for official approval and adoption as a policy instrument to guide

future land use and physical development in the country.

Perhaps the most important condition for sustainable development is that environmental *and* economic concerns be merged in the decision-making process, as they are in the real world; otherwise even the best land use planning efforts are doomed to fail. To this end, the coordination linkages between the Economic Planning Unit and the Physical Planning Office need to be improved, particularly if the PPO moves ahead with the preparation of an updated physical development plan.

The Physical Planning Office will require technical support to undertake a full land use planning project. Such support could be requested from an appropriate development assistance agency with a specific request that training to improve the technical and administrative capacity of the PPO for land use planning be made an integral part of the assistance package. Secondly, selected staff from other agencies to be involved in a national physical planning effort would also benefit from such training.

#### *(2) Upgrade the Development Control Authority.*

A number of policy initiatives or changes are required to improve the effectiveness of the Development Control Authority. These include:

- Enhancement of the Authority's image in the country by building public support for its functions;
- Strengthening DCA's Board to provide for better inter-agency representation in the development review and control process (for example, the Department of Agriculture and the Lands Division, both within the Ministry of Agriculture, plus the Antigua Public Utilities Authority should be represented on the DCA Board);

- Strengthening the surveillance/monitoring capacity of the DCA by creation of an enforcement arm within the PPO (which would require staffing changes and increased personnel in the PPO);
- Strengthening the legal authority of the DCA to monitor and enforce its decisions for land use changes (for example, the DCA needs to have the authority to require other GOAB agencies to comply with its rulings).

#### *(3) Improvement of the Land Delivery System.*

Government should develop a clearer, more specific policy on the distribution of public lands to persons in need. The policy should stipulate what institutional reforms are required for a more efficient land delivery system. Notably, changes are needed in the procedures for applying and receiving approval for land, payment provisions, and the expeditious survey of land subdivisions. An improved land delivery system would help to reduce squatting and facilitate better organization in the development of new or the expansion of older settlements.

#### *(4) Steps to Minimize Impact of Coastal Developments on Coastal Resources.*

The impacts of tourism-related development on coastal resources, particularly on the west coast, should be addressed by a combination of coastal planning, resource assessment and monitoring, and strict development control. Area-specific plans for the Dickinson Bay/Fort James area, the Deep Bay Resort/Five Islands area, and Jolly Beach should be considered as a means to minimize future conflicts in land use and to limit further resource degradation.

Legislation is needed to require the preparation of Environmental Impact Assessments for major projects in the coastal zone and other critical areas identified in this Pro-

file. An important consideration in developing legislation to require EIAs is the fact that the EIA process represents a positive step in the direction of improved inter-agency coordination. Formal EIA requirements would force a more holistic integration of technical data and expertise, while at the same time guaranteeing more systematic input into pro-

ject planning across department lines. Appropriate standards for various classes of development projects should be included in the legislation. An institutional capability for interpreting, and later carrying out, the technical aspects of environmental impact assessment needs to be created within the PPO and other appropriate GOAB agencies.

## SECTION 8 NATIONAL PARKS AND PROTECTED AREAS

### 8.1 OVERVIEW

Establishment of a formal System of National Parks and Protected Areas would provide both conservation and economic benefits for Antigua and Barbuda. A strategically planned system could preserve and enhance prime landscapes and selected habitats for recreation, tourism, education and science, and maintain the country's biological diversity of flora and fauna.

The institutional framework for a parks and protected areas system has already been established in the form of the National Parks Act of 1984 that created the Antigua and Barbuda National Parks Authority (NPA). NPA's function is to "preserve, protect, manage and develop the natural physical and ecological resources and the historical and cultural heritage of Antigua and Barbuda". Only one park -- Nelson's Dockyard National Park -- has been established by the NPA.

The National Parks Act of 1984 does not provide a definition for the term "national park" and makes no provision for other categories of protected areas. It is assumed that any area to be protected under this legislation must use the generic label "national park". This, as is discussed later in this chapter, is somewhat restrictive and inflexible if Antigua and Barbuda intends to develop a full parks and protected areas program.

#### EXISTING PARKS AND PROTECTED AREAS

**Nelson's Dockyard National Park (NDNP).** The Park comprises 8 percent of Antigua and Barbuda's land mass (see Figure 8.1 (1) and Table 8.1 (1)) and has both marine and terrestrial components. The land acreage given by the NPA for the park is 15 square miles or 3,885 ha (pers. commun., E. James, Parks Commissioner, 1990) compared to a figure of 12 square miles (3,108 ha) for the entire park cited by OAS (1988a). The ma-

rine acreage has not been calculated but extends out to the limit of the territorial sea (pers. commun., E. James, Parks Commissioner, 1990).

The National Parks Authority received valuable assistance from CIDA to establish the Dockyard National Park, including support for a broadly-based public consultative and participatory process. In Phase I of the park development program, CIDA focused much of its effort on providing organizational support for and institutional strengthening of the NPA, but it also repaired the docking (berthing) wall at the Dockyard and upgraded electricity and parking, for a total investment of Can\$2.36 million (Arthur Young, 1989).

The primary focus of development activities during Phase II is on upgrading basic infrastructure services and facilities to increase Park visitation. CIDA will provide Can\$5.0 million for a number of projects including a 6,000 square foot Interpretation Center at Dow's Hill, a sewer system for Nelson's Dockyard, and upgrading of the water supply system, trails and signs. This funding will be augmented by NPA which is using its own funds to execute a number of smaller projects.

A major objective for managing the Park is to create a world class tourism destination based on the strength of the Park's historical and natural resources (The DPA Group Inc, 1985). The Park includes areas of impressive landscape and scenic values as well as a unique historic restoration (see also Section 9 of the Profile). A 1989 estimate suggests that 20 percent of cruise passenger arrivals to Antigua, 19 percent of stay-over visitors and 92 percent of yacht arrivals visit Nelson's Dockyard National Park (see Table 8.1 (2)).

A recent evaluation of the development program for the Park identified the

Table 8.1(1). Protected areas and their economic value.

Protected Area	Date Established	Area (Ha)	Use Economic Value
Diamond Reef Marine Park, or Salt Fish Tail Marine Park (Antigua)	1973	2,000	Some fishing, lobster and conch
Palaster Reef Marine Park (Barbuda)	1973	500	Some fishing, wreck diving, tourism
Nelson's Dockyard National Park (Antigua)	1984	3,108	Historic and cultural, tourism, yachting

Source: OAS, 1988a.

following requirements needed to take full advantage of the natural and historical resources of the Park (Arthur Young, 1989):

- (1) Development of a Core Area Master Plan to coordinate developments in the area between Falmouth Harbor and Nelson's Dockyard, which forms the approach to the main historic precinct of the Park;
- (2) Preparation of a Residential Land Use Plan for the Park to eliminate squatting, upgrade settlements and reduce environmental impacts;
- (3) Completion of a Natural Resources Inventory;
- (4) Completion of an Archaeological Survey of the Park; and
- (5) Cultural research into the African heritage related to the historic development and use of the area.

**Diamond Reef Marine Park** (also called Salt Fish Tail Marine Park). This 2,000 ha park, located in Antigua, was established in 1973 under the provisions of the Marine Areas, Preservation and Enhancement Act (No. 5 of 1972). See Figure 8.1(1).

**Palaster Reef Marine Park.** This 500 ha park, located in Barbuda, also was established in 1973 under the Marine Areas, Preservation and Enhancement Act. See Figure 8.1(2).

Neither of the two marine parks is managed as a protected area.

Two areas were proclaimed Public Parks under the Public Parks Ordinance (No. 4 of 1965): one of 690 acres (279 ha) in the English Harbor/Falmouth region and the other of 117 acres (47.3 ha) in the Long Bay/Indian Town Creek area (UNDP, 1976). The first area is now a part of the Nelson's Dockyard National Park and should, therefore, receive some measure of protection. The latter area does not receive special management or protection, and the National Parks Act of 1984 does not refer to either park.

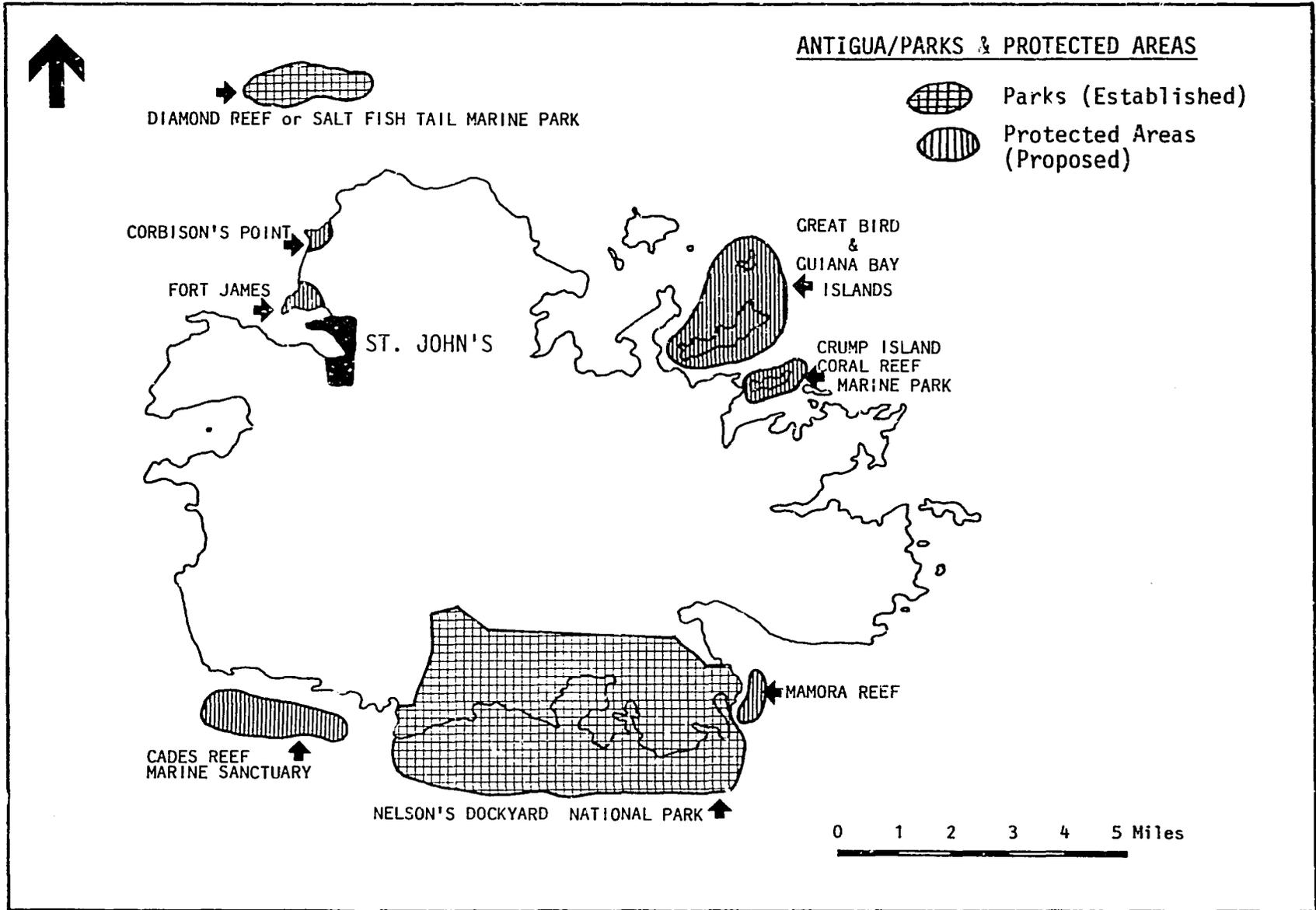
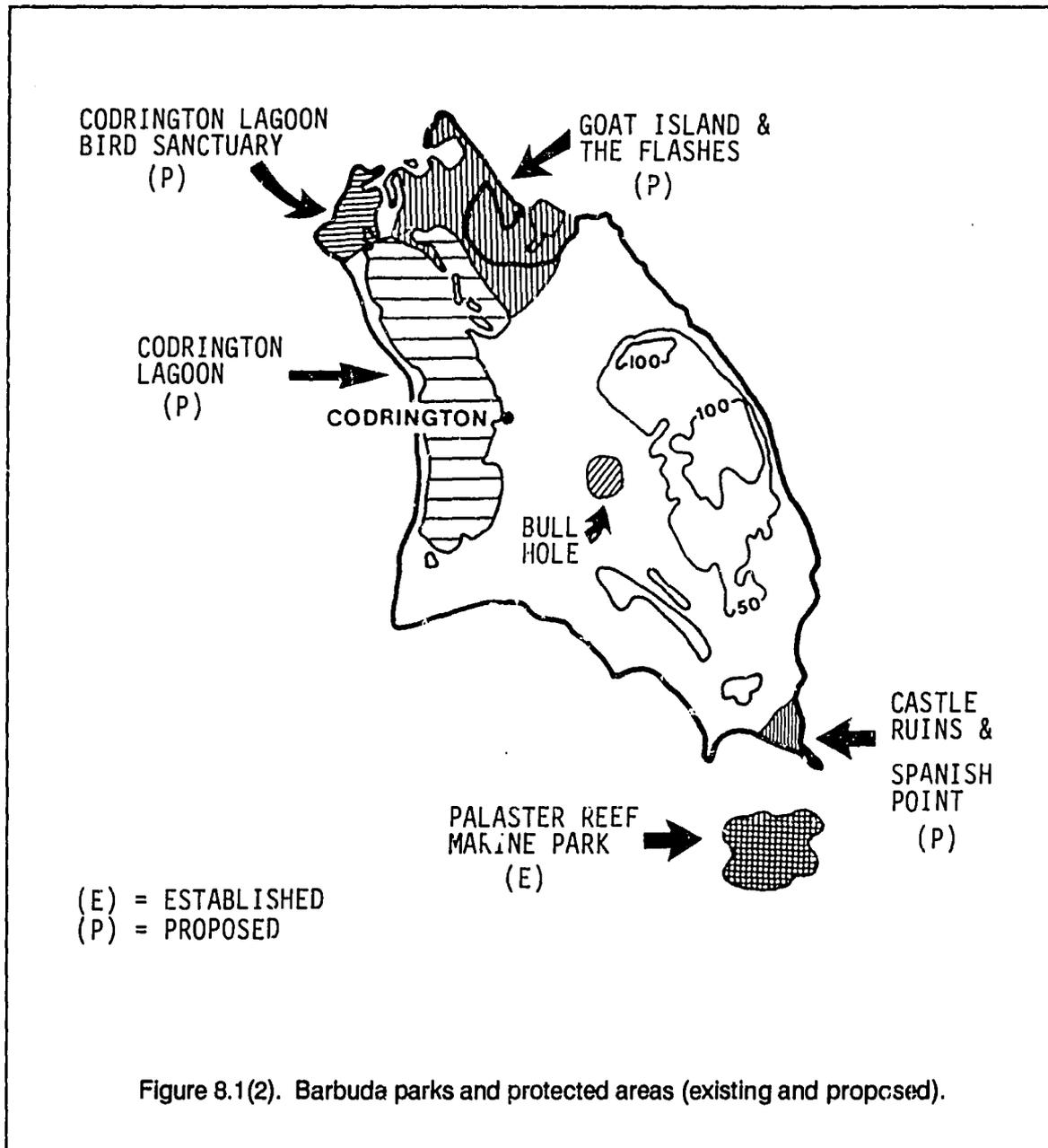


Figure 8.1(1). Antigua parks and protected areas (existing and proposed).



There is thus some degree of uncertainty over what constitutes a protected area in Antigua and Barbuda. A broad definition could include the Botanical Garden, which was created by the Botanical Gardens Ordinance in 1900. Likewise, forest reserves should be considered protected areas and managed as such. However, the Forest Ordinance (Cap. 99, 1941) and the Forestry Regulations (SRO No. 13, 1941, SRO No. 42, 1952, consolidated) are not effectively enforced. The uncertain and precarious status of forest reserves prompted one group of investigators (Miller, *et al.*, 1988) to recommend

that forest reserves for Antigua and Barbuda be re-designated and that designated reserves be surveyed and demarcated.

Some degree of legislative protection for beaches and mangroves has been attempted but without much success. The Beach Protection Ordinance (Cap. 298, 1957) prohibits removal of sand and other material from beaches without a permit from the Director of Public Works. The criteria for granting a permit are not specified in the ordinance, and, in any event, the law is not consistently applied. Furthermore, the legislation

Table 8.1(2). Estimates of park visitation, Nelson's Dockyard National Park.

Category	1985	1986	1987/88
Resident in Park:			
Local hotel visitors <sup>1</sup>	N/A	N/A	22,234
Yacht visitors <sup>2</sup>	11,000	12,000	13,382
Other Tourists:			
Cruise Ships	34,000	53,000	31,496
Stay-overs			11,746
Antiguan Residents <sup>3</sup>	N/A	N/A	936
	45,000	65,000	79,794

Notes: <sup>1</sup> Based on NPA Hotel Survey.

<sup>2</sup> Based on number of yacht calls and a mean of 5 to 5.4 persons per vessel.

<sup>3</sup> Based on NPA memberships.

Source: Arthur Young, 1989.

does not apply to Barbuda, an exclusion which is specifically stated in the law.

Recognizing the threat posed to beaches from development, the Antigua and Barbuda Cabinet issued a directive on November 30, 1988, that no private development should occur at eight beach areas, which should "remain for public purpose only". The areas so designated are: Pigeon Point, Fryes Bay, Halfmoon Bay, Fort James, Darkwood, Jabberwock, Long Bay and Morris Bay. Unfortunately, this directive could as easily be reversed by another Cabinet order and therefore has no long-term legal significance. Furthermore, it is not clear if the directive was intended to apply to privately-owned land immediately adjacent to these beaches. The ongoing construction of a house on private lands next to the beach at Pigeon Point would suggest that it does not. The directive did not make any reference to the operation of concessions at the beaches, but a small snack bar was recently constructed at Pigeon Point, and

three or four are being run at Fort James. Clarification over the true objective of the directive is needed, and better management of uses at these and other beaches seems desirable.

The Crown Lands Ordinance (Cap. 130, 1957) and the Fisheries Act (No. 14 of 1983) contain provisions which could afford protection to mangroves and publicly-owned wetlands. However, at the present time, such areas are not effectively protected.

#### REPRESENTATIVENESS

There is no fixed model that determines the degree of representation of ecosystems and species to be included within a parks and protected areas system. Maintenance of biological diversity is the cornerstone objective in many cases, and here the emphasis is placed on preserving representative samples of flora, fauna and habitats. A parks and

protected areas system may also seek to maintain outstanding scenic landscapes, geological attractions and important natural recreational assets.

The present parks system in Antigua and Barbuda does not provide adequate coverage of species, habitats and other environmental features. A generalized map of terrestrial life zones for Antigua, reprinted by ECNAMP in 1980 as part of a series of resource data maps for Antigua and Barbuda (ECNAMP, 1980a and 1980b), is provided in Figure 8.1(3). Four life zones are mapped: mangroves, cactus scrub, dry woodland and moist forest. Much of the dry woodland that existed in the English Harbor/Falmouth area prior to 1960 has been reduced to cactus scrub, but enough remains that both of these life zones are fairly well covered in the Nelson's Dockyard National Park. Moist forests also are well-represented within the Park. Most of the remaining moist forests occur in the southwest volcanic region of the country, but Faaborg and Arendt (1985) indicate that good samples also exist at the Wallings Forest Reserve and at parts of Christian Valley in the southwestern highlands. This points to the importance of upgrading forest reserve management.

The ECNAMP resource data maps also display important marine and coastal habitats; neither these habitats nor the endangered or locally important wildlife species they contain are adequately covered within existing parks. The northeast coastline of Antigua and adjacent offshore cays are particularly important for their concentration of wetlands, mangrove habitats, coral reefs, seagrass beds and seabird nesting; yet these have not been afforded protected status. Similarly, there is no legal basis for protecting the impressive biological diversity of Barbuda.

ECNAMP recommended areas for "special treatment" in both Antigua and Barbuda. The areas selected (see ECNAMP 1980a and 1980b) indicate that for Antigua the volcanic southwest and southern sections and their nearshore marine environment and the northeast and northern coastal and marine areas are vital for their representation of ecosystems, habitats, important species and

areas of outstanding recreational, historical and archaeological value. The Highlands of Barbuda and the extended marine habitats of its western and southern sides are similarly important. Barbuda's impressive number of shipwrecks also adds to its historical and archaeological significance. Thus, a much better representation of the natural and historical resources of both islands in a system of parks and protected areas is warranted.

## PROPOSED PARKS AND PROTECTED AREAS

Additional areas proposed for protection in Antigua and Barbuda, as recommended by OAS (1988a), are displayed in Table 8.1(3). OAS also proposed specific management categories for each area based on guidelines recommended by the International Union for Conservation of Nature and Natural Resources (IUCN). The IUCN categories and management objectives are described in Table 8.1(4). Figure 8.1(1) (Antigua) and Figure 8.1(2) (Barbuda) show the approximate locations of proposed parks and protected areas. In addition to those recommended by OAS (Table 8.1(3)), the following areas are included:

### Antigua:

- Fort James National Park for recreation, historic significance and protection of mangroves housing a cattle egret colony;
- Corbisons Point for recreation and history;
- Coral Reef Marine Park for ecosystem preservation and recreation.

### Barbuda:

- Goat Island Wildlife Park for wildlife protection and recreation;
- Castle Ruins and Spanish Point for historical importance.

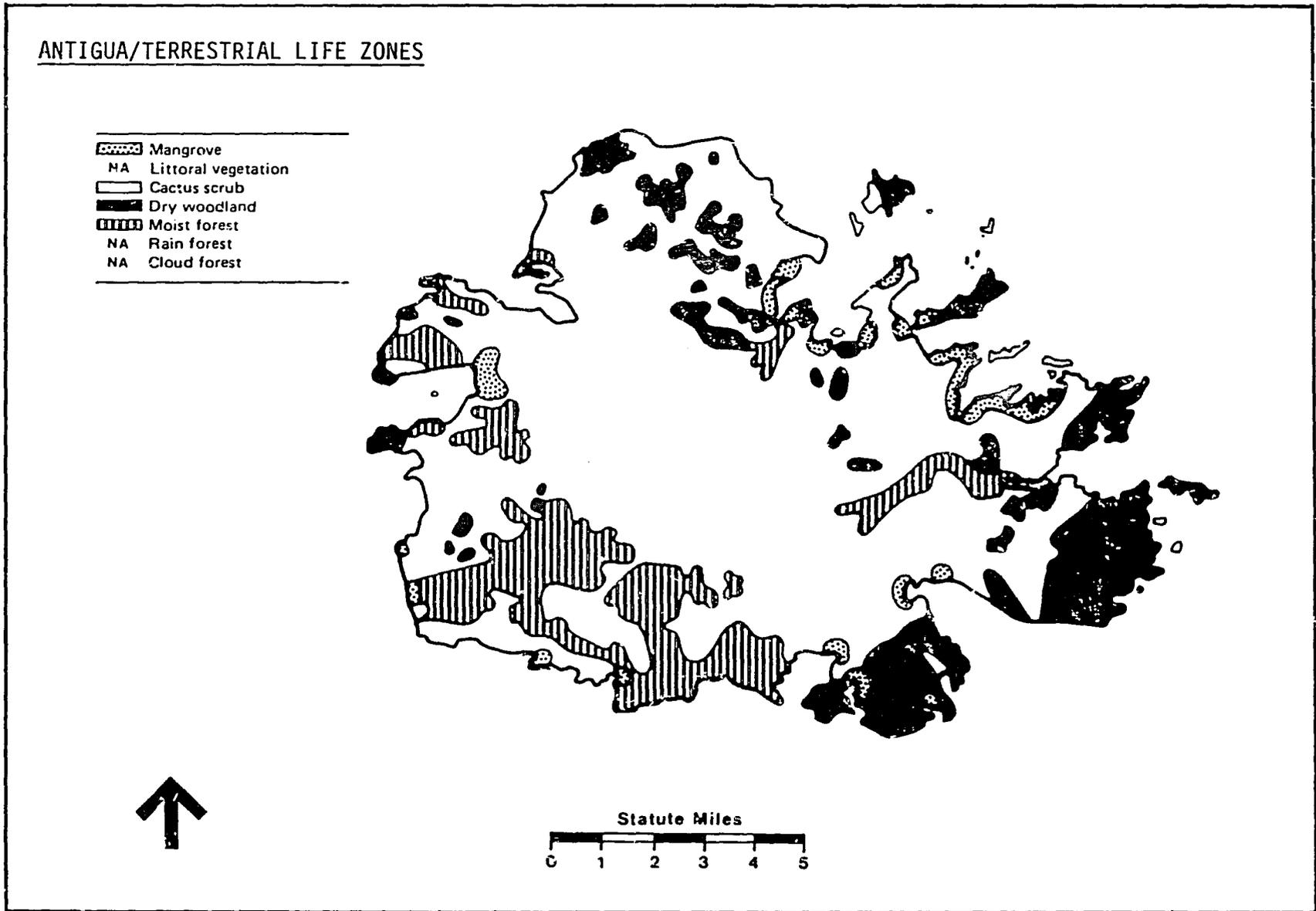


Figure 8.1(3). Antigua terrestrial life zones (source: ECNAMP, 1980a, based on Harris, 1963).

Table 8.1(3). Proposed protected areas for Antigua and Barbuda, as recommended by the Organization of American States (see also Figure 8.1(1) and Figure 8.1(2)).

Proposed Area	Proposed Management Category *	Area (Ha)	Type
Cades Reef Marine Sanctuary (Antigua)	II, IV, VIII	M	M
Mamora Reef (Antigua)	V	M	M
Great Bird Island and associated islets (Antigua)	IV	M	MI
Guiana Bay Islands (Antigua)	IV	600	MC
Codrington Lagoon (Barbuda)	IV	3,550	C
Bull Hole (Barbuda)	IV, VII	200	C
The Flashes (Barbuda)	IV	150	C

\* For definition of management categories, see Table 8.1(4).

KEY: M = Marine C = Coastal I = Island

Source: OAS, 1988a.

Various management options are open to countries wishing to develop a protected areas system (see Table 8.1(4)). IUCN Categories V (Protected Landscape and Seascape) and VIII (Multiple Use Management Area) would have ready application for Antigua-Barbuda in areas where resource conservation and exploitation must be skillfully matched. In this respect, they offer considerably more flexibility than Category II (National Park). Suitable amendment to the Antigua-Barbuda National Parks Act (1984) should therefore be considered to allow the use of management categories other than the "national park" designation.

## INSTITUTIONAL RESPONSIBILITIES

**National Parks Authority.** The NPA was created in 1985 and given authority over development and management of the Nelson's Dockyard National Park. It superseded the Society of the Friends of English Harbor, which was a private group involved with stabilization, restoration and adaptive use of the historic areas at Nelson's Dockyard since the 1950's. The society is now defunct.

With CIDA's help, the NPA has concentrated mainly on improving its capacity to manage its commercial interests within the Park, including concessions, rentals, directly-operated enterprises and the collection of fees

Table 8.1(4). IUCN protected area management categories and objectives.

CATEGORY	OBJECTIVES
I.	<i>Scientific Reserve/Strict Nature Reserve:</i> To protect nature and maintain natural processes in an undisturbed state in order to keep available representative examples of the natural environment in a dynamic and evolutionary condition.
II.	<i>National Park:</i> To protect natural and scenic areas of national or international significance for scientific, educational, and recreational use to provide ecosystem stability and diversity.
III.	<i>Natural Monument/Natural Landmark:</i> To protect and preserve nationally significant natural features and to provide opportunities for interpretation, education, research, and public appreciation.
IV.	<i>Nature Conservation Reserve/Managed Nature Reserve/Wildlife Sanctuary:</i> To assure the natural conditions necessary to protect nationally significant communities or physical features of the environment where these require specific human manipulation for their perpetuation.
V.	<i>Protected Landscape or Seascape:</i> To maintain nationally significant natural landscapes and seascapes which are characteristic of the harmonious interaction of man and land while providing opportunities for tourism and recreation.
VI.	<i>Resource Reserve (Interim Conservation Unit):</i> To restrict the use of these areas until adequate studies have been completed on how best to use the remaining resources.
VII.	<i>Natural Biotic Area/Anthropological Reserve:</i> To allow the way of life of societies living in harmony with their environment to continue undisturbed by modern technology.
VIII.	<i>Multiple Use Management Area/Managed Resource Area:</i> To provide for the sustained production of water, timber, wildlife (including fish), pasture, or marine products, and outdoor recreation.

Source: OAS, 1968a.

from visitors and yachts. Approximately 34 businesses operate in NPA-owned properties (Arthur Young, 1989).

The National Parks Authority is located within the Ministry of External Affairs,

Economic Development, Tourism and Energy. It has a Board of Directors (seven members) and a staff of approximately 35 persons, headed by the Parks Commissioner. Community involvement in the affairs of the Authority is facilitated but not fully realized

by an Advisory Committee of eight persons that meets with the Commissioner each quarter.

The organizational chart of NPA shows a void in planning and research functions which to date have been provided by CIDA consultants. It will be important for NPA to develop its own planning, research and resource monitoring capacity in the future.

It is unclear what additional responsibilities for managing protected areas NPA will be asked to assume. A public recreation park being developed at Halfmoon Bay through private initiative could be eventually handed over to the Authority. It could also be asked by Government to develop and manage similar parks at Fort James and Fries Bay.

**Fisheries Division.** The Fisheries Division, within the Ministry of Agriculture, Fisheries, Lands and Housing is legally responsible for the management of Diamond Reef (Antigua) and Palaster Reef (Barbuda) Marine Parks. The Division lacks both the staff and budget to manage the areas, and the designated parks remain unmanaged and neglected. The marine component of the Nelson's Dockyard National Park has suffered the same fate since the NPA also lacks the capacity to manage marine areas.

The institutional structures for managing mangroves and beaches are also weak. It is unclear whether the Fisheries Division has responsibility for the former. The law gives the Public Works Department control over beach sand mining, but overall beach management does not fall within the authority or responsibilities of any particular department.

**Barbuda Council.** No firm policy decision has been made on the ultimate responsibility for managing protected areas in Barbuda. Environmental problems and considerable controversy have arisen over the mining of beach sand in Barbuda, and the Council has brought legal action against SandCo, the sand mining company currently operating in Barbuda under an agreement with the national Government (see Section

1.1.2 of the Profile). The fact that the court has failed to rule on the case for two years indicates that the issues involved will not be resolved quickly or easily. It is also not clear if the Council would have legal responsibility for managing the Codrington Lagoon Bird Sanctuary, the Goat Island Wildlife Park or other proposed protected areas in Barbuda if they were to be established.

## 8.2 PROBLEMS AND ISSUES

### INSTITUTIONAL CONSIDERATIONS

As already noted in this chapter, the institutional framework for parks and protected areas in Antigua-Barbuda is inadequate. The primary problem is that laws have been passed without sufficient consideration of staffing and budgetary requirements, and hence funding to meet the overall costs for administration and enforcement has not been available. Additionally, the present range of legislation still leaves many resources unprotected unless they are identified within the boundaries of a designated park or reserve. Furthermore, institutional responsibilities and authority are not entirely clear under existing laws, for example, the management of protected areas in Barbuda.

A shortage of trained technical personnel is an impediment to the management of parks and protected areas. The problem is especially apparent in regard to marine areas. The marine parks created in 1973 are under the authority of the Fisheries Division but receive no management because the Division lacks both staff and financial resources to carry out these responsibilities. NPA is unable to provide the necessary management that the terrestrial areas of the Dockyard National Park alone require, much less assume responsibilities for management of the Park's marine areas.

The present NPA staff of 35 is primarily involved with the management of business concessions, yachting operations, maintenance and other activities related to services provided at Nelson's Dockyard. None of the

## CORAL REEF MARINE PARK

A group of local Antiguan is presently setting up a marine park on Crump Island off the northeast coast of Antigua. Initially the park will consist of a seaquarium and an associated 1,500 foot walkway around a living coral reef system displaying local marine life; a seaside restaurant and beach with watersports; and a campsite with marked trails. Some of these facilities are presently being constructed, and the park will be opened in August 1991.

The first of its kind in the OECS countries, this park was conceived as a symbol of national pride and achievement and is being designed to incorporate the educational, recreational, and environmental aspects of one of the country's more important natural resources -- its marine environment.

The idea for the park was developed by a few concerned Antiguan professionals who recognized the need for greater understanding and protection of the local marine environment. At the heart of park planning is the founder's commitment to a strong educational component, while the park's recreational center will provide additional leisure opportunities for Antiguan families. But most importantly, the park will concentrate its efforts on enhancing local awareness about the importance of the country's coral reefs and mangrove swamps and the need to conserve and protect these critical ecosystems.

permanent staff have adequate training in resource management, and therefore management of the Park's natural resources are overlooked at the present time.

Neither effective land use nor development control are practiced within the Park. Nevertheless, in order for long-term Park objectives to be realized, urban expansion has to be controlled, squatting reduced, and indiscriminate clearing of land and uncontrolled grazing prohibited within Park boundaries.

The present, time-consuming daily operational demands on current NPA staff means the Authority is not now in a position to design and manage an expanded parks and protected areas system for the country. Nevertheless, as argued below, expansion of the present park system is warranted. Therefore, given the existing constraints on the National Parks Authority, management responsibilities for protected areas need to be consolidated, or better coordinated, throughout the Government to achieve greater efficiency at a reasonable cost. For example, having both the Fisheries Division and the NPA responsible for marine parks or the marine components of

national parks is neither practical nor cost-effective.

Generally speaking, the *ad hoc* approach to land use in the country needs to be replaced by a more rational system of land management in which stricter control over development is exercised. Specifically, there is the need to identify institutional mechanisms which are better able to protect critical areas from unsustainable development -- particularly, the more productive wetlands.

## COVERAGE OF BIOLOGICAL DIVERSITY AND HISTORICAL RESOURCES

Ensuring the best possible representation of a country's biological diversity in a system of parks and protected areas is a complex undertaking requiring resource inventories, assessments, synthesis of data and public involvement. Antigua and Barbuda must avoid the pitfalls of creating additional large acreage of protected areas which leaves critical biological and historical resources outside of its parks and protected areas system (see also Section 9, Protection of Histori-

cal/Cultural Heritage). A process needs to be put in place which begins to evaluate and classify potential protected areas and establishes procedures to assess high risk as opposed to less threatened sites. The first step should be initiation of more aggressive data collection for proposed sites since, at present, data are either lacking or too fragmented to permit rational identification of new protected areas with delineation of boundaries. The ECNAMP resource data maps, now a decade old (ECNAMP 1980a and 1980b), need to be updated and, equally important, done at a scale (minimum 1:50,000) to be useful to local resource planners who must make on-the-ground decisions about the location and boundaries of protected areas.

### 8.3 POLICY RECOMMENDATIONS

(1) *Parks and Protected Areas System.* A comprehensive national parks and protected areas system should be created as a strategic component of Antigua and Barbuda's future development planning. The system should ensure adequate coverage of the biological diversity within the country and should seek to optimize the use of outstanding natural and historical resources and scenic areas for recreation and tourism.

The proposed parks and protected areas system could be a valuable mechanism for integrating conservation and development. Government should be prepared to provide the policy directive and support for planning, resource inventory, inter-agency cooperation, and legislative reform that would be required to create a viable system.

(2) *Beach Protection.* Beach protection should be given appropriate emphasis in the parks and protected areas program. A review and possible revision of the Beach Control and Beach Protection Ordinances should be carried out; it needs to be recognized that beach management requires more involvement by public sector authorities than the mere supervision of sand mining permits. The transfer of legal responsibility for beach management from the Public Works Department to a more appropriate agency should be effected. This might necessitate establishment of a new agency, perhaps as part of a comprehensive coastal zone management program (see Policy Recommendations in Section 3, Coastal and Marine Resources).

(3) *Technical Staff Requirements.* A recruitment, training and incentive program, aimed at eliminating the critical shortage of trained technical staff for park management, should be planned and executed without delay. NPA, for example, needs to acquire the capacity for resource planning, research and monitoring.

(4) *Institutional Restructuring.* A general review and reform of environmental policy is needed to address, among other things, weaknesses in the Government's institutional structure as it relates to the management of resources. Resource areas needing special attention for institutional restructuring include beaches (already mentioned), forests, wildlife and wetlands. The identification of appropriate mechanisms to ensure more effective coordination and collaboration among agencies responsible for resource management should be included in the restructuring exercise.

## SECTION 9 PROTECTION OF HISTORICAL/CULTURAL HERITAGE

### 9.1 OVERVIEW

The historical development of Antigua and Barbuda is reflected in the many surviving historical and archaeological sites which can still be found throughout the country. The abundance of reefs surrounding these islands, with their life-sustaining marine resources, favored the settlement of prehistoric peoples. Later Antigua's central plain with its flat land and rich soil provided excellent conditions for the establishment of sugar and other plantations. Antigua's indented coastline and central location in the Caribbean ensured its position as the principal Eastern Caribbean base for the English naval fleet in the eighteenth century and required the erection of many military installations on the island.

The Historical and Archaeological Society (HAS) has developed a very comprehensive inventory of historical and cultural heritage sites in the country. That listing, which is maintained at the National Museum of Antigua and Barbuda in St. John's, includes almost 800 entries, which are classified by name, type, and status plus a site-by-site recommendation for the placement of each site in one of three protection categories (see Section 9.3). Copies of the inventory have been distributed to the Development Control Authority, the Historical, Conservation and Environmental Commission and the National Parks Authority to guide these bodies in decision-making which may affect a known site. Other than sugar mills, most important sites are found in the coastal regions (see Figures 9.1(1) and 9.1(2)). Table 9.1(1) provides a summary of the information compiled by the Historical and Archaeological Society.

Antigua is very rich in its heritage of military architecture with at least forty forts having been maintained on the island between 1672 and 1800. Numerous examples of these early fortifications still survive, some not much more than large stone platforms and many others not more than fragments of former structures. Monks Hill and Fort Berkeley,

both of historic significance, are now in a state of ruin.

The island boasts several spectacular military installations such as Shirley Heights overlooking English Harbor, an extensive complex of arched stone buildings built into the side of a 200-foot cliff reaching straight up from the sea. The most celebrated of its military sites, however, is Nelson's Dockyard at English Harbor, which was built in 1725 as regional headquarters for the English naval force in the Caribbean. After 1890, the Dockyard fell into decay until 1951 when restoration efforts, spearheaded by the Society of Friends for the Restoration of English Harbor, were begun. Today, Nelson's Dockyard is a National Park, an important tourist attraction in Antigua, a center of yachting in the region, and at the same time is still counted as one of the key historic landmarks in the Caribbean (see also Section 1.3 and Section 8 on National Parks).

There are a number of windmills still standing in Antigua, a dominant landscape feature and a reminder of the island's affluent period as a sugar producer. Most of the remains are in ruins, however, as are the surviving great houses. One of the most important of Antigua's sugar plantations is the Betty's Hope Estate, dating back to 1655 and reportedly the oldest plantation site in Antigua. Interest in the preservation and restoration of Betty's Hope began over a decade ago, and the site -- although mostly still in ruins -- is now open to the public. A master plan for Betty's Hope restoration and development has been drafted (Witteborg and Goodwin, 1989), and a major fund-raising campaign is being organized to support excavation and restoration activities as well as development of an interpretive museum.

Antigua and Barbuda has many historic buildings dating to the colonial period. Many of them are concentrated in the capital of St. John's. Most are small in scale, one

Table 9.1(1). Summary of historic sites inventory compiled by the Historical and Archaeological Society. The full inventory is maintained at the National Museum of Antigua and Barbuda in St. John's.

<b>ANTIGUA <sup>1</sup></b>	
Precolumbian Sites	
Aceramic	60
Ceramic	51
Heritage Houses in St. John's	45
Historic Sites	321
Shipwreck Sites	123
	<hr/>
TOTAL SITES/ANTIGUA	600
<b>BARBUDA</b>	
Precolumbian Sites	
Aceramic	4
Ceramic	15
Historic Sites	15
Shipwreck Sites	146
	<hr/>
TOTAL SITES/BARBUDA	180

<sup>1</sup> Detail on Antigua Sites:

National Landmarks	68
Mill Towers Still Standing	109
Sites in Nelson's Dockyard National Park	180
Cannon Barrels	77

or two stories, with gabled roofs, outside staircases and verandas or galleries; collectively, they give the downtown area its unique architectural character. Although St. John's is not designated an "historic district," efforts have been made over the years to document and provide guidelines to retain the many examples of vernacular architecture which remain in the downtown area (e.g., see Cloyd, 1984). Most recently, as a part of a revitalization project for St. John's, OAS sponsored an updated inventory of buildings of historic and architectural interest in St. John's, including design guidelines and recommendations for policies which encourage adaptive use and restoration strategies through the employment

of economic and other incentives (OAS, 1989).

#### INSTITUTIONAL RESPONSIBILITIES

Unlike many of its sister islands in the Eastern Caribbean, Antigua-Barbuda did not pursue the "national trust" model as adopted throughout the region in the 1960's and 1970's. The country, therefore, lacks this centralizing force for resource protection and development. Nevertheless, a number of institutions, both within and external to Government, have some responsibility for the conservation and management of historical

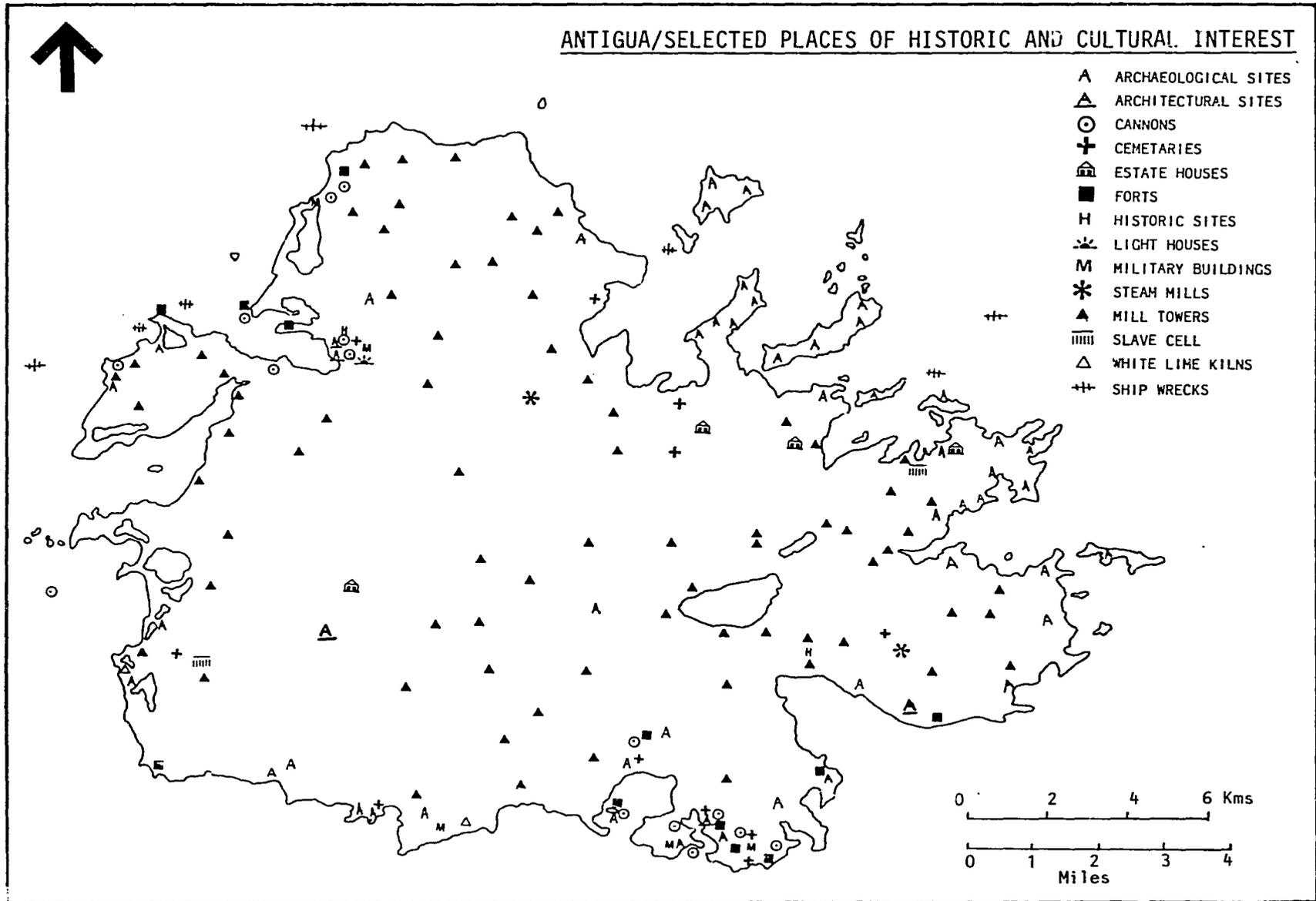


Figure 9.1(1). Places of historical and cultural interest in Antigua (source: D. Nicholson, HAS).

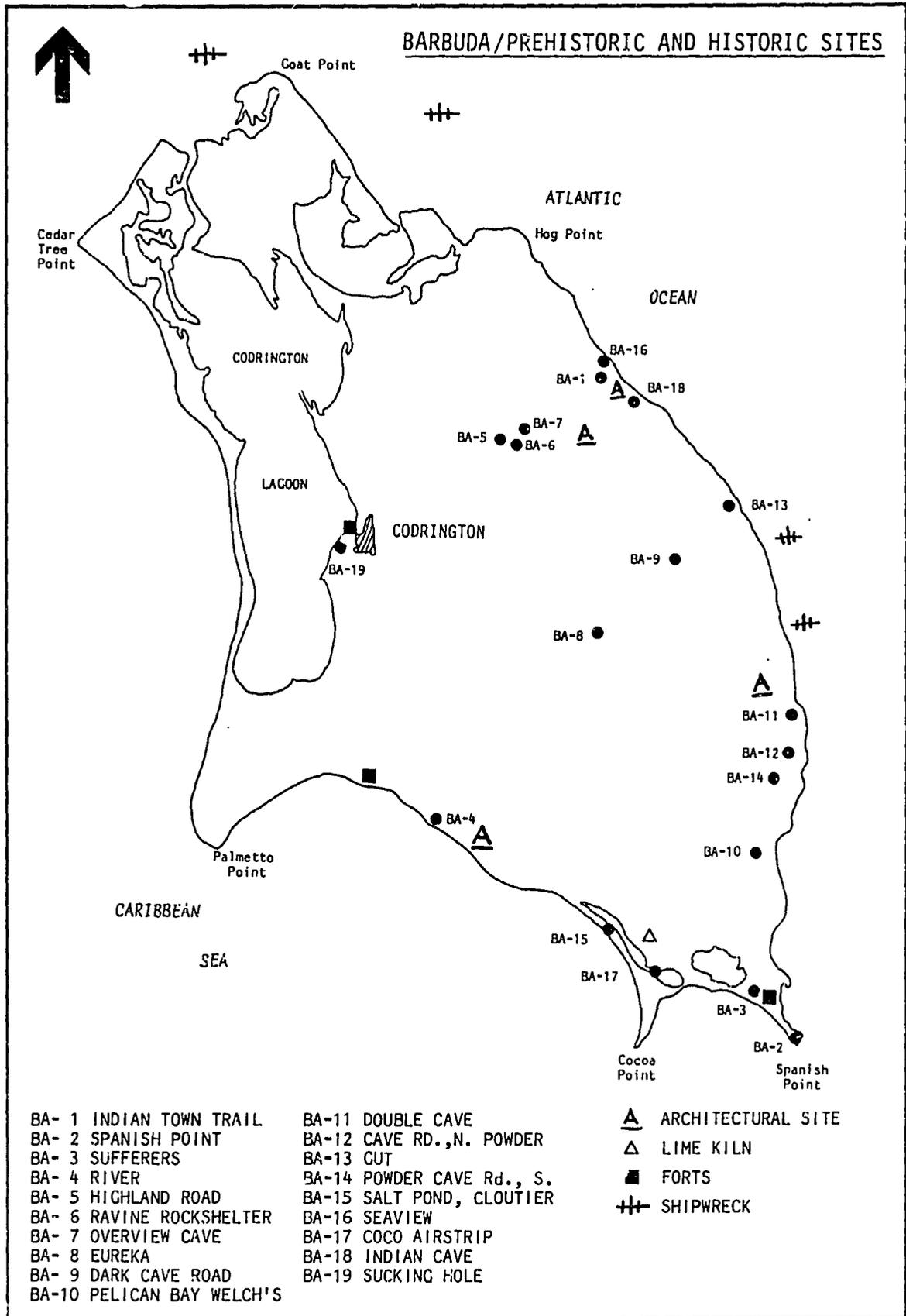


Figure 9.1(2). Pre-historic sites of Barbuda (source: D. Nicholson, HAS).

and cultural resources. Unfortunately, such diffusion of responsibility has meant that the country lacks a well-defined sense of direction as well as coordinated policies for historical resource protection, and it is therefore perhaps understandable that so much of the nation's heritage has been destroyed. Without a broader policy base for the management of historical/cultural resources, this pattern of neglect will continue.

The institutions currently involved in some aspect of historical/cultural resource protection and management are briefly discussed below.

(1) The Ministry of External Affairs, Economic Development, Tourism and Energy is responsible for most of the institutions that deal with historical resources. These include: the National Parks Authority, the St. John's Development Corporation, the Historical, Conservation and Environmental Commission, and the Betty's Hope Conservation Project, the latter being a joint effort of the Ministry's Department of Tourism and the Historical and Archaeological Society.

The National Parks Authority (NPA) is a statutory body created under the provisions of the National Parks Act of 1984. It is responsible for overseeing park operations and implementing a comprehensive park development plan. Thus far, only one national park, the Nelson's Dockyard National Park, has been legally established. The NPA oversees private and public sector development in the Dockyard and raises operational and development revenues through the leasing of park lands. It is also responsible for preserving and developing the natural, cultural and historical resources of any other park designated under the legislation.

The present national park at Nelson's Dockyard encompasses such historic landmarks as the eighteenth century naval dockyard, the Shirley Heights military complex, Fort George and several other important historic sites (Figure 9.1(3)). The NPA is responsible for the Dockyard Museum; many of the exhibits there are in need of conservation and should be made more interpretive. While the NPA has sole authority over historic sites

within the National Park, this unfortunately leaves any historic site outside of park boundaries without protection.

The St. John's Development Corporation was established by the St. John's Development Corporation Act in 1986. Its primary objective has been to promote the revitalization of downtown St. John's, but the Corporation is also carrying out a public awareness campaign to sensitize the community to the value of St. John's older houses, both as a part of Antigua's architectural heritage and as an asset in promoting tourism in St. John's and its environs. Forty-five "Heritage Houses" have been nominated for protection by the Corporation.

The Historical, Conservation and Environmental Commission (HCEC) held its inaugural meeting on September 14, 1989, but has yet to have its terms of reference solidified and approved by Cabinet. There are no statutory provisions for its operations. Functions which have been suggested for the Commission include:

- to advise Government and propose legal measures to protect historic sites and the environment;
- to monitor housing and land development schemes, pollution threats and other environmental impacts; and
- to educate the public on environmental issues.

At present the Shirley Heights Interpretation Center comes under the jurisdiction of the HCEC; however, since Shirley Heights is located within the boundaries of the National Park, it should be under the authority of the NPA. This is but one example of the ambiguity which surrounds the management of historical/cultural resources in the country.

(2) The Ministry of Agriculture, Fisheries, Lands and Housing includes the Development Control Authority, the Government's lead agency for controlling development in the state. The DCA was legally established under the Land Development and

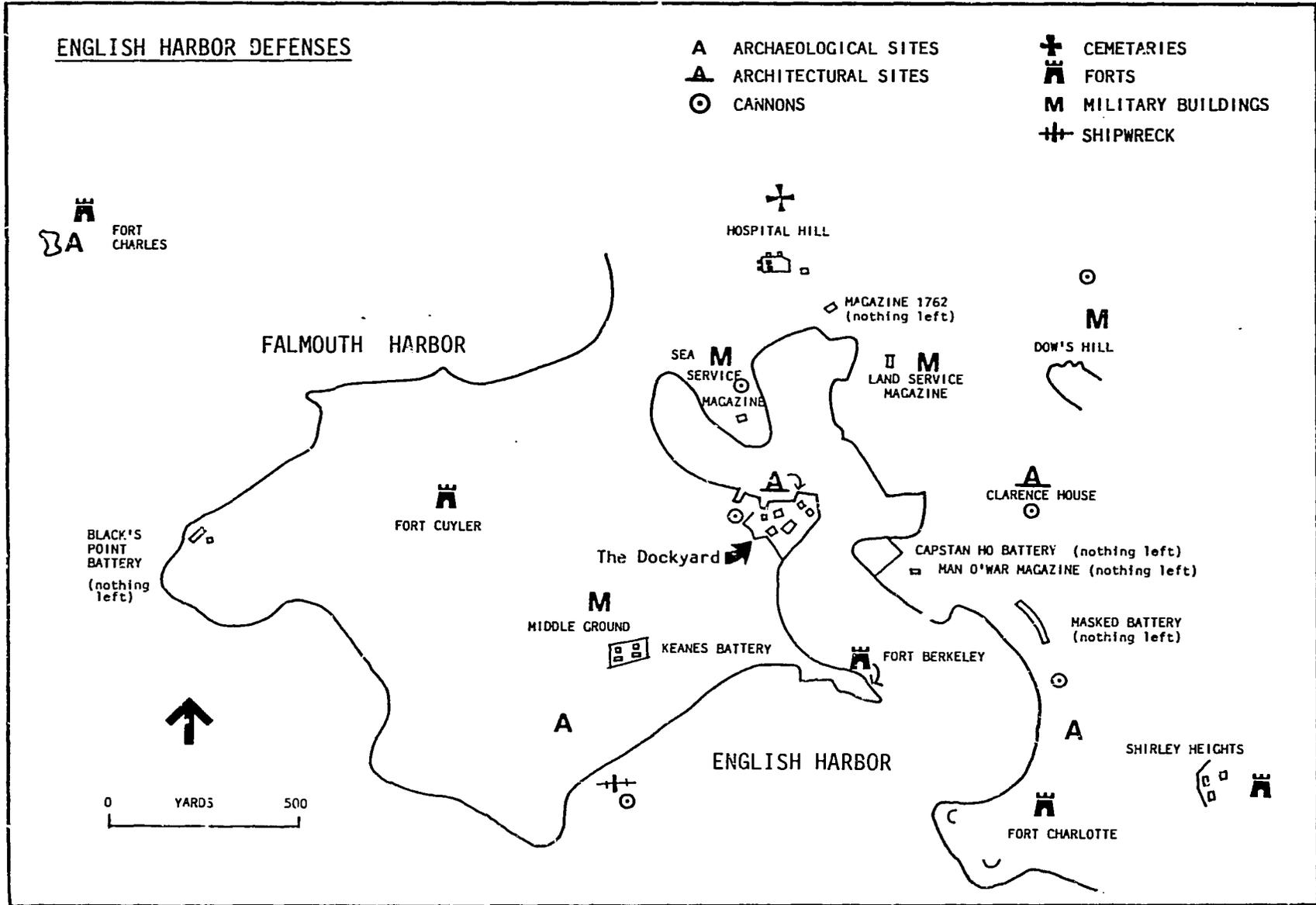


Figure 9.1(3). English Harbor defenses: sites of historical importance including Nelson's Dockyard (source: D. Nicholson, HAS).

Control Act of 1977. Its responsibilities under the legislation occur at two levels: (1) the DCA has authority to grant or refuse permission for the development of land and buildings and (2) the Authority is charged with the preparation of a National Development Plan. At present, the Authority has no formal procedures for technical input regarding the location and importance of known historic sites which might be affected by development projects. As for preparation of a National Development Plan, an inventory of historic sites by the Historical and Archaeological Society was first published in the Antigua-Barbuda National Physical Plan of 1976, but destruction of such sites nevertheless continues (see Section 9.2).

(3) The Ministry of Home Affairs is responsible for the island of Barbuda, where the Barbuda Council was created under the Barbuda Local Government Act of 1986. The Barbuda Council has power to make by-laws for development on the island. The first by-law was enacted in 1981 to protect the Palmetto Point area, but an impasse now exists between the Council and the national Government with reference to which authority will govern the development of Barbuda (Lausche, 1986; pers. commun., H. Frank, Barbuda Representative to Parliament, March 1990; see also Section 10.1 of the Profile). Given the large number of historic shipwreck sites to be found in the waters surrounding Barbuda (see Table 9.1(1)), it will become increasingly important that management authority for these important resources be resolved. Such sites need to be recognized as non-renewable assets which must be protected and managed in the public interest -- not exploited for private gain. Recently, exclusive rights to salvage shipwrecks in Antigua and Barbuda were granted for a 15-year period to a Florida-based treasure hunter (HAS, *Newsletter*, No. 24, Jan. 1989).

(4) The Ministry of Education and Culture runs the Cultural Office and the National Archives. The Cultural Office is responsible for promoting Antigua and Barbuda's culture. It has organized National Arts Festivals, and a "Cultural Village" was built in which annual cultural shows and exhibits are held. The National Archives is

housed in the old Court House building. By invitation, the Historical and Archaeological Society was asked to create the Museum of Antigua and Barbuda in the downstairs portion of this building.

(5) The Historical and Archaeological Society (HAS) is a non-governmental organization founded in 1965. It was registered in 1988 under the Companies Act, Cap. 358; as such, it is limited by guarantee and is not-for-profit. HAS created the Museum of Antigua and Barbuda in 1985. Its aim is to research the nation's historical and natural heritage, collect and preserve its artifacts and educate the public on the history of Antigua-Barbuda from its geological birth to its political independence.

(6) The Environmental Awareness Group (EAG) is a non-governmental organization founded in 1988 as an offshoot of the HAS. It aims to educate the public on the need to protect the total environment for a better quality of life. It also strives to protect historical heritage sites.

(7) Something You Need (SUN) is a benevolent society which was registered in 1982 under the Friendly Societies Act. It is interested in applying appropriate technology in the use of local resources for self-help projects and in preserving Antigua and Barbuda's cultural heritage and environment. It is in the process of revitalizing the site of a large fort next to the St. John's Deep Water Harbor, once known as "The Citadel".

## 9.2 PROBLEMS AND ISSUES

### HERITAGE DESTRUCTION

The country of Antigua-Barbuda currently lacks the following: (1) a national policy which would bring together all aspects of national heritage protection under one comprehensive, operational program; (2) clear lines of authority or responsibility for the management of historical resources; (3) adequate legislation to protect historical resources; and (4) effective procedures to con-

trol the use and development of historical resources.

Because there is no antiquities law to protect the country's cultural property, artifacts are routinely removed from the most valuable archaeological sites by local entrepreneurs and others. A National Trust Bill that dealt with the protection of cultural property was put forward in Parliament in 1975 but was not acted upon. At present, no agency is legally responsible for authorizing, prohibiting, or monitoring archaeological excavations for cultural objects except the National Parks Authority within national park boundaries. Even then, the NPA's authority is not as strong as it might be had regulations been enacted to the original National Parks legislation.

The "Valley of Petrifications" was the premier tourist attraction in Antigua in the 1920's, according to an old guide book (Ober, 1920), but today it is barren of artifacts. The Historical and Archaeological Society has attempted to recover Antiguan and Barbudan artifacts overseas through UNESCO's 1970 Cultural Property Convention entitled "The Means of Prohibiting and Preventing the Illicit Import, Export, and Transfer of Ownership of Cultural Property." Signatories to the Convention are obliged to prohibit the import of cultural property identified as stolen from another party to the Convention (Whiting, 1983). In the case of Antigua and Barbuda, however, no items can be identified as stolen, because there is no national law prohibiting the export of cultural property. In the meanwhile, pieces of the country's national heritage -- its artifacts and historic resources -- are being lost or exploited for personal gain. Several examples clearly illustrate this ongoing problem.

\* The Freetown conch shell Dog's Head, as illustrated in full color on the cover of the school book *Story of Arawaks in Antigua and Barbuda*, was taken from the country by art collectors. A finder was paid EC\$50 (the equivalent of US\$20), and it was later sold for US\$15,000. Now US\$90,000 is needed to bring it back, along with 27 other Caribbean cultural objects. The Ministry of Education has sought the

assistance of a UNESCO Inter-governmental Committee for its return. Efforts have been stalled, however, because the artifact is now in the United States, which is no longer a party to UNESCO and there is no proof of "illegal exportation".

\* Metal detectors, used mainly by visiting hobbyists, are a modern technology that can easily deplete an archaeological site. In June 1987, permission was given by the Tourist Board to a group organized by a travel agency to search Antigua's beaches for metal objects. Two bus loads of tourists with detectors appeared at Shirley Heights and quickly carried off vast quantities of buckles, badges and other artifacts, displacing, at the same time, metallic objects vital to archaeological excavations and for interpreting the site within the context of the National Park.

As a consequence of these and similar actions, the country now faces three kinds of heritage site abuse which are illustrated below with appropriate examples.

#### (1) *Destruction of Historic Sites.*

In June 1988, a house site was prepared on Indian Creek, one of the most outstanding prehistoric sites in the entire Caribbean. Neither the NPA nor the DCA was aware of this intended development. At Jolly Beach (site of the first known human settlement in Antigua, dating to 1775 BC), bulldozing has been done by private individuals engaged in a land dispute. Bulldozing is a commonly used *de facto* method of claiming land which can have devastating effects, including destruction of sites of potential archaeological value.

Montpelier and Gunthorpe's Sugar Factories are unprotected, and many fear these sites will one day be sold as scrap metal, thus eliminating their potential value in helping future generations of

Antiguans-Barbudans to understand and interpret that part of their history which was dominated by sugar production.

Many of St. John's designated "Heritage Houses" are in disrepair, partially eaten away by termites, unpainted and otherwise neglected. Land values have increased in recent years in downtown St. John's, and several fine old buildings have been torn down and replaced by modern office buildings; there is every indication that this trend will continue unless steps are taken to reverse the pattern. The St. John's Development Corporation has the power to restrict demolition or conversion but has not taken the necessary steps to do so. Such steps might include enactment of design guidelines which are supported by legislation and enactment of a program of incentives to encourage property owners to retain the unique architectural features of their historic buildings.

### *(2) Loss of Historical Identity.*

At present, there are no restored historic sites in Antigua and Barbuda. The Dockyard and the Lookout at Shirley Heights are not true restorations, but rather examples of adaptive use of historic structures. Authentic restoration would return a site to its original structural features and form, while interiors could be modernized in order to support commercial activities. In the case of the Shirley Heights Lookout, although plans for a restoration had been drawn by an historical architect commissioned by the Commonwealth Fund for Technical Cooperation, these were not used by the Park Foundation (forerunner of the NPA), and much historical authenticity was lost in the reconstruction (e.g., a naval style roof was placed on a military

building). Many local researchers believe the concept of historic site restoration is not fully understood in the country, and therefore it is undervalued as an educational tool and a means of encouraging local pride.

### *(3) Loss of Artifacts.*

The salvage of artifacts from historic shipwreck sites is becoming a more serious problem. Shipwrecks are protected by the Marine Areas (Preservation and Enhancement) Regulations (SRO No. 25, 1973) under the Ministry of Agriculture. However, shipwreck diving is rarely monitored. Often "treasure hunters" execute diving contracts with developing country governments without regard to the archaeological value of their finds. Wrecks are, in fact, historic time capsules, but they can also be very lucrative. Because of some divers' eagerness for treasure, scientific knowledge and rare artifacts are lost from the country's heritage.

## **PUBLIC AWARENESS**

Lack of public awareness about the value of the country's heritage is responsible for many of the problems described in this chapter. Much of the emphasis of existing heritage protection efforts in the country has focused on the colonial period. This is in part due to the fact that the original initiative for historic preservation came from the "expatriate" members of the community. For instance, from as early as the 1930's the island's British Governors had supported efforts to conserve English Harbor and Shirley Heights. The colonial period is an interesting component of Antigua and Barbuda's past, but only one part. By focusing so heavily on this, with its strong and bitter memories of the enslavement of the ancestors of today's population, many Antiguans and Barbudans have been alienated from their country's rich history. Tourism has had a positive effect in awakening an appreciation of cultural heritage

## ENCOURAGING DEVELOPMENT THAT PRESERVES HISTORICAL RESOURCES

Historic sites have been destroyed by developers throughout the Eastern Caribbean because the potential economic value of using – rather than destroying – the extant historical resources was not appreciated. Several years ago Antigua and Barbuda's Historical and Archaeological Society (HAS), as a part of its efforts to protect the country's heritage sites, sent a memorandum to a company that had been given rights to develop an unused tract of land on the east coast of Antigua at Nonsuch Harbor. The site contained important Amerindian ruins, and the Society was justifiably concerned about the fate of these resources.

In its memo to the development company (which was subsequently published in the Caribbean Conservation News in June of 1987), the Society briefly reviewed the historical importance of the site, pointing out that from about 300 AD the area had been occupied by maritime tropical forest Amerindians who had resettled from South America. Much later, in the late 1600's, early English colonials built a straight road across Antigua as a means of communication in the event of enemy attack. The road ended on the west coast at Five Islands Harbor and on the east at Nonsuch Harbor. Subsequently, two forts and a guard house were built at Nonsuch. After military occupation, the land was used for agriculture, until 250 years later when the site was contemplated for hotel and condominium development.

The Society, in its memo to the project's developer, suggested specific ways in which the historical importance of the area could be incorporated into site planning and the historical resources could be made a valuable asset for the development. Suggestions included:

- An Amerindian motif for the development
- Historical motifs for interior decoration
- Use of Amerindian architectural styles for beach houses, bars, craft centers, and other buildings
- A small on-site museum to interpret the locality
- Open and on-going excavations for the information and interest of visitors and tenants
- Restoration of the colonial guard house and cistern as a lookout or bar
- Identification of a university to take charge of on-site investigations and establishment of a summer school for student archaeologists.

Initially, the developers were very enthusiastic over the prospect of exploiting the site's historical significance. It invited HAS to peg out scientifically important areas where bush would be cleared by hand rather than by bulldozer, and it indicated its intention to use motifs and place names which recalled the history and culture of the Arawak Indians. A U.S. university (Tulane) was identified by the Society for a cooperative excavation program, and students were sent to Antigua on a field expedition.

Unfortunately, two years later, after this hopeful beginning, all has not gone as the Society had expected. Management changed several times, and the early commitment to developing the site while preserving its historical components vacillated. Some of the areas marked for investigation were indeed cleared by hand, but other identified areas (some of which were part of a land dispute) were bulldozed over as a means of claiming ownership. More recently, managers of the development seem positive once again about cooperative activities with HAS, including publication of a booklet on the Arawaks at Nonsuch Bay for each guest room, development of a small, model Arawak village, and preparation of a video including footage of actual excavations at the site.

Whatever the future holds for this particular development, the concept of linking tourism development to historical resource preservation remains a valid one, and the Historical and Archaeological Society will continue to pursue the "development without destruction" concept wherever it is appropriate.

because many historic sites can be developed as tourist attractions and are therefore of economic value to the country.

### INCREASING DEMANDS ON RESOURCES

The country's growing population and accelerating economic development are placing greater pressure on the land and sea. Urbanization has grown at an ever increasing pace during the last decade, while all forms of infrastructure -- roads, desalination plants, oil refineries, etc. -- are taking up more and more space on the country's limited land base and along its valuable coastline. Much of this development is occurring in areas that are believed to hold important archaeological information but have not yet been adequately studied. As the nation's sites become fewer and as people become more historically conscious, the remaining sites should be investigated by archaeologists before they are lost forever. Implementation of an Environmental Impact Assessment process for major development activities, particularly for projects in the coastal zone, could include a cultural resource assessment component as one step to ensure that protection of these resources is taken into consideration when development decisions are made.

### 9.3 POLICY RECOMMENDATIONS

(1) *A National Heritage Protection Policy and Implementation Plan is needed that would:*

- clarify the responsibilities and the authority of the various institutions now involved in some aspect of historical/cultural resource management and protection;
  - seek to harmonize existing legislation for historical resource conservation and development by identifying unnecessary overlaps and redundancies and providing for updated, revised, or new legislation where required in order to
- eliminate legislative gaps, inconsistencies, and oversights; and
  - identify the necessary resources to provide for implementation of the Policy.

Management plans need to be developed for individual sites, especially each site officially designated as a National Landmark. Suggested development drawings were made of several landmarks a decade ago (1978-80) by an historical architect provided by the Commonwealth Fund for Technical Cooperation architect. These are still available at the Ministry of Economic Development (pers. common., C. Edwards, Permanent Secretary, Ministry of Economic Development, 1990). Management plans also need to provide guidelines or regulations controlling the use of different classes of protected sites, including sites which have tourism potential, and designating what activities are prohibited for various protection classes.

A comprehensive inventory of heritage sites has already been prepared and forwarded to the DCA and the HCEC by the Historical and Archaeological Society. Recently, as a part of the Country Environmental Profile Project, that inventory was revised to include a recommended priority classification system, which provides the basis for future management strategies. Sites in the HAS national inventory have been grouped into three Protected Classes based on the following criteria:

- scientific, historical, and archaeological value;
- uniqueness;
- degree of disturbance; and
- esthetic value.

The three Proposed Protected Classes for Heritage Sites recommended by H/A/S are described below.

**Protected Class A.** Sites of the greatest importance based on the criteria indicated above.

**Management of Class A Sites.** Most are national landmarks, and they should be developed very carefully, if at all. Each should be restored with great care. They can be made into commercially viable enterprises by choosing a suitable adaptive use, but they should be restored authentically so their historical identity is not lost. A hypothetical adaptation for the old Central Sugar Factory would be restoration of the steam engines and development of a science museum focusing on later sugar technology. Two critical archaeological national landmarks are Indian Creek and Jolly Beach. These should not be built over but left for future research and investigation by Antiguans.

**Protected Class B.** Important sites based on criteria above, but of lesser importance than national landmarks.

**Management of Class B Sites.** This class of heritage site can be developed if done appropriately. Accommodations may be necessary, but these can enhance the economic and educational value of the site. The basic conversion rules for historic buildings including mill tower walls should be that the conversion is designed by a competent architect; the design is approved by the HCEC and DCA; the heritage site is left free standing apart from any building that might be erected as a part of the development; and the conversion retains its historical integrity and beauty.

**Protected Class C.** These sites either are known to be of lesser importance than Protected Class B sites, or they are suspected to be of lesser importance but have not been adequately studied.

**Management of Class C Sites.** Sites are to be surveyed and excavated only if a survey shows that no archaeological information or artifacts would be lost. A site could then be built over, but preferably, buildings could be placed to one side of any "significant" areas.

As discussed in Section 9.1, there are many Government and non-Government institutions associated with heritage protection. The responsibilities of these Government agencies and commissions, statutory bodies, and NGOs must be clarified, and clearer lines of authority and responsibility need to be established. Coordination needs to be improved, and specific procedures for the review, referral, and approval of development applications which impinge upon an identified heritage site must be formalized.

Environmental Impact Assessments (EIAs), that include an analysis of the historical and cultural resources affected by development activities, should be mandatory and used by DCA in reaching its decisions (see also Section 7 of the Profile). Opportunity for input by appropriate technical experts should be provided for in the planning/evaluation stage of major development projects, i.e., persons associated with HCEC, HAS, and/or the Dockyard National Park. Procedures should be mandated to require an evaluation and recommendations from a trained archaeologist for the most important or threatened archaeological sites.

*(2) A National Heritage Protection Program should be established.*

Government should consider establishing a National Heritage Protection Program to raise awareness and incentives for conserving the country's historical and cultural heritage. Antigua and Barbuda has many heritage sites, but they are being underutilized for education and tourism. The nation needs to look beyond Nelson's Dockyard, Shirley Heights and St. John's Cathedral -- the historic areas now most frequented by tourists -- to identify sites which also are worthy of restoration and development.

Additional sites recommended for development include: Betty's Hope Plantation and the Citadel (both now in progress), Gunthorpe's and Montpelier Sugar Factories, Fort James, Fort Barrington, Indian Creek Amerindian site, and Bat's Cave. Amerindian sites could be developed by building exact replicas of Indian houses with interpretative centers, souvenir shops, and other facilities.

Other important heritage sites could be interpreted by the placing of suitable signs and providing guide leaflets. Such efforts could undoubtedly attract support from donor agencies (as they have in other OECS countries, e.g., Grenada, Dominica), for these activities are easily linked to tourism development and economic growth.

A National Heritage Protection Program should include a strong education component, targeted to the full population ranging from school children to government officials. One objective would be to bring about community attitudinal changes necessary to protect the nation's heritage over the long term.

It might be useful to survey Antiguan and Barbudans to determine how they feel about their historical heritage, such a survey to be administered during a "National Heritage Week" that could be jointly organized by the HCEC, NPA, HAS, and EAG. The media could be instrumental in the program by reaching people through radio, television, films, lectures and exhibits.

A final component of a National Heritage Protection Program would be the expansion and upgrading of museums in the country. Table 9.3(1) summarizes current and projected museum and interpretive center programs in Antigua-Barbuda.

Table 9.3(1). Museum development in Antigua and Barbuda.

MUSEUM	THEME	STATUS			MANAGEMENT
		Oper.	Dev.	Prop.	
Museum of Antigua-Barbuda	National History	X			HAS
	Culture			X	Cultural Office
Dockyard	Maritime History	X			NPA
Shirley Heights	Military History	X			NPA
Dow's Hill Interpretive Center	Natural, Cultural and Military History		X		NPA
Bat's Cave	Natural History			X	NPA
Betty's Hope Estate	Early Sugar History		X		Betty's Hope Restoration Project
Gunthorpe's Sugar Factory	Later Sugar History			X	Betty's Hope Restoration Project
Martello Tower	Barbuda History			X	Barbuda Council
Museum of Marine Living Art and Ancient Civilizations	Shells, Ancient History	X			Private
Coral Reef Marine Park, Crump Island	Marine Biology		X		Private

KEY: OPER. = operational; DEV. = in developmental stage; PROP. = proposed.

Source: D. Nicholson, HAS.

Consideration must be given to developing financial incentives to compensate property owners for participating in the conservation and restoration of designated heritage sites. The St. John's Development Corporation and the OAS have jointly designated 45 buildings in St. John's as "Heritage Houses," and the OAS has provided guidelines for development and utilization of these sites without loss of their historical and architectural integrity. Incentives which could be employed by Government to compensate owners who renovate Heritage Houses might include property tax exemptions, lower utility

rates, low interest loans, and customs concessions on materials used in renovation (OAS, 1989).

Consideration should also be given to Government acquiring ownership of critical heritage sites which are most threatened by development. For selected sites, such as Indian Creek, it may be feasible to exchange Government lands in another area for the heritage site. In the specific case of Indian Creek, this alternative has been proposed to the Ministry of Agriculture, and a decision from Cabinet is pending.

## **SECTION 10 INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT**

### **10.1 GOVERNMENT ORGANIZATION**

Antigua and Barbuda, with its uninhabited dependency of Redonda, is an independent unitary democracy. After over 200 years as a British colony, Antigua and Barbuda attained associated statehood in 1967. In this status, Antiguan and Barbudans enjoyed full internal self-government through a locally-elected assembly, while Great Britain retained control over foreign defense and external affairs. In November of 1981, Antigua and Barbuda gained complete independence.

As a member of the British Commonwealth, the country observes the traditions of a Constitutional Monarchy and the practices of a parliamentary democracy. The Monarch appoints a Governor General, who in turn appoints, as Prime Minister, the leader of the majority party in the 17-member, popularly-elected House of Representatives. The Governor General also appoints the 17 members of the Senate. He is advised by the Prime Minister on the appointment of eleven senators, by the Opposition Leader on four, and by the Barbuda Council (see below) on one. The Governor General appoints the remaining senator at his own discretion. The Constitution of 1981, promulgated at the same time the country gained independence, guarantees the rights of opposition parties in government (Sturges-Vera 1989).

Judicial matters are handled at three levels. The Magistrate Court deals with summary offenses, the High Court handles indictable offenses, and the Eastern Caribbean States Court of Appeal hears appeals from the two lower courts.

The functional responsibilities of Government are carried out by the following ministries:

Prime Minister's Office (including Defense)

- Ministry of External Affairs, Economic Development, Tourism and Energy
- Ministry of Legal Affairs and Attorney General
- Ministry of Finance
- Ministry of Education, Culture and Youth Affairs
- Ministry of Labor and Health
- Ministry of Home Affairs
- Ministry of Public Utilities and Aviation
- Ministry of Agriculture, Fisheries, Lands and Housing
- Ministry of Public Works and Communications
- Ministry of Trade, Industry, and Commerce.

### **THE BARBUDA COUNCIL**

The island of Barbuda was formally annexed to Antigua in 1860. Influential land owners governed Barbuda by lease until 1903, when the authorities on Antigua were ordered to govern it as a Crown Estate. The position of warden, or manager, was established the next year, and this official administered the island until 1976. In that year, in recognition of secessionist sentiment on Barbuda, the Barbuda Council was established to allow a greater degree of internal self-government.

The Council, which is empowered to make by-laws, consists of nine elected members (elections are held every two years), the two Barbudan representatives to the national Parliament, and a government-appointed

## ANTIGUA-BARBUDA RELATIONS

Barbuda currently has an estimated resident population of 1,100, slightly less than it had in 1960 when 1,145 people were enumerated on the island. There has been some return migration of Barbudans from Britain, the United States and the USVI, and this should intensify as many Barbudans who migrated in the 1960's reach retirement age or are attracted home by expanding opportunities.

Many consider Barbuda's relationship *vis a vis* the national Government in Antigua to be one of dependency, although technically the island has local government in the form of the Barbuda Council and a seat in the country's Parliament. Relations between Barbuda and Antigua have been strained for some time. In 1969 Barbudans petitioned Britain for separation from Antigua, and at present they have a case on appeal before the Privy Council to decide on their historical claim to all of Barbuda.

Since the Government in Antigua has steadfastly maintained that most of Barbuda is "Crown" land, many development projects have been approved by Cabinet without the knowledge or input of Barbudans. The issue of sand mining in Barbuda is discussed in more detail in Sections 3 and 4 of the Profile. Additionally, tourism development projects approved for Barbuda by Cabinet can have far reaching consequences for the island's environment and people. One tourism complex now being developed (the K Club) has already drained and filled some of the mangrove swamp behind the hotel; furthermore, the acreage approved by the Barbuda Council for this project was substantially smaller than the area eventually fenced off by the developers, reportedly with the national Government's approval. Many Italian workers were imported by the project's Italian owners, and a small community was erected for them. The same group has leased another 250 acres from Government to build a large development at Palmnetto Point, and reportedly a British group is attempting to put together a sizeable project for Spanish Point. If most of these projects are fully developed (which could raise the number of hotel rooms from the current level of about 50 to 300-400), their labor demands could not be met locally, as existing tourism facilities already have to bring in some workers from Antigua and there has been discussion of importing additional labor from within the Caribbean, e.g., from Guyana.

Since Barbudans are a closely-related and tightly-knit people, the prospect of large numbers of outsiders on the island is certain to have serious social and political repercussions. Barbudans are generally distrustful of outsiders (Antiguans are included in this category), and, based on past experiences, they are quite skeptical of the promised benefits that may accrue to Barbudans from proposed development activities.

The new environmental awareness reported in Antigua (see Sections 1.4 and 10.3) has been slow to take root in Barbuda. Barbudans are nonetheless aware of the importance of the bird sanctuary for nature tourism and have watched with interest the steady stream of outsiders who have come to study their bird colonies. They are also aware that Barbuda's shipwrecks and reefs offer splendid opportunities for dive tourism, and it is because of this that some Barbudans are quite disturbed over the agreement entered into by the Antiguan Government and a Florida-based salvager/"treasure hunter" which gives the salvager the right to take a major portion of artifacts out of the state (see also Section 9 of the Profile). Many Barbudans believe that the shipwreck sites off their waters should be properly charted, studied, and photographed, but should be left essentially undisturbed.

member. The Ministry of Home Affairs in Antigua is responsible for coordinating the activities of the Council, and the Council submits proposals for capital and special expenditures to the Ministry. (Nicholson, 1984; Bourne, 1987)

## **LEGISLATIVE FOUNDATION OF ENVIRONMENTAL MANAGEMENT**

The evolution of an administrative framework for environmental management in Antigua and Barbuda can be traced by reviewing the legislative history of the country. The authority to regulate activities to protect and manage the environment is dispersed among the laws and ordinances listed in Table 10.1(1). This listing was primarily compiled by an OECS-NRMP consultant (Lausche, 1986), who completed a similar review of resource management legislation in other OECS countries.

### **10.2 GOVERNMENT INSTITUTIONS CONCERNED WITH ENVIRONMENTAL MANAGEMENT**

No single agency in Government is charged with responsibility for the environment, and consequently responsibility for resource management, resource conservation, and resource development rests with a number of GOAB agencies, which are described in the sub-sections which follow.

#### **MINISTRY OF AGRICULTURE, FISHERIES, LANDS AND HOUSING**

The Department of Agriculture (a part of the Ministry of Agriculture, Fisheries, Lands, and Housing) is responsible for agricultural extension, agricultural engineering, plant protection, forestry, veterinary and livestock services, and horticulture. The Department's headquarters and an experiment station are located at Dunbars, north of St. John's. Nurseries are located at Green Castle and Christian Valley. Smaller agricultural stations are located at Cades Bay, Orange Valley, and Bethesda. (pers. commun., F.

Henry, Director of Agriculture, 1990) (see Figure 10.4(1)).

Extension activities are divided between two sections. An Extension Officer oversees a small group of agricultural instructors, who provide technical information to farmers and livestock owners. In addition, a Principal Administrative Officer is in charge of a force of Field Officers and Agricultural Assistants who process requests to lease land parcels of five acres or less, remove or shoot stray animals grazing on cultivated land, and coordinate plowing and other services.

The Agricultural Engineering Unit constructs, repairs and cleans small dams and ponds that provide agricultural water and handles other duties related to irrigation and drainage. The unit is also responsible for soil and water conservation. However, very little is done regarding soil or water conservation, and no major conservation programs currently exist.

The Department's forestry responsibilities are presently under the charge of a Forestry Assistant. (The position of Forestry Officer is currently vacant.) Another Forestry Assistant is now studying in Canada and will return to Antigua in 1991. Tree seedlings are propagated at Christian Valley and Green Castle. The current regulations protecting forest resources are outdated and unenforceable until state-owned forest reserves are surveyed and demarcated (Bourne 1987; Lausche, 1986; Miller, *et al.*, 1985).

The Pesticide Control Act of 1973 authorized the creation of a Pesticide Control Board with powers to draft and enact regulations to supervise the importation, use and disposal of pesticides. The Board was established in 1978 but generally has been inactive, particularly over the last several years. The position of Plant Protection Officer, who headed the Board in the past, is currently vacant. The Director of Agriculture is attempting to reconvene the Board. He has obtained copies of pesticide regulations from Dominica and St. Lucia and expects to adapt these for use in Antigua and Barbuda (pers. commun., F. Henry, Dir. of Ag., 1990).

Table 10.1(1). Primary resource management legislation in Antigua-Barbuda.

PLANNING	Town and Country Planning Act (Cap 278, 1948) (for building regulations) Town and Country Planning Regulations (SRO No. 24, 1953)
DEVELOPMENT	Land Development and Control Act (No. 15 of 1977) The St. John's Development Corporation Act (No. 1 of 1986) Antigua Agricultural Development Corporation Act (No. 11 of 1973)
CROWN LANDS	Crown lands (Regulation) Act (Cap. 130, 1917) The Crown Lands (Land Settlement) Regulations (SRO No. 24, 1930) The Crown Lands (Renting) Regulations (SRO No. 23, 1926) The Crown Lands (Sale) Regulations (SRO No. 9, 1939)
AGRICULTURE	The Pesticides Control Act (No. 15 of 1973) Plant Protection Act (Cap. 102) Produce Protection Act (Cap. 103) Fumigation of Plants Act (Cap. 100)
FORESTS	Forestry Act (Cap. 99, 1941) Forestry Regulations (SRO No. 13, 1941, and SRO No. 42, 1952) The Barbuda (Lease of Government Buildings and Cutting of Firewood) By-Law (SRO No. 23, 1934) Bush Fires Act (Cap. 303)
WATER	The Public Utilities Act (No. 10 of 1973) Watercourses and Water Works Regulations (SRO 23, 1954, and SRO No. 24, 1961)
BEACHES	Beach Control Act (Cap. 297, 1959) The Beach Control (Prevention of Danger) Regulations (SRO No. 25 of 1976) Beach Protection (Cap. 298, 1957) Beach Protection (Amendment) Act (No. 1, 1968)

(continued)

The Fisheries Department, another section of the Ministry, is tasked with assisting the fishing industry by helping it obtain duty-free fishing equipment, boats or vehicles, by selling ice and fishing equipment at concessionary or subsidized rates, and by making loans for boat repairs.

Extensive authority to protect marine resources has been given to the Ministry under several pieces of legislation. Under the Marine Areas Act (Preservation and Enhancement) of 1972, the Ministry may restrict

fishing in marine areas to preserve flora, fauna, natural beauty and shipwrecks and to promote recreation or scientific study. Salt Fish Tail Reef (Diamond Reef) off Antigua and Palaster Reef off Barbuda have been declared restricted areas, but none of the areas are actively managed or controlled. The Fisheries Act of 1983 gives the Ministry power to preserve habitats, restore degraded areas and promote scientific study in any area of territorial waters and adjacent land by designating it a marine reserve. No marine reserves have been designated.

Table 10.1(1) (continued). Primary resource management legislation in Antigua-Barbuda.

PROTECTED AREAS	The National Parks Act (No. 11 of 1984)
	National Parks (Amendment) Act (No. 3 of 1986)
	Botanical Gardens Act (Cap. 300, 1900)
	Botanical Gardens Regulations (1901)
	The Marine Areas (Preservation and Enhancement) Act (No. 5 of 1972)
	The Marine Areas (Preservation and Enhancement) Regulations (SRO No. 25, 1973)
	The Marine (Restricted Areas) Order (SRO No. 47, 1973)
WILDLIFE	Wild Birds Protection Act (Cap. 115, 1919)
	Proclamation (SRO No. 16, 1937)
	Proclamation (SRO No. 3, 1976)
	The Barbuda (Shooting and Fishing) By-Law (SRO No. 41, 1959)
	Protection of Animals Act (Cap. 113)
MARINE	The Fisheries Act (No. 14, 1983)
	Fisheries (Protection of Lobster) Regulations (SRO No. 3, 1978)
	Turtle Act (Cap. 333, 1927)
	Seal Fisheries (North Pacific) Act (1912, UK)
	Maritime Areas Act (No. 23 of 1986) (formerly entitled Territorial Waters Act, No. 18 of 1982)
WASTE MANAGEMENT	Public Health Act (Cap. 236, 1957)
	Public Health Regulations (SRO No. 35, 1959; SRO No. 25, 1958; SRO No. 24, 1958)
	The Litter Act (No. 7, 1983)
	The Litter (Fixed Penalty Procedure) Regulations (SRO No. 41, 1984)
	The Litter (Fixed Penalty Procedure) (Amendment) Regulations (SRO No. 16, 1985)
	Privy Regulations (Cap. 236, 1965)
	Dumping at Sea Act (No. 29 of 1975)

N.B. All "Ordinances" were renamed "Acts" in 1987 (No. 14).

Source: Lausche, 1986; pers. commun., L. Hesse, 1990.

The Ministry's **Lands Division** is responsible for the management and control of all Government lands, including land reclamation, land use and the sub-division of land. Since over half of the country's land is owned by Government, this Division has a key role in determining the conversion of land to non-agricultural uses (Soler, 1988). The Division answers directly to the Permanent Secretary of the Ministry of Agriculture.

The **Development Control Authority (DCA)** is a statutory body responsible to the Minister of Agriculture; the Authority was created by the Land Development (Control) Act of 1977, the principal law governing land use planning and development control in the state. It is tasked with monitoring and regulating development and construction in Antigua and Barbuda. DCA relies on the professional and technical staff of the Physical Planning Office to carry out its functions.

That staff consists of a Town and Country Planner, two Senior Planning Assistants, one Building Technician, two Building Inspectors, and one Assistant Inspector Technician.

In many OECS countries, strong development control authorities have assumed an important centralizing and coordinating role in regulating national development. This is not the case, however, in Antigua-Barbuda where the DCA is seriously constrained in exercising such leadership; at the same time, no other statutory body or government agency has taken over this role. Additionally, coordination and communication linkages between the DCA and other Government departments dealing with physical infrastructure or land use issues are generally very poor. For example, the Public Works Department and the Public Utilities Authority do not systematically provide the DCA with data and planning information about their development projects (Soler, 1988). (For a more detailed discussion of development planning and the role and capabilities of the DCA, see Section 7 of the Profile.)

#### **CENTRAL MARKETING CORPORATION**

The Central Marketing Corporation (CMC), a statutory body, is responsible for domestic and export marketing of agricultural products, limited importing, and selling of farm inputs to farmers. It owns a packing house, grading equipment, and a wholesale outlet. Most farmers prefer to sell directly to hotels, supermarkets, "hucksters" (market women), or consumers at public markets and therefore use CMC as a market of last resort. CMC lacks an information system that allows it to predict production levels or market demand, and generally operates at a loss (IICA, n.d.).

#### **CENTRAL BOARD OF HEALTH**

The Central Board of Health (CBH) is responsible for enforcing environmental sanitation regulations, preventing the spread of infectious diseases, operating a mosquito control program, and collecting and disposing of solid and liquid waste. This last responsi-

bility consumes most of the agency's resources. Antigua and Barbuda's waste collection system has improved considerably in the last two to three years, in large measure because of the creation of a position for, and subsequent hiring of, a Solid Waste Manager. However, enforcement of sanitation regulations (which are themselves very weak) is still inadequate, fines are low, and illegal dumping in wetlands, swamps and other areas is a problem.

The principal legislation for waste management and pollution control is the now outdated Public Health Act. The Act follows the colonial pattern common to the region of using "nuisance" violations for pollution control, but enforcement is difficult because concepts are outdated (Lausche, 1986). (See also Section 6 for a more detailed discussion.)

#### **WATER DIVISION**

The Water Division of the Antigua Public Utilities Authority (APUA) is responsible for providing drinking water and ensuring its quality for public consumption. The Division is a part of the Public Utilities Authority, a statutory body which reports to the Ministry of Public Utilities and Aviation; it was created by legislation in 1973 and merges responsibilities for electricity, telephone, and water services under one Authority. Lausche (1986) states that the emphasis of the enabling legislation is on the provision of utility services, and the law is weak on giving the Water Division specific authority for water resource management and protection.

The Planning and Development section of the Division is responsible for hydrological and hydrogeological studies, the development and construction of wells, the planning and design of dams, and contracting out major construction projects. The Operations and Maintenance section is in charge of pumping stations and water treatment plants, small construction projects, and the installation, inspection and repair of water meters.

The Water Division is also responsible, under the Public Utilities Act of 1973, for

establishing, operating and maintaining a sewage system, but currently no system exists.

## **PUBLIC WORKS DEPARTMENT**

The Public Works Department, part of the Ministry of Public Works and Communications, is responsible for enforcement of the Beach Protection Act of 1957 which prevents the removal of sand, stone, gravel or shingle from beaches or foreshores without a permit. The Department formerly mined and sold sand to the public but stopped this practice in Antigua in response to community pressure. The practice continues in Barbuda, however, where mined sand continues to be exported to Antigua and elsewhere (see also Sections 3 and 4 of the Profile). The Department is also responsible for building roads and therefore for maintenance of road drainage systems throughout the country.

## **MINISTRY OF EDUCATION, CULTURE AND YOUTH AFFAIRS**

Nearly all of the schools in Antigua and Barbuda are publicly supported and therefore represent an important resource for increasing awareness and understanding about critical environmental issues. Some efforts have already been made to integrate environmental education into the curricula of primary and secondary schools.

Agricultural Science, a part of the Fifth Form Caribbean Examination Council (CXC) level, is presently taught at four of the country's nine secondary schools: Princess Margaret, Pares Secondary, All Saints Secondary, and Jennings Secondary. In Antigua, the practical examinations in Animal Husbandry to meet CXC requirements are conducted at the Agricultural Department's Olivers Livestock Station. Instruction dealing with safe pesticide use, composting, soil and water conservation techniques, and similar practices could be included in course work in order to encourage and promote a more direct environmental education focus. The syllabus, on which the CXC examinations are based, influences course curricula, and teachers can petition the CXC to include particular

questions on the examinations, thus allowing them to base their instruction on locally-important content or issues during the school year.

Two U.S. Peace Corps volunteers (one with extensive tree cropping experience) will begin serving as Agricultural Science teachers for two years in 1990.

Miller and Howell (1989) have identified five other CXC syllabi with environmental relevance: chemistry, biology, physics, integrated science, and geography. These could provide the context for enhanced environmental education at all of the secondary schools, including the non-agricultural science institutions: Antigua Girls' High School, Antigua Grammar School, Clare Hall Secondary, and Ottos Comprehensive in the St. John's area, and Holy Trinity Secondary on Barbuda.

A foundation has also been laid for teaching environmental issues at the primary level. The World Wildlife Fund's Caribbean Resource Management Education Program has developed materials for primary and lower secondary grades in the English-speaking Caribbean on the natural history of major island ecosystems and the importance of prudent resource management. These materials have been field-tested and revised and were reportedly available via teachers' colleges starting in 1988 (Brown, 1989).

The Ministry of Education and Culture also includes the **Cultural Office** (responsible for the promotion of national culture, including festivals, exhibits, and the like) and the **National Archives**, now housed in the old Court House building in St. John's.

## **NATIONAL PARKS AUTHORITY**

The National Parks Authority was created as a statutory corporation in 1985, following enactment of the National Parks Act one year earlier. This statutory body is responsible to the Minister of Economic Development and Tourism and, as such, most of the Authority's efforts have focused on strengthening the commercial viability and tourism

potential of the Nelson's Dockyard National Park, which is at present the only legally declared park under the enabling legislation.

The National Parks Authority is responsible for the implementation of the National Parks Act and for all matters associated with park management, including planning and the management of funds generated by park operations and activities. Management authority, however, has been weakened as the National Parks Act lacks supporting regulations. Furthermore, the legislation did not provide a legal definition for what constitutes a "national park" and makes no provision for protected areas. Thus, while passage of the National Parks Act, creation of the NPA, and establishment of the Nelson's Dockyard National Park are encouraging steps forward for Antigua-Barbuda, the country has yet to make a full commitment to a comprehensive parks and protected areas program. (See also Section 8 of the Profile for additional information on the organizational structure of the NPA.)

#### **HISTORICAL, CONSERVATION AND ENVIRONMENTAL COMMISSION**

Government has established an advisory body, with no statutory provisions, to provide input and guidance in the management of the nation's natural and historical resources. The formation of the Historical, Conservation and Environmental Commission (HCEC) had been under discussion for a number of years, but the HCEC did not hold its inaugural meeting until September of 1989. Unfortunately, its terms of reference have yet to be promulgated and approved by Cabinet. Current membership of the Commission is drawn from both the public and private sectors. In early 1990, the Commission was designated as the local national committee to provide direction to CCA and IRF in the preparation of the Antigua-Barbuda Environmental Profile. (See Section 9 of the Profile for additional information on the HCEC.)

#### **ENVIRONMENTAL EDUCATION**

Hill (1988), in a country report prepared under the auspices of UNEP's International Environmental Education Program, prioritizes needs and suggests measures for environmental education in Antigua-Barbuda. The steps identified in Hill's report include:

- Development of a national policy on environmental education;
- Designation of one ministry charged with responsibility for environmental education;
- Establishing environmental education networks and linkages between ministries at all levels, political and technical;
- Implementation of special workshops and seminars for various interest groups, e.g., Chamber of Commerce;
- A review and upgrading of existing school syllabi to incorporate instruction on the special environmental problems of Antigua-Barbuda;
- Implementation of a public awareness program to inform the public through effective use of the media;
- Creation of an environmental monitoring system to document environmental problems;
- Training of teachers, administrators, and parents in environmental issues.

Hill's report is primarily oriented toward building environmental awareness programs in industrial education, which for Antigua-Barbuda focuses on the Antigua State College, the Antigua and Barbuda Technical and Vocational Center, and the Hotel and Training Center. Educating students enrolled in tourism service courses is important according to Hill.

Environmental education is the number one priority mentioned by a former USAID Regional Environmental Management Specialist in a 1988 report which focuses on interviews with Government and non-government persons in Antigua. DeGeorges (1988) proposes expanded use of media outlets to work with environmental groups in developing appropriate materials and programs for environmental education (see also "The Media" in Section 10.3 below) and employment of U.S. Peace Corps volunteers to assist with tasks such as environmental education curriculum development.

### 10.3 THE NON-GOVERNMENTAL SECTOR IN ENVIRONMENTAL MANAGEMENT

Generally speaking, Antigua-Barbuda has not yet developed a strong private-sector base for community support of environmental programs. The recent revitalization of the country's oldest "conservation" organization (the Historical and Archaeological Society) has been encouraging as has the emergence of a second non-governmental organization (NGO) with a broader environmental agenda. Antigua also supports a variety of rural development and cooperative or quasi-cooperative groups, many of which have active resource management components. Finally, within the country's strongest growth sector -- tourism -- there are some private-sector organizations which have an interest in promoting long-term planning and the development of balanced growth strategies. The primary NGOs and private-sector groups with environmental interests are reviewed below.

The Historical and Archaeological Society of Antigua and Barbuda (HAS) was established over three decades ago and throughout most of its institutional history was a fairly small organization. The year 1985 marked a significant turn-around for the Society when, with support from Government and under grants provided by UNESCO and CIDA, HAS established the National Museum of Antigua and Barbuda which it continues to operate in St. John's. The Society also carries out historical research, assists

historic site preservation efforts (e.g., Betty's Hope Estate Restoration Project), and provides leadership for the protection and preservation of artifacts and historic relicts.

The National Museum is used extensively by visitors to Antigua and by local persons, especially primary and secondary school teachers and their classes. At the time of the Museum's founding in the mid-1980's, Society members reported that its establishment had provided a new focal point for growth and expansion of the organization and, at the same time, represented an important commitment on the part of Government and signaled an opportunity for expanded private sector involvement in environmental programs (Towle, *et al.*, 1987).

The Environmental Awareness Group (EAG), a recent offshoot of the Historical and Archaeological Society, was organized in 1988 with a stronger focus on environmental issues. Its primary objective is to raise public concern about, and awareness of, important environmental problems facing the country. EAG sponsors a lecture series, conducts walking tours of environmentally sensitive areas, and has begun to record and monitor specific instances of pollution, illegal sand mining, and similar acts that threaten the environment. It co-sponsors Earth Day activities, including tree plantings and a clean-up of a trash dump site near Shirley Heights. In March of 1990, with funding from the Caribbean Conservation Association, EAG co-organized with HCEC a workshop which began to explore issues leading to development of a National Conservation Strategy. Several members of EAG serve on the Historical, Conservation and Environmental Commission, and in 1990 EAG was selected as the local NGO counterpart for implementation of the Antigua-Barbuda CEP project.

Except for one paid staff member in each group, both HAS and EAG rely on volunteers. Many of the volunteers belong to the expatriate community, and the need to expand membership to a broader community base is a recognized goal of each organization. Both groups publish newsletters, and are planning outreach programs for schools and the general public in an attempt to increase

membership and involve more Antiguans and Barbudans in their activities.

The **Cooperative Farmers Association (CFA)** was registered as a cooperative in 1982. Members jointly lease 50 acres of land at Sandersons, near the Potworks Reservoir in central Antigua, where each of the 25 active members has access to two acres for individual cultivation. CFA has established its own irrigation system, drawing water from both Potworks and its own pond. It handles group purchases of inputs and some marketing of products. Many of CFA's members are part-time farmers and have a range of professional and managerial skills that are unusual for a cooperative of this size. The Pan American Development Foundation has received funding from USAID to sponsor an agroforestry project with CFA; CFA has also received support from the Inter-American Foundation and Island Resources Foundation.

The **Antigua Livestock Improvement Cooperative Society (ALICS)** was established in 1986 as part of a USAID-funded livestock improvement project implemented by the Department of Agriculture and Winrock International, a U.S. philanthropic foundation. When the project was terminated in 1987, its resources, including nearly a quarter million dollars in equipment, were turned over to ALICS. The Society provides its approximately 20 members with mechanized brush cutting, land preparation, post hole digging and livestock hauling services, the use of breeding bulls, and educational materials. ALICS presently has one paid employee, a tractor driver (pers. commun., P. Millwood, ALICS President, 1990).

The **Small Farmers Association (SFA)** is presently inactive, although its president hopes to revive the group. In the past, SFA counted as many as 125 crop and livestock farmers as members for whom the Association provided a variety of services, including land preparation, group purchase of livestock inputs, cleaning of ponds, the construction of irrigation dams, and training (pers. commun., J. Samuel, SFA President, 1990).

The **Antigua and Barbuda Fishermen's Association** is the only representative body for local fishermen. Its activities focus on education, research and lobbying on behalf of fishermen, and the group is concerned with the impact of tourism development in coastal areas, specifically the destruction of mangroves and other areas important as fishery habitats and nurseries (Towle, *et al.*, 1987).

The **Organization for Agricultural Development (OAD)** grew out of a Meals for Millions Project that started in 1979. OAD offers various types of material, financial, advisory, and production assistance to small farmers, beekeepers, and fisherman. It helped establish and continues to provide support for community gardens and irrigation ponds throughout Antigua. Its nursery at Blubber Valley provides fruit tree and plant seedlings to the community and home gardeners. OAD contributes 50 percent of the cost of inputs (tools, fencing, seeds, and fertilizer) to nearly 100 participants in its home gardening program.

Additionally, OAD has established a revolving loan fund to assist 35 fishermen to make boat repairs and purchase engines, communication equipment, and fish pots; it works with a "pre-cooperative" of 35 beekeepers and has established a training and marketing program in candle making.

OAD receives support from a variety of donor agencies, including the Inter-American Foundation, USAID, the Canadian High Commission, the Freedom from Hunger Foundation, EEC's Cooperation for Development Fund, and Barclays International Development Fund. There are four paid staff: the Director, an Administrative Officer/Secretary, a Gardens Coordinator, and an Assistant Gardens Coordinator (pers. commun., R. Spencer, OAD Director, 1990; OAD Annual Reports for 1988, 1989, and 1990).

**Caribbean Advisory and Professional Services (CAPS)** was originally organized in Antigua as the Caribbean program of a U.S. NGO, International Voluntary Services; the program was later privatized and its headquarters moved to St. Lucia, although

personnel are still working in Antigua. Its multi-disciplinary team of West Indian development specialists provides assistance to Caribbean NGOs and small businesses in agribusiness development, women's entrepreneurship, small-scale industry development, financial management, feasibility studies, and project design (Towle and Potter, 1989).

The **Antigua Hotel and Tourism Association** was established by hotel owners in the 1960's to present a unified industry voice when dealing with Government and unions. The Association has since taken on additional members and functions, including cooperative advertising and the development of promotional themes and activities (e.g., Sailing Week), and long-range planning and forecasting. Members are concerned about balanced growth for Antigua, the adequacy of the nation's infrastructure, and the lack of public understanding and support for the tourism industry (Antigua Hotel and Tourism Assn., 1989; pers. commun., A. Hawley, Executive Director, 1990).

## **THE MEDIA**

Those responsible for natural resource conservation and management in the Eastern Caribbean emphasize that the lack of an energized public constituency is one of the most important obstacles they face in implementing programs and promoting change. Eyre (1989), who describes several successful media campaigns in the Caribbean to develop broader environmental constituencies, claims that the intelligent use of media is the most important avenue for furthering environmental education initiatives in the region.

The media in Antigua and Barbuda include the Government-owned Antigua Broadcasting Service's radio and television stations, several commercial and one religious radio stations, and several newspapers. The Government stations are willing to broadcast programs produced by local organizations (pers. commun., N. Campbell, teacher and HAS member, 1990), and the newspapers will publish articles addressing environmental issues. (pers. commun., B. Brown, Peace Corps

Volunteer and EAG member, 1990). Expanded use of all of these outlets needs to be made by GOAB and by all NGOs and other community groups interested in enhancing the level of environmental awareness in Antigua and Barbuda.

## **10.4 DONOR-SUPPORTED RESOURCE MANAGEMENT PROGRAMS**

The **Organization of American States (OAS)** recently completed a summary report of its Natural Resources Assessment for Agricultural Development Project, a multi-year, comprehensive investigation of Antigua and Barbuda's land and water resources as they relate to agricultural development (OAS, 1990). The study concluded by proposing two projects, a tree crop project and an onion development project, but it is presently unclear whether either of these projects has the necessary funding support. OAS has also funded projects to investigate the viability of solar drying of agricultural products and biogas technology (IICA, n.d.). Outside of the agricultural sector, OAS has been actively involved in efforts to promote the revitalization of downtown St. John's, supported a study of development control and physical planning in the state, and helped to establish a new land classification system for the country (see Section 1.2.3 of the Profile).

In 1986, the **Organization of Eastern Caribbean States (OECS)**, with assistance from OAS and GTZ (the German Agency for Technical Cooperation), initiated its Natural Resources Management Project (NRMP), designed to enhance the capacity of member countries to establish natural resource management programs. In Antigua-Barbuda, OECS-NRMP activities have focused on land use management issues, with OECS-NRMP hosting a workshop in 1987 on the inefficient use of lands in the country. Antigua-Barbuda was also included in regional surveys sponsored by OECS-NRMP, including environmental legislation (Lausche, 1986) and GOAB resource management agencies (Bourne, 1987).

The University of the West Indies (UWI) is the leading institution of higher education in the region. The University's Faculty of Agriculture is located at the Trinidad campus, and selected faculty serve as extension specialists and resource personnel for Eastern Caribbean ministries of agriculture. The agricultural school is the home of the Caribbean Agricultural Extension Program (CAEP). Funded by USAID, CAEP provides training and technical extension materials to national extension workers on safe pesticide use, integrated pest management, proper fertilizer application, pasture management, and soil conservation (Chemonics, 1988; DeGeorges 1989a).

In Barbados, UWI's Cave Hill campus houses the Center for Resource Management and Environmental Studies (CERMES). CERMES currently offers a post-graduate diploma in environmental studies and natural resources management and plans to offer master's degrees in coastal management, fisheries and terrestrial ecological systems. UWI's Mona Campus has offered a bachelor's degree in environmental science since 1988 (Miller and Howell, 1989).

The Caribbean Agricultural Research and Development Institute (CARDI) is the agricultural research arm of the Caribbean Community and Common Market (CARICOM). With primary laboratories in Trinidad, CARDI also maintains representatives and a full program in each member island. In Antigua, CARDI has an office near St. John's and an experiment station near Betty's Hope in the eastern part of Antigua (see Figure 10.4(1) for location of key CARDI and GOAB agricultural facilities in Antigua). Current projects include its West Indies Tropical Produce Support Project, an attempt to increase exports of non-traditional agricultural products, and its Agricultural Research and Extension Project (funded in part by USAID), an effort to establish linkages between the research and extension activities of UWI, national ministries of agriculture, and CARDI.

The Caribbean Agricultural Rural Development, Advisory and Training Service (CARDATS) is CARICOM's agricultural

training arm. A CARDATS project (funded in large part by UNDP) in the late 1980's sought to assist small farmers in the Eastern Caribbean in five program areas:

- Marketing and reduction of post-harvest losses;
- Farm management, agricultural credit and farm re-investment;
- Improved soil conservation;
- Livestock development; and
- Group dynamics and communications.

In Antigua and Barbuda, CARDATS worked with a target group of about 50 primary farmers and nearly 400 secondary farmers. It offered training in farm management, agricultural credit, record-keeping, financial analysis, plant propagation, and poultry and vegetable production. A twice-weekly radio program with information about market prices and agricultural technology was initiated. The project supported the construction and enlargement of ponds, and included a demonstration small-scale trickle irrigation system (CARDATS, 1988).

The Canadian International Development Agency (CIDA) has funded a pilot stall feeding program for livestock (with support from CARDATS), financed the establishment of Antigua-Barbuda's first National Park at Nelson's Dockyard, and proposed a five-year forestry and watershed management program (the latter a proposal to which Government has not, thus far, responded).

Other donors active in the resource management sector in Antigua-Barbuda include the United Nation's Food and Agricultural Organization (FAO), which is assisting with efforts to update and strengthen the country's legislation dealing with water resources, forestry and wildlife. The European Development Fund (EDF) is sponsoring a livestock improvement project (see Section 2.1 for more a more detailed discussion).

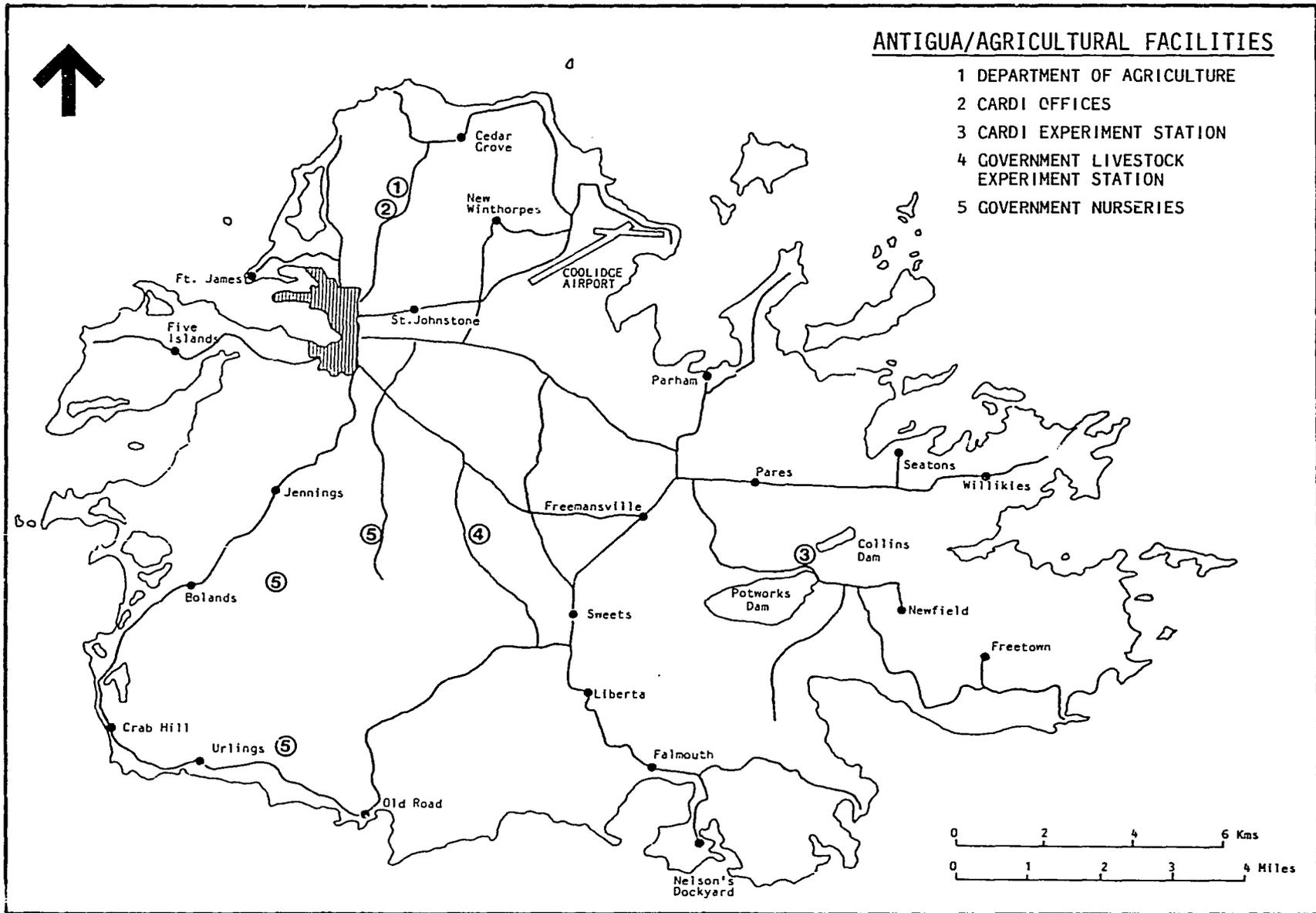


Figure 10.4(1). Location of key GOAB and CARDI agricultural facilities in Antigua.

## 10.5 ASSESSMENT OF THE INSTITUTIONAL FRAMEWORK FOR ENVIRONMENTAL MANAGEMENT

### GOVERNMENT

Those prescribing remedies to Antigua and Barbuda's environmental problems must acknowledge several constraints. The economies of the small island countries in the Eastern Caribbean are for the most part not sufficiently developed to take on the broad range of resource management activities which are increasingly expected of modern states. The variety of scientific and technical expertise needed to cope with pollution control, national park management, land use planning, and the like requires a larger, better trained staff than most Eastern Caribbean countries, including Antigua and Barbuda, can afford to employ or keep fully occupied. Training in a variety of specializations cannot be provided locally; overseas training is long and costly, and qualified applicants may not be available.

At the same time, it should be recognized that the Government of Antigua and Barbuda over the past several decades has not aggressively supported or strengthened many of its resource development and resource management agencies specifically charged with land use and development control responsibilities, with protection of the country's natural resource base, or with ensuring the environmental health of the population. For example, problems associated with the effectiveness of the Development Control Authority, the National Park Authority and the Pesticide Control Board have already been identified elsewhere in this Profile.

Additional problems facing Government in the environmental sector include the following, and all need to be addressed (see also USAID, 1985; Lausche, 1986; Bourne, 1987):

(1) *Staffing for environmental programs.* Although the Ministry of Agriculture, Fisheries, Lands, and Housing plays an essential role with respect to environmental man-

agement, its budget is inadequate for the responsibilities it carries. Key sections responsible for national development planning (including the Development Control Authority), soil and water conservation, disposition of government lands, protection of forests and marine resources, and pesticide regulation are understaffed. As a result, many legislative mandates are ignored or poorly implemented (e.g., management of marine protected areas, imposition of soil and water conservation farming practices, enforcement of the safe use of pesticides). Staffing problems also hamper the effectiveness of the Central Board of Health.

(2) *Legislation issues.* Much of the legislation pertaining to environmental matters is outdated, lacks regulations, is ignored, or is unenforceable. For example, public health legislation is seriously outdated, lacks standards, and is based on colonial legal concepts which are inadequate to deal with modern pollution control problems. Both the National Parks Act and the Fisheries Act do not have supporting regulations and therefore specific management procedures as well as prohibited activities for protected areas (e.g., national parks and marine reserves) are not defined or controlled. New legislation dealing with forestry and wildlife and with water resource management has been proposed, but these legislative initiatives have not yet been approved by GOAB (see Sections 2.1 and 2.2 of the Profile).

(3) *Improved coordination of resource management agencies.* Responsibility for each of several critical environmental protection and management functions -- including development control, land use planning, water management, and utilization of marine resources -- is dispersed among several ministries and departments of Government, and there is no formal mechanism to improve coordination in dealing with these responsibilities across departmental lines. Coordination/integration issues and the lack of sufficient technical input into the decision-making process are particularly critical in the following sectors: forestry management, land use planning, and water resource management. Improved coordination for water issues is particularly important as the sole agency

dealing with the water sector at this time is a public utility which tends to treat water principally as a commodity rather than as a natural resource requiring protection and management.

Coordination procedures are also weak within several statutory bodies with critical resource management responsibilities. For example, many key agencies are not represented on the Development Control Authority, e.g., the Department of Agriculture and the Lands Division of the Ministry of Agriculture. This, in turn, weakens Government's ability to protect prime agricultural lands in the face of expanding urbanization. The Antigua Public Utilities Authority and the St. John's Development Control Corporation are also not represented on the DCA. With reference to the National Parks Authority, Lauseche (1986) points out that input from forestry and fisheries staff in the Ministry of Agriculture is important for national park management, but at present there is no formal mechanism for regular communication and coordination between the Ministry and the NPA.

A related coordination issue concerns the present multi-layered approach to program development and approval which often affects activities in the resource management sector. An excellent example of the need for streamlining and centralizing this process is the history of a new five-year forestry and watershed management project first proposed by CIDA in 1988 as a part of its natural resource management program in Antigua-Barbuda. Although the unit of Government most affected by the proposed program, the Department of Agriculture, has endorsed the project, final approval does not rest with the Ministry of Agriculture. In keeping with current procedures, the proposal is first forwarded to the Ministry of Economic Development for review and endorsement and then to the Ministry of Finance for approval and commitment of GOAB resources to complement those to be provided by CIDA. If the project -- which is still unapproved -- passes all inter-governmental hurdles, it will still be subject to annual re-examination as GOAB funds are not committed for the life of the program, but only on a yearly basis.

One means for more effective and regular coordination among resource management, development control, and land use planning agencies might be the newly-established Historical, Conservation and Environmental Commission. The Commission has not yet been given an official mandate or terms of reference, and, therefore, consideration should be given to providing it with substantive coordination/integration responsibilities, e.g., for recommending environmental policy across departmental lines, for establishing procedures for monitoring the environmental impacts of development activities, and for enforcing pollution control standards, particularly when these responsibilities are shared by more than one GOAB department or are not clearly defined in existing legislation. At the very least, the Commission should be vested with sufficient authority to vet critical development/environment issues, to bring into that process a broad cross-section of appropriate GOAB technical persons, and to make recommendations to appropriate decision-making authorities on its findings.

In the last analysis, effective implementation of resource management programs in Antigua-Barbuda will require:

- (1) public sector consensus on general resource management and environmental protection objectives;
- (2) sufficient political will to support those objectives; and
- (3) a sharing of program goals and development objectives between national government departments, local communities, and relevant interest groups.

There is little point in shaping new resource management policies or environmental protection standards unless the political and social means are available to carry these out. This will require close cooperation between political leaders at the highest levels of Government, coordination of environmental activities at the technical, middle-management levels of Government, and interaction between Government and those non-governmental "user" groups impacted by both gov-

ernment regulation and damage to the resource base.

## NON-GOVERNMENTAL ORGANIZATIONS

NGOs concerned about environmental issues are relatively weak in Antigua-Barbuda, and programs need to be identified which can help to expand and strengthen existing NGOs. The active members of the three farmers associations comprise only about two percent of the farmers in the nation, while the membership base of the country's two "traditional" environmental organizations (HAS and EAG) is substantially smaller.

Many of the skills that are necessary for development of a dynamic NGO sector are missing, in part because they are also lacking in the private sector in general (USAID, 1989). The mixed and often weak level of basic management and marketing skills among the heavily volunteer staffs and boards of the country's NGOs may result in overlooked or missed opportunities for more successful fund raising, inadequate long-term institutional planning, inefficient use of volunteer time, and other, related institutional problems -- all of which jeopardize the effectiveness of NGO environmental programs and the ability of these organizations to influence public policy.

Several donor-supported programs are currently operational in Antigua-Barbuda which should help to strengthen the institutional capacities of many of the country's NGOs. With funding from USAID, Island Resources Foundation recently initiated a five-year program to provide institutional development support for environmentally-focused NGOs in the Eastern Caribbean. The headquarters office for that program is now based in Antigua. The Caribbean Conservation Association's Caribbean Heritage Program also has an institution-building component built into project activities; in Antigua-Barbuda the program's focus will be on the island of Barbuda. The Pan American Development Foundation's agroforestry project for Antigua likewise has a strong institutional development component, in this case specifi-

cally directed at improving the capabilities of the Cooperative Farmers Association.

Finally, the Country Environmental Profile Project, as funded by USAID and implemented by CCA and IRF, was designed, in part, as an institution-strengthening effort, with one NGO in each target island designated as a local implementing organization with specific support and assistance given to the NGO for carrying out its responsibilities under the project. Other donor groups should be encouraged to build similar NGO institution-building components into resource management activities funded for the Eastern Caribbean.

## PRIVATE SECTOR

It is no exaggeration to say that the tourist industry, and by extension the economic health of Antigua-Barbuda, depend upon the quality of the environment. The country's clear waters, coral reefs, and clean beaches are major attractions for vacationers, and those who have made long-term investments in hotels or condominiums theoretically should have an interest in maintaining the environmental health of Antigua-Barbuda. Ironically, the tourist industry has become perhaps the major potential threat to the environment (Miller, *et al.*, 1989).

Some limited precedents for mobilizing private sector firms and institutions to protect the environment already exist in Antigua. Cades Reef and Mares Reef are actively protected by dive shop owners who use these areas as dive sites; Green Island, one of Antigua's most important marine areas and tourist anchorages, is a privately-owned nature reserve. Two other proposals for private control and management of marine resources should be supported: Coral Reef Marine Park in Antigua and Goat Island in Barbuda (Miller, *et al.*, 1989; pers. commun., P. Lay, marine biologist and EAG member, 1990; pers. commun., I. Pereira, Vice President, Barbuda Council, 1990).

Organizations like EAG should be encouraged to work with the hotel and tourism industry (perhaps through the

Antigua Hotel and Tourism Association) and to identify other creative approaches to "privatized" resource management.

### ACHIEVING INSTITUTIONAL SYNERGY

Over the past decade, nearly a dozen major donors, technical assistance agencies, and NGOs have provided funds and other support for programs and activities which address environmental problems in Antigua and Barbuda. With few exceptions, most of these efforts have been independently planned and implemented, often resulting in costly and unnecessary redundancy by the failure to build on previous efforts.

Steps need to be taken to more aggressively share information and resources. For example, projects implemented by OAS' Department of Regional Development throughout the OECS countries have produced a wealth of information, studies and recommendations that can be used by planners and technical persons in Antigua and Barbuda. Additionally, OAS, OECS, and USAID -- to name a few -- have all sponsored important studies of various aspects of the natural resource management sector in the Eastern Caribbean. At this point, it is important for a central coordinating body such as the Historical, Conservation and Environmental Commission to take responsibility for serving as a clearinghouse of information con-

cerning development/environment issues. The prospect of success in this endeavor would be increased if an NGO, such as the Environmental Awareness Group, worked in concert with the HCEC to establish an Environmental Information Center, easily accessible to all interested persons, whether from the public or private sector. EAG has made a substantial start in this direction during implementation phases of the CEP Project and now maintains the most comprehensive and up-to-date library of environmental source material in the country. A follow-up outreach effort is needed to ensure that this information is more widely available beyond EAG's membership base:

Institutions with environmental responsibilities should also expand their efforts to gain access to regional information resources such as those available through the Panos Institute's Wider Caribbean Information Program and the Caribbean Environmental Information Network (CEPNET).

Finally, efforts to combine local resources with regional programs and expertise should be expanded. The recently established marine pollution monitoring program, implemented by the Central Board of Health and the Caribbean Environment Health Institute in St. Lucia, is a good example of this approach. Many other opportunities for regional collaboration in the resource management sector exist and should be actively explored.

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