DRAFT ENVIRONMENTAL PROFILE

ON

BARBADOS

Funded by A.I.D., Bureau of Science and Technology, Office of Forestry, Environment and Natural Resources under FSSA SA/TOA 1-77

with

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THE UNITED STATES NATIONAL COMMITTEE FOR MAN AND THE BIOSPHERE
Department of State, IO/UCS
WASHINGTON, D. C. 20520

An Introductory Note on Draft Environmental Profiles:

The attached draft environmental report has been prepared under a contract between the U.S. Agency for International Development (AID), Bureau of Science and Technology (ST/FNR) and the U.S. Man and the Biosphere (MAB) Program. It is a preliminary review of information available in the United States on the status of the environment and the natural resources of the identified country and is one of a series of similar studies now underway on countries which receive U.S. bilateral assistance.

This report is the first step in a process to develop better information for the A.I.D. Mission, for host country officials, and others on the environmental situation in specific countries and begins to identify the most critical areas of concern. A more comprehensive study may be undertaken in each country by Regional Bureaus and/or A.I.D. Missions. These would involve local scientists in a more detailed examination of the actual situations as well as a better definition of issues, problems and priorities. Such "Phase II" studies would provide substance for the Agency's Country Development Strategy Statements as well as justifications for program initiatives in the areas of environment and natural resources.

Comments on the attached draft report would be welcomed by US MAB and ST/FNR and should be addressed to

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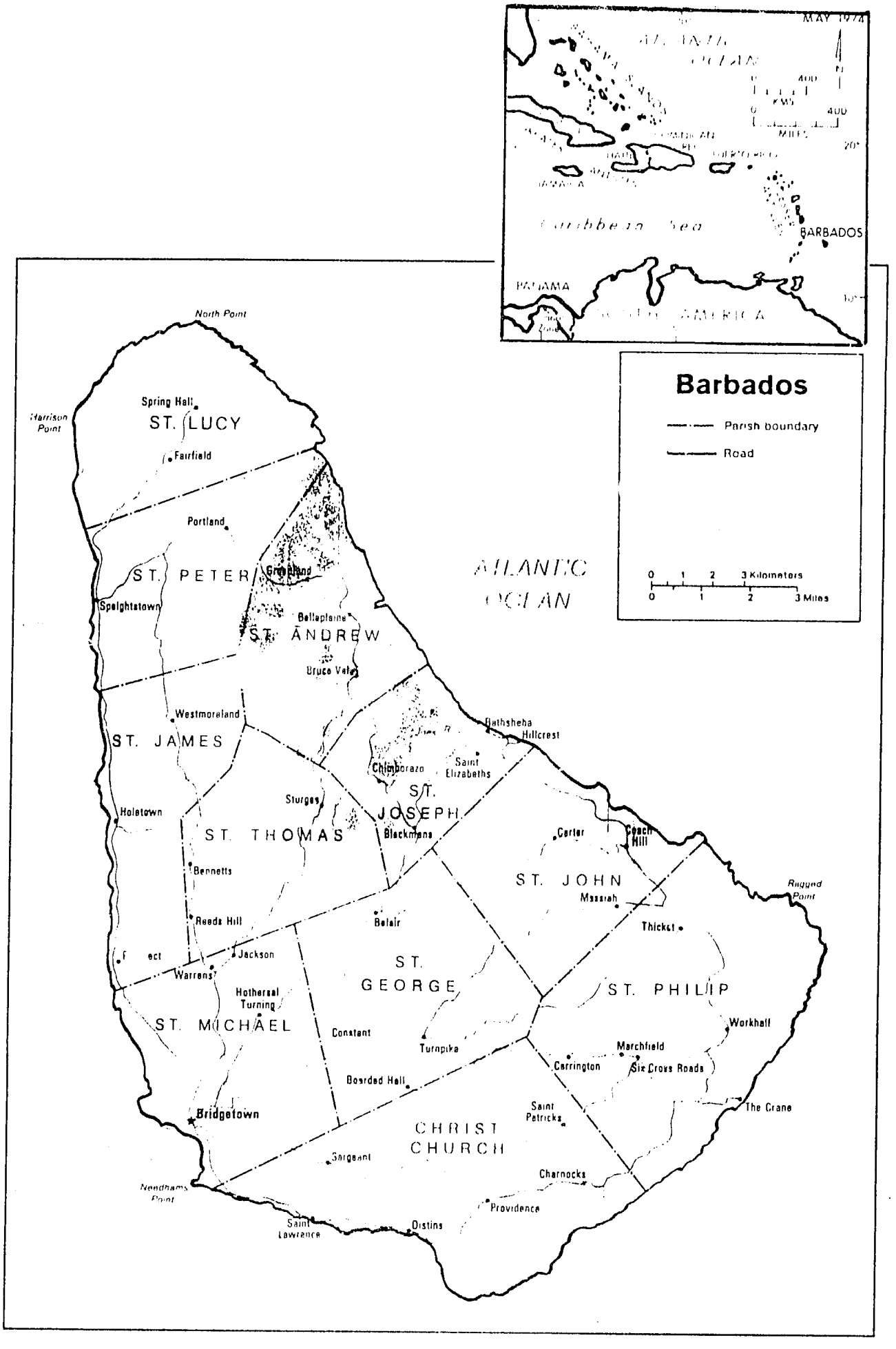
Barbados
Parish boundary
Road
0 1 2 3 Kilometers
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BARBADOS
Caribbean Sea
ATLANTIC OCEAN
North Point
Harrison Point
Spring Hall
ST. LUCY
Fairfield
Portland
ST. PETER
Speightstown
Bellaplaine
ST. ANDREW
Bruce Vale
Westmoreland
ST. JAMES
Bathsheba
Hillcrest
Chimborazo
Saint Elizabeths
ST. JOSEPH
Sturges
Holetown
ST. THOMAS
Blackmans
Carter
Coach Hill
Bennetts
ST. JOHN
Rugged Point
Reeds Hill
Belair
Thicket
Jackson
Warrens
ST. GEORGE
Hothersal Turning
ST. PHILIP
ST. MICHAEL
Workhall
Constant
Turnpike
Marchfield
Carrington
Six Cross Roads
Boardad Hall
Bridgetown
Saint Patricks
The Crane
CHRIST CHURCH
Sargeant
Charnocks
Needhams Point
Providence
Saint Lawrence
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0.0 Introduction and summary

The easternmost of the islands of the Lesser Antilles, Barbados, relatively low-lying and roughly triangular in form, is washed by the currents of the Atlantic Ocean on its eastern and southern coasts and by the waters of the Caribbean Sea on its west coast. A constitutional democracy numbering among the nations of the British Commonwealth, Barbados has experienced political stability since gaining its independence from Great Britain in 1966. The government is presently controlled by the Barbados Labour Party, which retained power after elections held in 1981.

With a total land area of 431 square kilometers and a population of nearly 250,000, Barbados is one of the most densely populated nations in the world (580 persons per square kilometer). The population, ethnically over 90% Negro, has a high literacy rate and a relatively good health status, with life expectancy at 70.5 years. Population growth has been slow, ranging from between 0.5% to 1.5% over the past few decades. Playing a major role in maintaining the health level of the population is the high quality of the water supply, recent figures showing that the entire population has access to a "reliable and safe" piped water supply.

With its limited land area, Barbados has few natural resources, although crude oil has been produced since 1973, with production running at some 900 barrels per day as of mid-1978, and gas deposits are also exploited. Barbados major resources, however, are undoubtedly its soils, which are used principally for the sugar cane production that has been the lifeblood of the island's economy, and its beaches, which attract the tourist trade that now rivals sugar cane in its economic importance for the island.

Rational use of its limited soil and land resources is certainly Barbados most important overall environmental concern. Because of its limited land area and its high population density (951 persons per square kilomter of arable land), Barbados has the vital task of ensuring that its valuable agricultural land is properly used and that alienation of this land to other than agricultural purposes is controlled. Although degradation of land resources through soil erosion is a danger throughout the island, soil and land erosion in the northeastern area known as the Scotland District is usually cited as the island's most pressing environmental problem; here, man-made changes have exacerbated problems arising from the natural fragility of the area, and landslides, washouts, and rockfalls occur. Given the small land area of Barbados, the potential loss of the some one seventh of the island represented by the Scotland District presents a significant problem.

Another significant environmental problem is coastal pollution, which threatens economically vital tourist beaches with oil slicks and which has already begun to show signs of endangering the coral reefs that act as a protective barrier from the heavy waters of the Atlantic Ocean. It also threatens the country's incipient fishing industry.

There are presently few problems with water resources. However, the island receives relatively low levels of rainfall, has no significant surface water resources, and relies on groundwater resources for its water supply. It has been projected that increasing demand on the island's water resources from agriculture, industry, and tourism could lead to water supply problems by the end of the century.

Barbados has virtually no forest area (only about 0.42% of the island is categorized as forested) and because of this dearth of habitat there is little wildlife.

The efforts of the government of Barbados to confront its environmental and resource problems have consisted of both legal and organizational steps. There is legislation covering such vital areas as water resources planning, soil conservation, and the preservation of marine areas. Significant among organizational developments is the cabinet level recognition of environmental concerns as witnessed by the establishment in 1978 of the Ministry of Housing, Lands and Environment. Also of note was the establishment in 1980 of the Barbados Water Authority, which has been charged with a broad range of responsibilities in dealing with water resources, water supply, and sewerage.

1.0 POPULATION CHARACTERISTICS

1.1 General population statistics

Total population (1977 estimate): 249,800*

Birth rate: 16 per 1,000 population (WPDS 1981)

Death rate: 8 per 1,000 population (WPDS 1981)

Rate of natural increase: 0.9% per year (WPDS 1981)

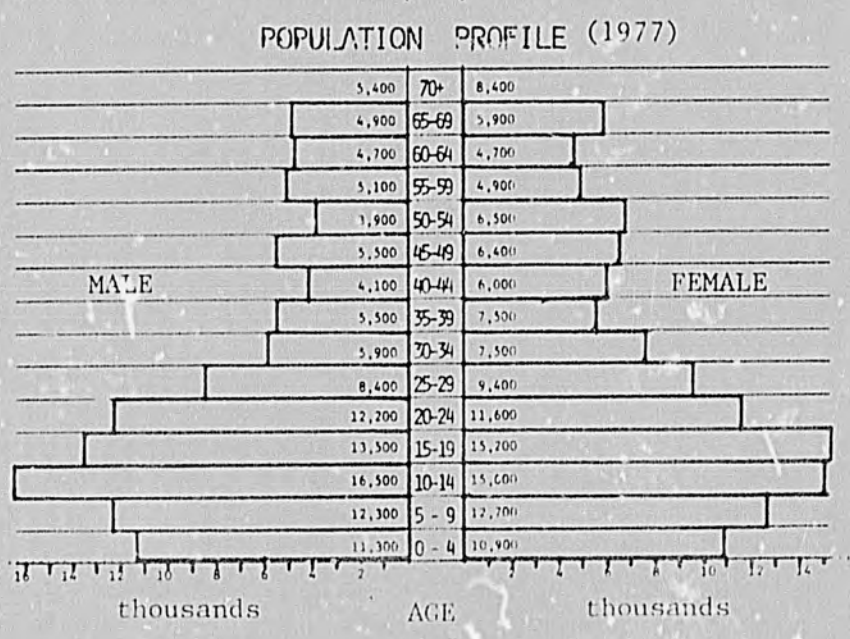
Number of years to double population: 80 (WPDS 1981)

Population in the year 2,000: 300,000 (WPDS 1981)

Population under 15 years of age: 10% (WPDS 1981)

Population over 64 years of age: 10% (WPDS 1981)

The rate of population growth, which varies with the amount of out-migration, has ranged from 0.5% to 1.5% over the past few decades. In general, migration of population has been encouraged to relieve population pressure. Emigration from Barbardos has slowed down considerably, however, since the possibility of emigration to the United Kingdom was restricted in 1962 (Kurian 1978: 122).



(Source of figures: World Bank 1979:108)

*Government censuses were conducted in 1960, 1970, and most recently in May 1980. Only provisional results of the 1980 census were available as of December 1981; these show a total population of 249,000--118,600 males and 130,400 females. Recent population estimates place the population considerably higher: the 1981 World Population Data Sheet shows 300,000 and the The World Factbook--1981 reports 256,000 as of January 1981.

1.2 Distribution of population

1.2.1 Population density

580 persons per square kilometer (based on 1977 estimate of .25 million)
951 persons per square kilometer of arable land

Barbados, with a land area of some 431 square kilometers (166 square miles) and a population of roughly 250,000 persons, is one of the most densely population countries in the world.

1.2.1 Urban-rural population

By recent estimates the urban population of Barbados constitutes some 39% of the total population; most of this urban population in located in the capital, Bridgetown, which with a population of about 95,000 is the only significant urban concentration in the country. Other towns are Speightstown (the second largest town), Holetown, and Oistin Town. The remainder of the population is fairly well distributed throughout the country. However, because of the small size of the country (the island is only 21 miles long and nowhere more than 14 miles wide) and the excellent road system, which makes centers of economic activity easily accessible, the rural-urban dichotomy is not of great significance (UNEP/ROLA 1977:2).

1.3 Ethnic, linguistic, and religious characteristics

Before the coming of the Europeans to Barbados during the 16th century, the island was populated by Arawak Indians, whose presence on the island is today witnessed only by remains of former settlements in caves and along the coast. As of 1970 the population mix was 224,318 Negro (92%), 9,354 white (3.8%), 9,305 mixed (3.8%), and 675 East Indian (0.27%). About 70% of the population are Anglicans, but the Roman Catholic Church and other protestant denominations are also represented. English, typified by local features, is the official language of the country.

1.4 Educational characteristics

Percentage of literate population (1970): 94% (PAHO 1979:91) *

Percentage of population 5-14 years enrolled in primary schools (1973): 55% (PAHO 1979: 91) *

Percentage of population 15-19 years enrolled in secondary and vocational schools (1973): 81% (PAHO 1979:91)

Percentage of population 20-29 years enrolled in university (1973): 4% (PAHO 1979:91)

*World Bank 1979 estimates 97% literacy and 100% primary school enrollment for the year 1970 (World Bank 1979: Country Data).

Free, though not compulsory, education is provided in all Government Primary and Secondary Schools in Barbados. Primary education is offered not only in Government Primary Schools but also in Independent (private) schools and Government-Maintained Secondary (Grammar) Schools. Secondary education is provided by Government Secondary (Grammar) Schools, Secondary Comprehensive, Aided-Independent, and Independent Schools (CYB 1980:88).

Technical education is available for an increasing number of students. Both full-time and part-time day and evening classes are provided at the Technical Institute in a variety of courses preparing students for standardized technical examinations (CYB 1980:88).

Higher education is offered by the University of the West Indies and the Barbados Community College. For more details on these and related institutions, see section 4.4.

1.5 Health characteristics

1.5.1 General health indicators (Source: PAHO 1979:91)

Life expectancy at birth (1975-1980): 70.5
Death rate per 1,000 population (1977): 8.4
Infant mortality rate per 1,000 live births (1977): 24.2
Death rate 1-4 year per 1,000 population (1977): 1.2
Percentage of deaths from infectious and parasitic diseases (1976): 2.3
Percentage of deaths from influenze, asthma, pneumonia, bronchitis and emphysema (1977): 8.8
Number of physicians per 10,000 population (1977): 6.7
Number of hospital beds per 1,000 population (1977): 8.4

1.5.2 Health problems

The health status of the people of Barbados is relatively good, and it has been speculated that the island environment may actually act as an insulator against the introduction or reintroduction of communicable diseases.

Although the tropical disease dengue fever persists as a problem despite an active campaign to eradicate its vector, the *Aedes aegypti* mosquito, heart disease, stroke, and cancer, rather than diseases usually associated with developing countries, rank first, second, and third as the causes of death in Barbados (UNEP/ROLA 1977:16).

Malnutrition exists but, according to surveys, at lower rates than in some other Caribbean countries. There is a well organized National Nutrition Center which, among other things, monitors the nutrition status of children and provides domicillary and hospital treatment of malnourished children (PAHO 1979: 92).

Another significant health problem is presented by the large number of rats, which carry leptosporosis, a disease responsible for some 23 deaths between 1961 and 1974. 54 cases of the disease were reported in 1975. In addition to carrying disease, however, rats also consume and cause the spoilage of both human and domestic-animal food supplies, destroy property, and act as a deterrent to tourism (UNEP/ROLA 1977:16-18).

1.5.3 Health Care

Barbados is divided into three health districts, each of which is served by a main health center and sub-centers. The main health centers are headed by medical officers of health assisted by public health nurses and public health inspectors. Various types of clinics are conducted at these centers: pre-natal, child health, VD, chest, and diabetic.

Thirteen District Medical Officers conduct 11 out-patient clinics, while hospital care is provided by the government at the Queen Elizabeth Hospital (593 beds) in Bridgetown, an acute general hospital, two maternity hospitals, a leprosarium, and five district hospitals for the destitute and chronically sick. Psychiatric care is offered by a 637-bed psychiatric hospital. There are also three private hospitals; the largest, St. Joseph's Roman Catholic Hospital, has 100 beds (CYB 1980:89).

Government medical care is provided free at the point of delivery. Private (patient-paid) medical care is available from family physician practices and from hospital consultants who also engage in private practice (Hoyos 1981:3).

Maternal and child care and family planning

Maternal and child health clinics are conducted at the health centers and clinics throughout the country, while maternal health clinics are held at Queen Elizabeth Hospital. Nearly 100% of all births took place in hospitals in 1979.

There is an active family planning program conducted by a strong family planning association and financed by the government, IPPF, UNFPA, and UNDP. UNFPA has also funded a project aimed at strengthening and improving the quality of family planning services by providing an extended and integrated coverage of clinical family planning services within the health care services offered by clinics (PAHO 1981:77).

1.5.4 Health planning and policy

The National Development Plan 1979-1983 has several broad policy objectives relating to health. These include: the development of a free national health service with the structure of the National Insurance Scheme; improvement of quality and extension of the coverage of health care to the entire population; reorganization of the structure and administration of the health service in order to achieve the unification of the private and public subsectors into a National Health Sector providing primary, secondary, and tertiary health care; integration of the mental health services into the total health service; expansion of the present health education program; improvement in the quality of environmental health; and training of medical, nursing, and allied health personnel to meet the needs of the improved service (PAHO 1981:77).

1.5.5 Water supply and sanitation (see also 2.2)

The water supply of Barbados has been described as both "reliable and safe" (PAHO 1981:78). Figures available in 1977 show that the entire population is served by piped water provided by the Water Department of the Ministry of Communications and Works. About 67.5% of the population had water piped directly into their homes; the remaining 32.5% relied on standposts for their water supply (OAS 1977:112). According to World Health Organization figures, 97% of the urban population was served by house connections as of 1975 (WHO 1976:572).

As of 1976 the Water Department was supplying some 23 million gallons per day (MGD) of water. This supply was derived from a total of 16 sources: 14 wells and two springs. The wells are scattered through the country; 10 are located in the sheet water area (see 2.2) and four directly on underground streams. Domestic water usage accounted for 17 MGD, commercial and industrial usage for about 6 MGD (OAS 1977:112). Because the coral underlying the island acts as a filter, most of the water is clean and only chlorination is needed for treatment (CYB 1980:91).

At present Barbados has no public sewerage system. Excreta disposal, therefore is by septic tanks and suck wells for houses with water connections. Other houses use pit latrines that are partly subsidized by the Public Health Engineering Unit, which manufactures the necessary slabs and risers. However, a few large hotels have sewage treatment plants. As of 1980 a public sewerage system for the Bridgetown area was under construction with a loan from the Interamerican Development Bank. Furthermore, a Water Authority was established by Act of Parliament in October 1980; this body will assume responsibility for both water supply and sewage disposal. One national engineer has completed training in sanitary engineering on a PAHO/WHO fellowship; he is now attached to the Bridgetown sewerage project (PAHO 1981:78).

Little information on solid waste disposal was available. There is a recently established government solid waste management program under the Sanitation Service Authority; arrangements have been made for the training of both the manager and assistant manager of the program. A pulverization plant, construction of which began in 1979, was completed and put into operation in 1980. Most of the island's solid waste is expected to be channeled through this plant (PAHO 1981:78).

2.0 RESOURCES OF BARBADOS

2.1 Topography and climate

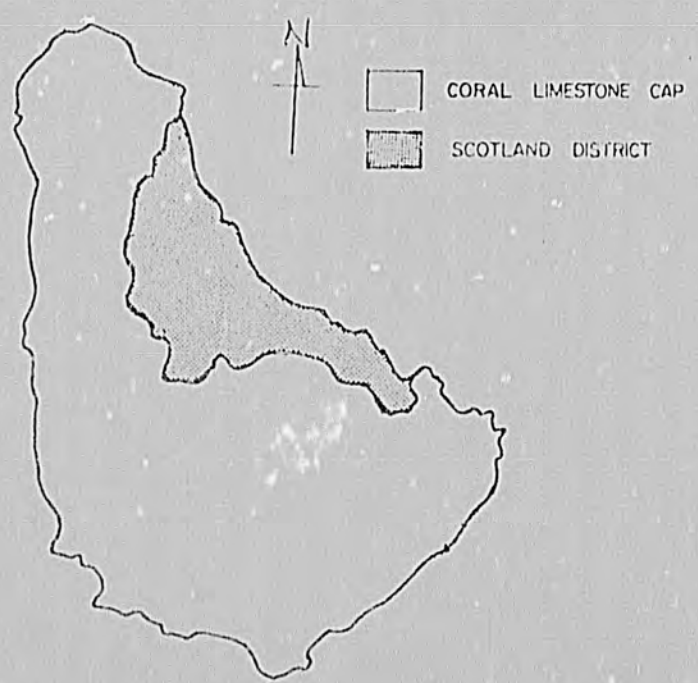
2.1.1 Topography

Barbados, with a land areaof 431 square kilometers, is roughly triangular in shape, being about 33.6 kilometers long and 22.4 kilometers across at its widest part. Although it is generally counted among the islands of the Lesser Antilles chain, Barbados is located about 160 miles to the east of its nearest neighbors (St. Vincent and St. Lucia) and is surrounded by great oceanic depressions of from 1500 to 2300 meters which make it an isolated oceanic island.

In contrast to many of the islands of the Antilles group, Barbados has a relatively low profile. The island has an interior highland region with altitudes ranging from about 180 to 240 meters above sea level; this region includes the highest point in the island, Mt. Hillaby (339.9 meters) in St. Andrew Parish in the Scotland District. In the south there is another somewhat elevated area known as Christ Church Ridge with heights of from 60 to 90 meters. On the whole, however, Barbados consists of lowlands and has few sharp topographical inclines (Gooding 1974:9-10).

With regard to its geological makeup, about 85% of the surface of Barbados is covered with coralline limestone generally varying in thickness from 24 to 100 meters, although this coral cap may be much thinner in some areas such as Ragged Point in St. Phillip Parish. Underlying this coral is an impervious stratum of ocean formation consisting essentially of clays and sandstone. In the remaining 15 % of the island, however, the oceanic formation outcrops at the surface, forming the Scotland District (Goodwin 1977:106).

Because of the history of the formation of the coralline area, this region consists of a series of coral limestone terraces, the outer edges of which form the inland cliffs which are so prominent a feature of the landscape of parishes such as St. Peter, St. James, and St. Michael on the eastern side of the island. In contrast, the land of the Scotland District is hilly, with steep valleys backed on the inland side by the coral cap in the form of a cliff, quite spectacular in some places, ranging from 220 to over 300 meters in height (Gooding 1974:10).



Delimitation of Coral Area and Scotland District (Source: Goodwin 1977:106)

2.1.2 Climate and precipitation

Barbados is situated in the tropics and has what has been characterized as a tropical, oceanic climate. Lying within the belt of the north-east trade winds, which temper the tropical temperatures, Barbados experiences average annual temperatures ranging from 24 to 28 degrees centigrade with daily variations of less than 3 degrees, although temperatures in the highest areas are a few degrees cooler. Daily sunshine is least in October (about 7.3 hours) rising to 8.8 hours in April. Humidity levels are usually between 71% and 76% throughout the year. The island is not within the normal hurricane belt (Randall 1970:155).

Because of its generally low topography, Barbados, in contrast to islands with higher elevations, does not receive a great deal of rainfall. Although extremely variable from year to year, rainfall averages about 1600 millimeters annually and comes in two usually well-marked seasons: a wet season(June to October-November) during which about two-thirds of the total rainfall occurs, and a dry season (November-December through May-June), during some months of which rainfall may be less than 25 millimeters.

Rainfall levels vary with elevation, the higher elevations in the central area of the country (see map on page 8) receiving as much as 2,032 millimeters per year and the lower coastal zone, particularly the southern coastal area, receiving as little as 1,026 millimeters per year. Furthermore, higher areas usually get showers even during those months when the lower areas may be completely dry. There are also variations according to location; the north and the south of the island receive about 1100 millimeters per year, while the central parts of the east and west coasts receive only 1350 millimeters (Randall 1970:155).

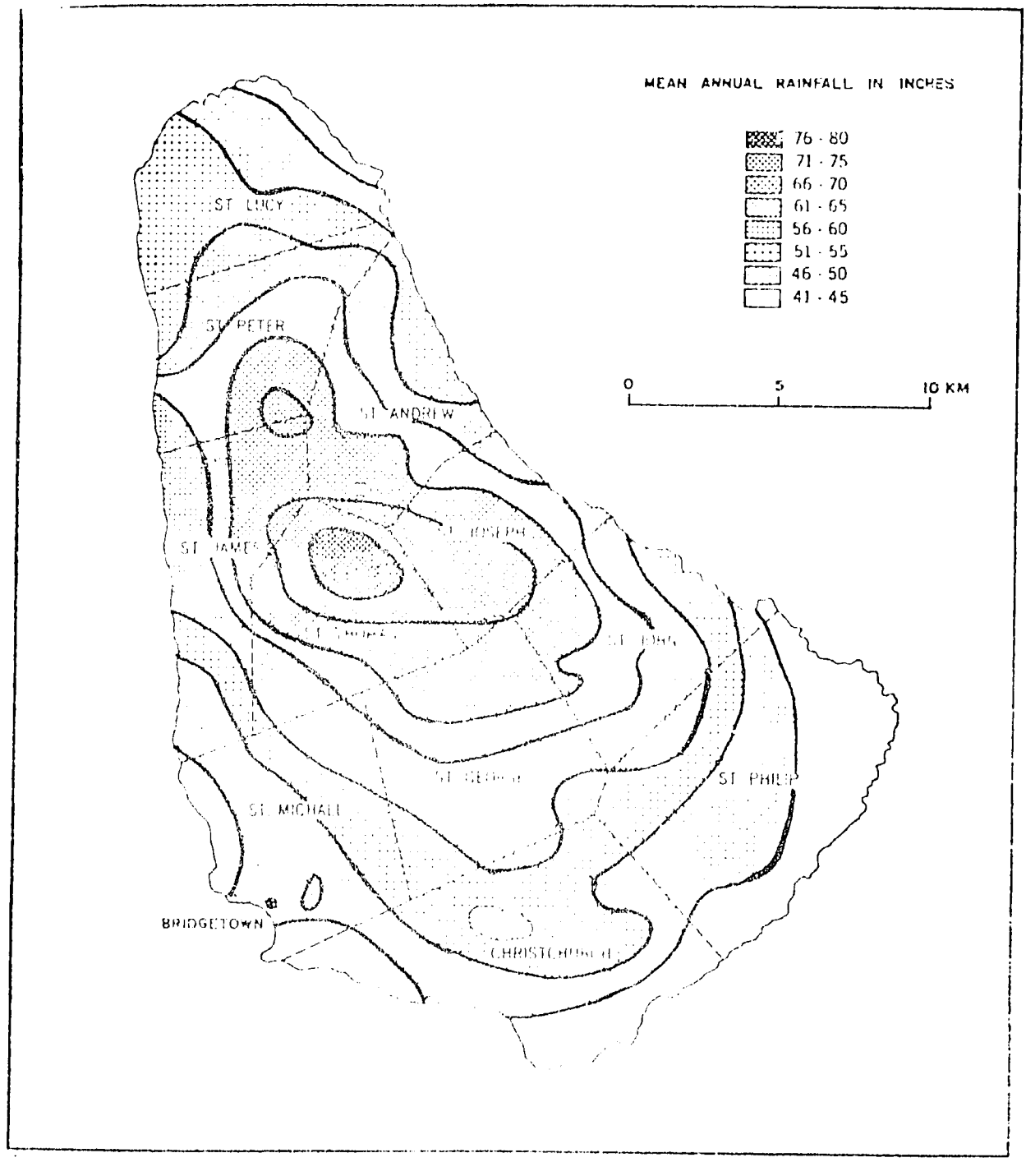
2.2 Water Resources

2.2.1 Surface water and groundwater resources

Because of various factors, including comparatively low rainfall levels, its basically flat topography, and the geology of the island, Barbados has, with the exception of some relatively unimportant and intermittent streams, no significant surface water resources. Only in the Scotland District are there steep well-drained slopes. Here runoff is heavy, forming what are for the most part only seasonal streams. Only St. Joe's River in this district and a few other streams such as Indian River in the south-west, Farmer's Gully and the Threehouses stream usually have water all year round; the last has been canalized and is used for irrigation (Carson and Tam 1977:186; Goodwin 1974:90).

On the other hand, the geological formation of the island is well suited for the provision of a good supply of groundwater (see Goodwin 1977 for a discussion of these characteristics). The source of most of the groundwater is the rainfall in the central coralline highlands, an estimated one-fifth of which contributes to Barbados groundwater reserves. This rainwater may be caught in the numerous shallow depressions, some of which open into natural fissures in the underlying limestone known as "sucks". (Where such openings do not exist, farmers have often dug wells through the upper crust of the coral in order to reach fissures which serve to carry away surplus

RAINFALL MAP (Source: Smith 1976:63)



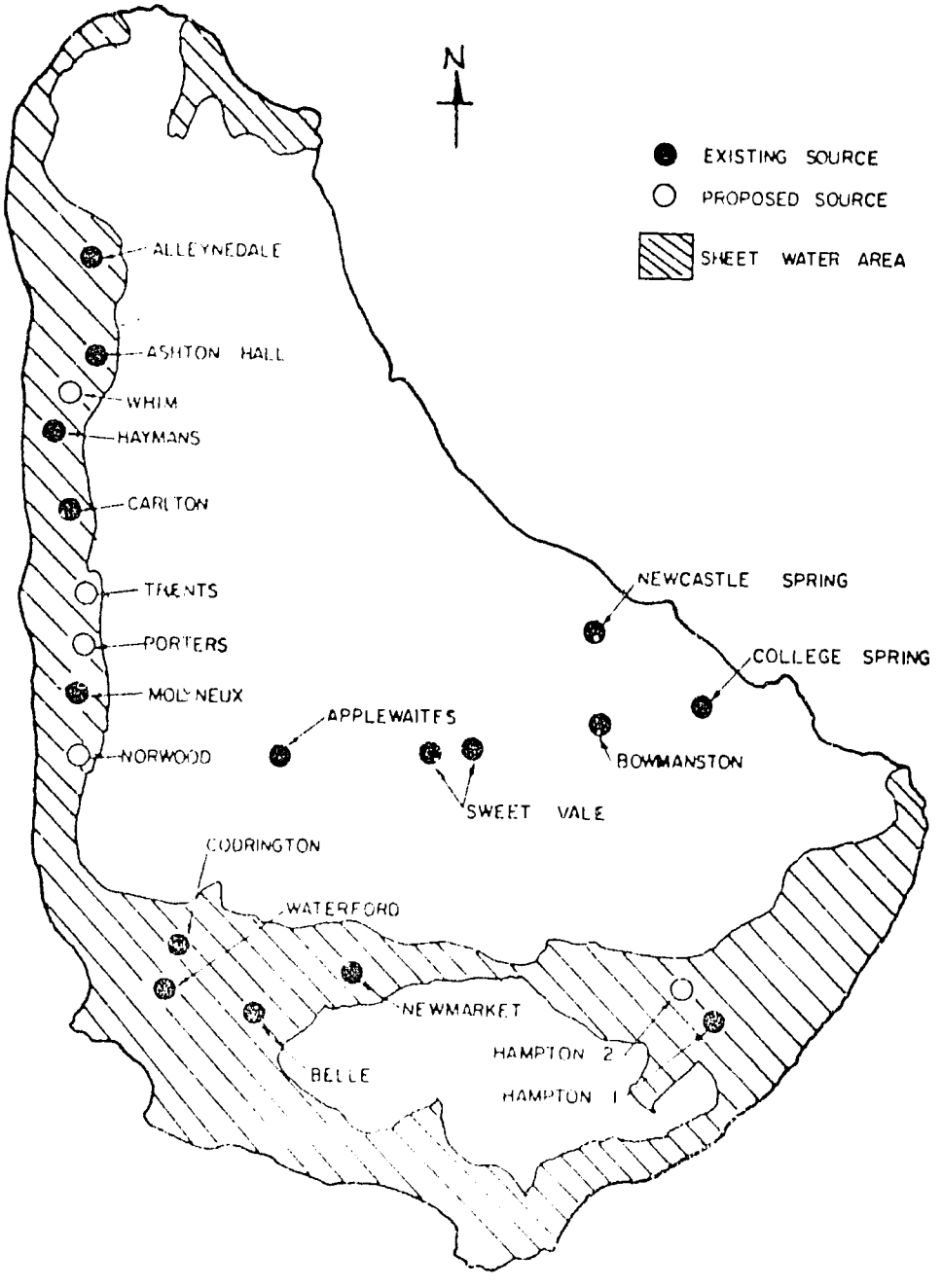
rainwater). However, both the soil and the limestone rocks in these regions are relatively permeable so that even water standing on the surface gradually sinks into the coral, eventually reaching the underlying impermeable clay stratum along which it flows towards the sea. In the lowland coastal region, this water then forms a coastal reservoir of freshwater, designated as sheet water, which is found in a strip along the entire eastern and southern coasts of the island, varying in width from a few hundred feet to over four miles in some places. At the beginning of this sheet water system, the fresh water rises to a height of one to four feet above mean sea level (Goodwin 1977:106-107).

Investigations of groundwater resources as cited in Goodwin 1977 were carried out in the late 1940's and in the 1960's. The calculations of H. Tullstrom (1963) based on an estimated 1524 millimeters of rainfall per year and as revised by H.A. Sealy (1968) are shown in the table shown below, which indicates the safe yield of present and potential supply source; the locations of these sources are shown on the map on page 10. The map and table on page 11 indicate the major catchment areas and their groundwater yields.

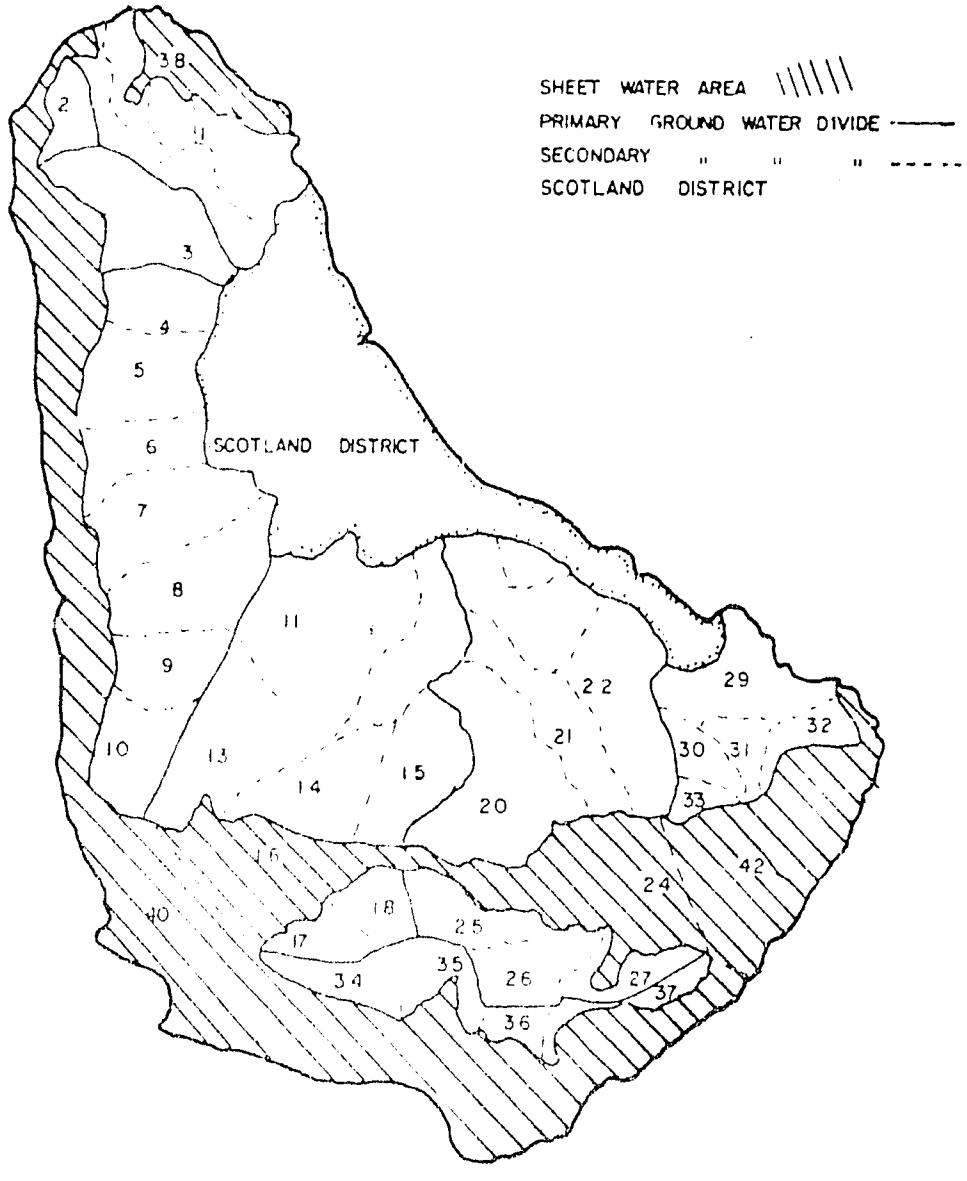
Safe Yield of Supply Sources
(Source: Goodwin 1977:110)

Name of Source	Safe Yield (Tullstrom) MGD	Safe Yield (Sealy) MGD	Present Output MGD
Alleynedale	1.25	1.25	0.5
Ashton Hall	1.0	1.0	0.24
Whim	0.8	0.88	-
Haymans	0.85	0.85	0.82
Carlton	1.0	1.0	0.25
Porters	0.7	0.9	-
Trents	1.0	1.0	-
Molyneux	0.8	1.0	0.63
Norwood	0.25	0.3	-
Sweet Vale I Sweet Vale II	1.25	0.3	1.04
Applewaites	3.0	1.57	0.4
New Market	2.5	3.0	1.7
Belle	7.0	8.0	7.8
Codrington			
Bowmanston	2.0	2.0	1.43
Hampton I	4.0	5.05	3.3
Waterford	1.5	1.55	1.03
Newcastle Springs Codrington Springs	0.75	0.85	0.75
Hampton II	-	4.28	-
	29.65	34.78	19.89

Location of Supply Sources
(Source: Goodwin 1977:111)



MAJOR CATCHMENT AREAS (Source: Goodwin 1977: 109)



Yield in Coral Rock Area (average rainfall)

Catchment	Area Square miles	Yield MGD
St. Lucy-Northeast Area 1-2	8.99	2.69
Western Area 3-10	24.04	11.88
St. Thomas - St. Michael Area 11-18	29.90	14.02
St. John - St. Philip Area 19-28	29.55	10.10
Codrington College - East Point Area 29-33	9.51	1.77
TOTAL	101.99	40.46

2.2.2 Water resources utilization

Water utilization as of 1977 was estimated at just under 28 million gallons per day (MGD), about 23 MGD of which was supplied by the Waterworks Department. In addition to these public extractions, private extractions for irrigation, swimming pools, golf courses, and other uses were estimated at about 3 MGD, while an additional 1.8 MGD was extracted by sugar factories during sugarcane reaping season (Goodwin 1977:112).

Domestic usage

Domestic water usage, which accounts for about 74% of public water supply usage, is dealt with in section 1.5.5 above.

Commercial and industrial usage

Commercial and industrial usage, which accounts for about 26% of public water supply usage, consists of water used in the tourist sector (particularly hotels), business premises, bottling plants, and water sold to shipping. Of the some 6 MGD consumed as of 1977, usage by tourist hotels accounted for about 4.5 MGD; investigations indicated that water usage per guest in just three of the island's luxury hotels was as high as 270 gallons (Goodwin 1977:112).

During the sugarcane reaping season, sugar factories privately extract water needed for their operations; such extractions usually amount to about 1.8 MGD per season. Factories located in areas subject to drought are sometimes forced to use the public water supply system as well (Goodwin 1977:112).

Private extractions

Private extractions, amounting to about 3 MGD, are for irrigation, swimming pools, and golf courses. The volume of private extractions has been increasing as farmers have been encouraged by government programs to purchase and install irrigation equipment. Some water for these purposes also comes from the public water supply (Goodwin 1977:112).

2.2.3 Water resources outlook

As of 1977 water usage amounted to about 78% of the total estimated 34.78 MGD safe yield of supply sources in the coral rock area of the country. It has been projected that if demand for water keeps growing at the present rate, this entire amount will be required for the public water supply alone by the year 1996 (Goodwin 1977:113).

Possibilities for augmenting water supply are considered by Goodwin 1977. The first and most promising possibility is the artificial recharge of groundwater by the construction of recharge wells at strategic locations to absorb storm runoff. Artificial recharge might also be achieved by the construction of dams in the deep gullies that form part of the natural drainage system of the island; this would slow down storm water runoff

and give water more time to percolate downward to the groundwater aquifer.

The second possibility considered by Goodwin is the use of the some 3 MGD of brackish water available on the northern and southern tips of the island. Most of this water is presently being used for irrigation, but it is possible that through dilution with water of low chloride content, its present 700 parts per million (ppm) chloride content could be reduced to a level that would make it acceptable for the public water supply (the WHO standard stipulates a maximum 200 ppm chloride content).

A third possibility is the utilization of the water resources of the Scotland District. As of 1977 these resources had not been subjected to a detailed investigation, although Tullstrom had claimed in 1963 that 3 MGD of potable water and 7 MGD of irrigation water could be obtained from the area. However, because these resources are primarily surface water with a high proportion of suspended and dissolved solids, its utilization would required the construction of expensive impounding reservoirs and extensive treatment plants (Goodwin 1977:108,114).

Desalination of sea water, another possibility for augumenting water supplies, may still be too expensive to be a practicable solution.

On additional possibility is simply the controlling of consumption through conservation measures. The present average daily use of 95 gallons per persons for those receiving piped water in their homes is considered quite high; it has been estimated that if the public were educated into water consciousness and if universal metering of water consumption were introduced, usage could be reduced by as much as 25%, thus essentially solving the water supply problem. Particularly significant in this regard would be the reduction of the water often misused in the irrigation of small garden plots, trees, and lawns (Goodwin 1977:114-115).

2.2.4. Water pollution

Pollution of water resources does not appear to be a problem in Barbados, and the government appears to be committed to protecting this resource. In a statement at a 1979 conference on environmental management and growth in smaller Caribbean islands, a Barbados official noted that protection of the high quality of its groundwater reserves was the major factor in the government's decision to build a pulverization plant handle solid waste rather than to rely only on landfill as a waste disposal method (Beller 1979:72-73).

2.3 Soils of Barbados

The basic soil map for Barbados--that used for the Caribbean portion of the FAO-Unesco Soil Map of the World, is that prepared by K.C. Vernon and D.M. Carroll and published in 1966 as Number 18 of the Soils and Land-Use Survey Series of the Trinidad College of Tropical Agriculture. This publication was not available for the preparation of this profile, but was the basis for the soil description contained in Gooding 1974, on which the following material is largely based.

2.3.1 Soil types

The soils of the coralline areas of Barbados have been classified into 9 groups with differences partially associated with age and the length of time they have been exposed to weathering. Another important factor is exposure to falls of volcanic ash, since all of these soils consist of a mixture of break down products of coral limestone and volcanic ash. All of the nine types of soil are basically medium clays. Those in the higher elevations are red in collar and have a relatively poor water holding capacity. As elevation decreases, there is a gradual change of color from red through reddish brown to black and a corresponding increase in water holding capacity. Thus soils at higher levels support lush natural vegetation because they receive higher levels of rainfall, whereas soils at lower levels receive less rainfall but are able to support vegetation because they have a higher water holding capacity (Gooding 1974:22-27).

Soils of the Scotland District differ considerably from those of the coralline region. Derived almost entirely from underlying parent rocks or alluvium washed down from higher rocks and low in volcanic ash content, these soils are clays, sands, silts, loams and several derivations thereof. Vernon and Carroll identified 50 types of soil in this area. They are unstable and have suffered serious erosion (Gooding 1974:23).

2.3.2 Utilization of soil

According to recent estimates, some 60 to 65% of the total land area of Barbados is planted to crops, 10% is permanent meadows, and 30% is unused, built upon, or wasteland (World Factbook 1981:14). The major crop is sugar cane, but about a fifth of the sugar cane lands produce food crops in rotation. Details on agricultural production are contained in section 3.1 below.

2.3.3 Soil problems

Two characteristics of the soils of Barbados contribute to problems: their shallow depth (about 60 cm on the average) and their slow regeneration. While the first factor, combined with the undulating topography of the island and periods of intense rainfall, make the soils vulnerable to erosion, the second means that soil losses are practically irreversible (OAS 1977:12,19).

Soil erosion has been a problem in Barbados, beginning with the destruction of the forest cover, which followed within a few decades of the English colonization of the island in 1626. The cultivation of tobacco, cotton, and sugar cane, which replaced the earlier forest, contributed to both erosion and exhaustion of the soil. However, the later extension and improvement of sugar cane cultivation resulted in the control of soil erosion problems as the waste and leaves of the cane were used as a protective cover to the land, conserving its humidity and organic matter. This source of soil protection was threatened, however, when, at the end of the 1960's, famers began burning the cane fields to facilitate the harvest and cut labor costs. Such burning was restricted by the government in 1974, but it is estimated that it has take many years for the soil to recover from the ill effects--loss of soil fertility and thus of sugar cane productivity--caused by the practice (OAS 1977: 19; UNEP/ROLA 1977:6-7).

While soil erosion is a danger throughout the island, it is a particularly serious problem in the some 60 square kilometers of land which comprise the Scotland District of northeastern Barbados. As described by Carson and Tam in a detailed discussion of the Joe's River Muds, where land erosion rather than simply soil erosion occurs, the problem in this already vulnerable area has been accelerated by man-made changes in the natural environment, particularly the clearing of natural cover for agriculture, as well as by inappropriate conservation measures which, by aiming to reduce infiltration on slopes, have accentuated flood runoff amounts and rates (Carson and Tam 1977:185).

This problem is not new. Landslides, washouts, and rockfalls have plagued the area as long as can be remembered and have often resulted in the collapse of roads and bridges and in the loss of entire agricultural crops. Stressing the severity of the problem, a recent editorial in a Bridgetown newspaper warned: "If the erosion in the Scotland District cannot be halted, one seventh of the total area of 166 square mile Barbados will slide into the Atlantic Ocean (IDG New, August 1981:8; JPRS 78702, August 7, 1981:13).

soil conservation measures in the Scotland District

In the past, the government of Barbados has attempted to stabilize the situation in the Scotland District through the erection of dams and the introduction of new drainage systems. As Carson and Tam point out, however, some of these measures have actually been detrimental in the long run. The most recent scheme, to be undertaken by the Soil Conservation Unit of the Ministry of Agriculture, Food and Consumer Affairs, involves a series of conservation measures including reshaping and terracing the land. The program, to be funded by a US$4,445,000 loan from the Inter-American Development Bank approved in June 1981 (the total cost of the project is estimated at US$5.8 million), also involves the establishment of seven water courses and the construction of about 30 kilometers of hillside ditches to reduce slopes between terraces. Among other planned activities is a massive reforestation program using sugar cane. fruit trees and forest cover legumes to conserve soil and increase productivity. The program is to be conducted on Government-owned estates but will also entail the collection and analysis of soil and hydrological data throughout the Scotland District. The Soil Conservation Unit is expected to obtain the services of a specialized organization that will provide advice on the maintenance of engineering machinery and the conducting of training exercises (JRS 78702, August 7, 1981:13-14).

2.3.4 Land use Problems

Questions of land use are of great importance in Barbados, with its small land area and high population density. While sugar cane continues to play a vital role in earning foreign exchange, its cultivation claims a major amount of land available for the production of food crops. There have been attempts to remedy this situation through government agricultural diversification programs (UNEP/ROLA 1977:6-7; see also 3.2).

While sugar cane production limits the production of food crops, the continued allocation of land to non-agricultural uses reduces the overall amount of land available for cultivation and represents a serious loss of a vital resource. Contributing to this loss of agricultural land have been: the construction of roads to accomodate increasingly larger numbers of automobiles; expansion of tourism related facilities as the tourist trade has expanded; the demand of larger lots of land for private residences; and the practice of land speculation, which idles a considerable amount of agricultural land (OAS 1977:21).

2.4 VEGETATION RESOURCES

2.4.1 General description

The flora of Barbados has been drastically altered since the island was settled by the British in the early 17th century. The felling of the tropical forest which once covered most of the island caused profound changes in the natural vegetation. Tilling of the soil has forced out much of the natural vegetation as have grazing and the depredations of usually human-caused fires. Furthermore, man has introduced many plants into Barbados; some of these such as mahogany, have become naturalized and incorprated into the wild flora of the island (Gooding 1974:23-24). A detailed treatment of the plant life of Barbados is provided by Gooding (1974), who identifies several types of natural plant communities (beaches and sand dunes, sandy fields and sandy bushlands, sea cliffs and sea rocks, rock land and inland cliffs, gullies, forests, and coastal swamps) and man-made habitats (canefields, pastures, canefield roads, roadsides, ponds and streams, and miscellaneous waste places). Only forests, however, will be treated here.

2.4.2. Forests

2.4.2.1 The resource

There are many indications that when the colonization of Barbados began in 1627 the island was abundantly forested. However, by 1647, as much as half of the forest had already been cut, and by 1750 forests on the island were probably already reduced to scattered patches of woodland not much more extensive than those remaining today (Gooding 1974:62). As of 1976, only some 18 hectares were designated as forest land (about .042% of the total land area)(Johnson and Johnson 1977).

Remnant natural forests, comprising today considerably less than 1% of the total territory of the country, include poor coastal woodland such as that near Bath on the East Coast, undercliff woods at scattered spots on rocky slopes around the lip of the Scotland area from near Codrington College to Boscobel, and a relic mesophytic forest at Turner's Hall in St. Andrew.

Coastal remnant forest

Trees of the remnant coastal forest, which is rather xerophytic in nature, include sea grape (*Coccloba uvifera*), whitewood (*Tabebuia pallida*), and manchineel (*Hippomane mancinella*). On the windward (eastern) side of the island these trees tend to be stunted in growth, while on the protected leeward (western) side of the island they attain greater heights, with manchineel reaching heights as great as 12 meters.

Turner's Hall Wood: a relic mesophytic forest

Turner's Hall Wood in the Scotland district is the last remnant of the mesophytic (semi-deciduous) forest which by all indications once dominated the interior of the Island. Covering no more than 20 hectares, the forest is on steep land at an elevation of between 180 and 240 meters, where rainfall averages about 1550 millimeters per year. The forest consists of two stories. The denser lower canopy, attaining heights of from 10.6 to 19.8 meters, is comprised mostly of medium sized evergreens, including Spranish oak (Inga laurina), beef wood (Pisonia fragrans), fustic (Chlorophora tinctoria) leather coat tree (Coccoloba pubescens) bastard locust (Coccoloba swartzii), two wild clammy cherries (Cordia collococca and C. sulcata). The few deciduous species include birch gum (Bursera simaruba), hog plum (Spondias mombin), and white harklis (Fagara caribaea).

The more open upper canopy (21 to 30 meters) is composed mostly of dedicuous or partly deciduous trees, including locust (Hymenaea coubaril), silk cotton (Ceiba pentandra), fiddle wood (Citharexylum spinosum), and sandbox (Hura crepitans). Evergreens include jack-in-the-box (Hernandia sonora), poison tree (Sapium hippomane), and cabbage palm (Roystonea oleracea) (Gooding 1974:66-72).

Although this forest, because of its limited size, cannot be considered a resource of the Barbados, it retains so many of the features of the original vegetation of the island that it has been called "a priceless treasure and unique storehouse of Barbados' natural history (Gooding 1974:72).

Undercliff woods

The undercliff woods, which at one time were continuous with the coastal forest are found mainly on rocky slopes at the base of the coral cliff that extends from Sealy Hall in St. John around the rim of the Scotland District (see map) to Boscobel in St. Peter. In one of these woods, Forsters Hall Wood in St. John the following species, ranging from xerophytic to more mesophytic, have been identified: whitewood (Tabebuia pallida), fustic (Chlorophore tinctoria), poison tree (Sapium hippomane), white harklis (Fagara caribea), birch gum (Bursera simaruba), fiddle wood (Citharexylum spinosum), leather coat tree (Coccoloba pubsecens), galba (Calophyllum antillanum), white willow (Capparis indica), black willow (Capparis cynophallaphora), Trema lamarckiana, balsa (Ochroma pyramidale)--but only rarely, cabbage palm (Roystonea oleracea), and the endemic macaw palm (Aiphanes erosa). Part of the wood contains mahagony (Swietenia mahagonia), which was introduced to the island in the mid-18th century. This forest has few large trees and only a rather patchy canopy (Gooding 1974:65).

In some of the more accessible undercliff forests such as Joe's River Wood, the Ministry of agriculture is experimenting with commercial timbers (Gooding 1974:65).

Swamp forests

In the past there were many coastal mangrove swamps, especially on the sheltered leeward side of the island. Except for a few remnants all of this area has been lost to coastal development. Considerable area around Bridgetown, the capital, had been mangrove swamp; the final destruction of this mangrove area was completed when the Constitution River was canalized in the 1950's. As of the mid-1970's some mangrove swamp was still reported at Indian River (since lost to the Bridgeport harbour enlargement scheme) and at Brandons as well as a few trees at Holetown, also on the west coast. Two native species of mangroves Conocarpus erectus and Avicennia nitida have disappeared as a result of the loss of the mangrove swamp (Gooding 1977:181).

2.4.2.2 Forest utilization

Although there is some reported use of the Turner's Hall Forest for both firewood and timber, this has been carried out only on a limited scale. Most forest planting schemes have as their goal soil conservation or windbreaks rather than use for timber or firewood. The FAO reports imports of both fuelwood and roundwood into Barbados.

2.4.2.3 Reforestation

The government is reported to have recently acquired an area of 38.4 hectares of unimproved forest land in the Scotland District of the country, where work continues on thinning and replanting. Afforestation is now being carried out in some of the coastal lands of St. Andrew for creating shelter belts and wind breaks from the steady salt-laden Trade Winds coming off the sea (CYB 1980:99). Plans for reforestation in the Scotland District are mentioned under 3.3 above.

2.5 Wildlife

2.5.1 The resource

Wildlife on Barbados appears to be limited in numbers, and very little information on its occurrence could be found. Given the very limited area available for wildlife habitat, it is, of course, unlikely that much wildlife would be found. Even as early as 1750, the date of Griffith Hughes' account of the natural history of the island, only a few mammals, apart from domestic animals, occurred: monkeys, raccoons, rats, cave bats, and mouse bats. Monkeys, even in 1750 confined chiefly to inaccessible gullies, were, along with raccoons, considered such a nuisance to farmers that a premium was paid for their destruction, with the result that "they yearly decrease rather than multiply (a discussion of the origin of the present feral African green monkey (Corcopithecus aethiops) population of Barbados is found in Denham 1981). Rats, still a vexing problem in Barbados, were reported in 1975 to be "so very numerous and so very destructive to sugarcanes, that the yearly loss to the inhabitants of the parishes of St. Joseph's and St. Andrew's alone is computed to be no less than two or three thousand pounds" (Hughes 1972 (1750):64-68).

Birds reported by Hughes include the guinea fowl, the crane-like dark-colored gaulding, the lesser turtle-dove and the large turtle-dove, coots or moor hens, the quail-like two-penny hen, the thrush, the cotton tree bird, the very numerous blackbird, the rare goldfinch, the sparrow-like pivet and the very similar Spanish lacker, the swallow, the sugar bird, two species designated as sparrows, the hummingbird, and the small yellow-bird. Birds of passage listed by Hughes are the wild woodpigeon, the wild duck, the teal, the crooked-bill curlieu, the shivering curlieu, the stone curlieu, the black-breasted plover, the ring-necked plover, the sandy-breasted plover, several mopuses, the long-legs, the great snipe, and the little snipe (Hughes 69-79). Descriptions of the bird population of Barbados and other Caribbean Islands can be found in Bond 1971 and similar publications. Birds protected under wildlife legislation are shown under 2.5.3 below.

Reptiles listed by Hughes are several species of snakes, the spotted or poisonous lizard, and the green lizard (Hughes 1972 (1750):64-66,88). Sea turtles occur in the waters off the Barbados coast. The finding of the relatively uncommon leatherback sea turtle (Dermochelys coriacea--one of the species listed in the U.S. Fish and Wildlife Service's List of Endangered and Threatened Wildlife and Plants) some five miles off the Barbados coast is reported in Hawkins and Borstad 1978. Colorful reef fish are common in the coral reef areas of the coast (Archer 1976:4).

2.5.2 Wildlife management and nature reserves

Laws covering wild birds (see 5.3), turtles (see 5.4), and the marine areas of Barbados (see 5.6.3) provide a basis for the protection of the wildlife of Barbados.

Although the 13 acres of grounds and gardens of Farley Hill are now called a "national park," Barbados presently has no areas legally designated as national parks or nature reserves. Plans to establish a coastal national park are presently in the works, however (see 2.6.4). Furthermore, Welchman Hall Gully in St. Thomas is being developed as a tropical garden by the National Trust (CYB 1980:112).

2.5.3. Protected species

The following birds are protected under the Wildlife Birds Protection Act 1907 (see 5.3).

Blackbird	*Quiscalus fortirostris*
Yellow bird	*Dendroeca capitalis*
Pee whittler	*Elainea martinica*
Rain bird	*Tyrannus rostratus*
Large humming bird	*Eulampis holosericcus*
Small humming bird	*Orthorhynchus cristatus*
Wood dove	*Zenaida amabilis*
Ground dove	*Chamoepelia passerina*
Grass canary	*Sycalis luteiventris*
Gold finch, Christmas bird	*Setophaga ruticilla*
Thrush	*Margarops densirostris*
Red-seal coot	*Gallimela galeata*
White-seal coot	*Fullca americana*

None of these birds appears on the *List of Endangered and Threatened Wildlife and Plants* of the U.S. Fish and Wildlife Service (*Code of Federal Regulations* 45,17:11).

2.6 Coasts and beaches

2.6.1 The resource

Barbados is an island with some 95 kilometers of coastline. Not greatly indented at any point and relatively lacking in sheltered coves, land-locked marine lakes or shores with tidal-pool areas, the Barbados coast comprises 34 kilometers of coral cliffs, 32 kilometers or coral sand beach, 11 kilometers of silica sand beach, 11 kilometers or older sedimentary cliffs, and 7 kilometers of sea defenses. The tidal range is about one meter. Waves are considerably greater on the eastern than on the western coast (Randall 1970:155). Because of its very narrow continental shelf--only 5.6 kilometers at its widest point--Barbados has only limited offshore shallows for fish propagation (Archer 1976:4).

Barbados lies within the path of the South Equatorial Current, which remains constant in direction throughout most of the year, striking Barbados on the eastern and southern coasts. The Current has one very beneficial effect for Barbados: it brings with it the ocean-spawning flying fish which have been so important for the fishing industry of the island. On the other hand, the current also carries with it pollutants dumped from ships in areas as far off as the coasts of Africa and Spain; such pollutants reach Barbados before touching any other habitable land area in the South Atlantic (Archer 1976:7).

A prominent feature of the Barbados coast are the coral reefs which almost surround the island and are particularly prominent along the entire eastern and southern shores. These reefs, notably the ten-mile stretch known as Cobbler's Reef along the southeastern shore act as an important preventive barrier to the destructive wave action of the Atlantic Ocean and also provide fruitful feeding areas for marine fauna and colorful reef fish (Archer 1976:4).

The beaches of Barbados represent an important economic resource for Barbados; they are the key factor in attracting tourists to the island. Of the large number of tourists visiting Barbados (the number grew from 156,417 in 1970 to 370,916 in 1979) over 60% stay at the over 50 hotels and guest houses along the 30 kilometers of coastline from Bridgetown to Ragged Point on the southwest, south and southeast coasts of the island (Archer 1976:14-15).

The fishing industry of Barbados will be considered in 2.7 below.

2.6.2 Coastal pollution

Coastal pollution is one of the major environmental problems of Barbados, with potentially disastrous effects for both the tourist and fishing industries. In recent years Barbados has experienced frequent inflows of oil onto its beaches and coral reefs. Because the country lacks facilities for monitoring and analyzing oil slicks it has been assumed that these originate from wastes discharged by passing ships. The incidence of this pollution is revealed by the stranding of oil patches on inshore coral reefs and of large viscous deposits (tar balls) on beaches. Beaches particularly hard hit are those extending along the east coast from Cattle Wash southward to Long Bay and Silver Sands on the southeast coast, which are persistently polluted by oil from the Atlantic. In the

coasts of the south and southwest, where tourist activity is more intense, pollution is less frequent, but it is feared that this area would also be affected by a heavy oil spill within the territorial waters of Barbados (Archer 1976:15).

One effect of oil pollution seems to be damage to the coral reefs, with resulting sea encroachment. This has been experienced particularly at Consetts Bay on the eastern coast, where as of 1976 a strip of several meters had been affected and there was some evidence of erosion of reef structure. Although such damage has often been attributed to the force of waves from the Atlantic, research has led scientists to conclude that oil pollution is the more likely culprit. It has been demonstrated that all four species of corals from the Barbados coast are sensitive to pollution by both crude oil and the dispersants used to control oil spills, with the more detrimental effects actually coming from the dispersants. It is therefore feared that a persistent oil slick for several days on a coral reef could results in damage to the reef and its eventual disintegration by wave action (Archer 1976:11).

Barbados worst oil slick was experienced in July 1981. Originating from a ship off the eastern coast of the island, the slick affected some 24 kilometers of coastline from the East Coast Road in St. Andrew Parish to Bath in St. John Parish. Chunks of tar from the slick were reported to be very large and to weigh as much as 15 to 20 pounds. Damage to marine life was evidenced by dead crabs, lobsters, barnacles, and other shell fish that were washed ashore (JPRS 78921, Sept. 8, 1981:24).

2.6.3 International cooperation for marine pollution control

Understandably concerned with the possibility of damage to its economy as a result of marine pollution but lacking the resources to deal effectively with the problem on its own, Barbados has shown great interest in regional approaches to dealing with marine pollution. Barbados has, for example, been involved in planning sessions for the Organization of American States' Action Plan for Coastal Pollution and Oil Spill Control in the Caribbean (Beller 1979:63). Furthermore, Barbados was one of 23 Caribbean states which in April 1981 approved a broad environmental action plan (Caribbean Action Plan) for the Caribbean, which lists marine pollution as one of its major concerns. Sponsored by the United Nations Environment Program, the plan has been launched with a 1.5 million dollar trust fund, with major contributions from France, Mexico, and Venezuela; Barbados has pledged $16,500 (WER April 27, 1981; Ambio, vol. 10, 1981:196).

2.6.4 Coastal national park

Since late 1977 the government of Barbados has been developing plans for the establishment of a national park on the east coast of the island. Advice has been solicited from overseas governments, which have assisted in the preparation of tentative plans. As presently envisaged, the park would be a coastal national park intended to preserve the natural scenic beauty of the cliffs and beaches of the eastern coast and make them accessible to visitors. Although no boundaries have yet been drawn, present proposals call for an area in the north and east coasts running from Archers Bay in the parish of St. Lucy in the north to Ragged Point in St. Phillip to the south. For several reasons the park would most likely not meet the national park criteria of the International Union for the Conservation of Nature for national parks and reserves but would strongly resemble the "protected landscape" areas designated as national parks in Great Britain and Wales. Most agricultural activity presently being pursued in the area would probably not be curtailed, and mineral exploitation would also continue. Existing tourist facilities would be allowed to continue operation, but new hotel complexes would probably not be approved. As part of the proposal it has been suggested that nature reserves be established in Graeme Hall Swamp and Turner's Woods (Hookway 1980; see also JPRS 77603, March 17, 1981:4).

2.7 Fisheries

Because Barbados has a very narrow continental shelf, the fishing grounds within the country's territorial waters are limited to the coral reefs and a few offshore shallows, the only waters providing favorable conditions for fish propagation. Studies of current movements in the area of Barbados have indicated, however, that certain stagnant coastal waters (areas of lesser current movements) near Ragged Point on the east coast and at spots all along the west coast might well serve as spawning grounds for fisheries development (Archer 1976:14).

The mainstay of the fishing industry of Barbados has been and continues to be the pelagic flying fish, which spawns and develops near the surface in the Atlantic Ocean and is brought towards the island by the South Equatorial Current. However, with considerable government assistance and encouragement, expansion and mechanization of the fishing industry is being carried out. Wheras fishing was once the occupation of a small percentage of coastal dwellers, the industry now employs some 2,500 persons, including ancillary occupations. There are presently over 500 small boats ranging from 20 to 30 feet in length fishing the territorial waters of the country, while trawlers equipped with refrigeration equipment range as far as the northern coasts of South America (CYB 1980:99; Archer 1976:11).

Catch consists of flying fish, dolphin, shark, barracuda, king fish, bream, snapper, bonita, and albacore. Total catch for 1978, as reported by the Barbados Fisheries Department, was 3,425,000 pounds (1,553.58 metric tons).* Most of the catch is consumed locally, being an important element in the diet of inhabitants of the island and in the fare offerred by tourist hotels, but some frozen fish is now being imported to England as well (CYB 1980:99).

marine pollution and the fishing industry

Because the flying fish that is still so important for Barbados' fishing industry is surface-spawning, it is vulnerable to the toxic effects of floating oil. According to one observer, a falling off of catches of this fish in the early and mid-1970's may have been caused by patches of floating oil in its Atlantic spawning grounds (Archer 1976:11-12).

As noted above (see 2.6.2), damage to marine life has resulted from oil spills within the territorial waters of Barbados. Furthermore, it is feared that oil pollution could stifle Barbados potential for developing fisheries in the quieter waters off certain parts of the coast, since these waters would not only provide fruitful grounds for fish propagation but would also retain oil pollution that could destroy inshore fish hatcheries (Archer 1976:14).

*Europa Year Book 1981:622

2.8 Mineral resources

Barbados has no metallic mineral deposits. However, pockets of natural gas have been discovered and are being exploited in the St. Andrew district; gas production rose from 166,000 cubic feet in 1977 to 412,000 cubic feet in 1979 (Europa Yearbook 1981:1622). Crude oil drilling, carried out by General Crude Oil Company under government license, has also led to the discovery of oil, which as of 1980 was being exploited at the rate of 1,500 barrels per day. The oil fields are located about five miles north of the airport, in the parish of St. Philip. A number of new potentially important offshore fields have also been discovered (Europa Year Book 1981: 1620). A small oil refinery is located in Bridgetown; this processes "cocktail" crude imported from Venezuela. Barbados crude, which requires a more complex refining operation, is refined in Trinidad and Tobago (Economic Counselor, Embassy of Barbados, December 22, 1981).

Limestone deposits are used for coral building blocks as well as for agricultural lime, while clay deposits are use for the production of local pottery (CYB 1980:99).

2.9 Air pollution problems situation by a Barbadian government

A survey of the environmental situation by a Barbadian government official on the occasion of World Environment Day in 1977, indicated that there was no cause for "serious concern" about air pollution, monitoring efforts having found very low levels of pollution even in the center of Bridgetown, the country's largest town. Factors cited as contributing to the favorable air pollution situation are the trade winds, the absence of deep valleys and mountains, and the abundant sunshine (Caribbean Conservation Association 1977:24-25). However, the existence of legislation aimed at controlling pollution from the country's sugar factories (see 5.10) indicates that these establishments are a potential source of air pollution problems.

In 1975 plans were announced for the establishment of a pollution monitoring station in Barbados as part of the global network (GEMS) of the United Nations Environment Programme. Plans called for the operation of the station by the Caribbean Meteorological Institute, with responsibility for chemical analysis falling to the Cave Hill Campus of the University of the West Indies. Major concerns of the project were listed as (1) establishing whether dust clouds covering the region in mid-year come from Africa and might contribute to a late start of the rainy season and (2) determining if windborne crop diseases are carried from across the Atlantic Ocean (BNB, 1975, Independence Issue).

3.0 The Economy of Barbados

3.1 General economic statistics

Gross national product (1979): US$644 million (World Factbook 1981:15)

GNP per capita (1979): US$2,360 (World Factbook 1981:15)

Real growth rate (1979): 7.3% (World Factbook 1981: 15).

Exports: US$147 million (1979); sugar and sugarcane byproducts, electrical parts, clothing (World Factbook 1981: 15)

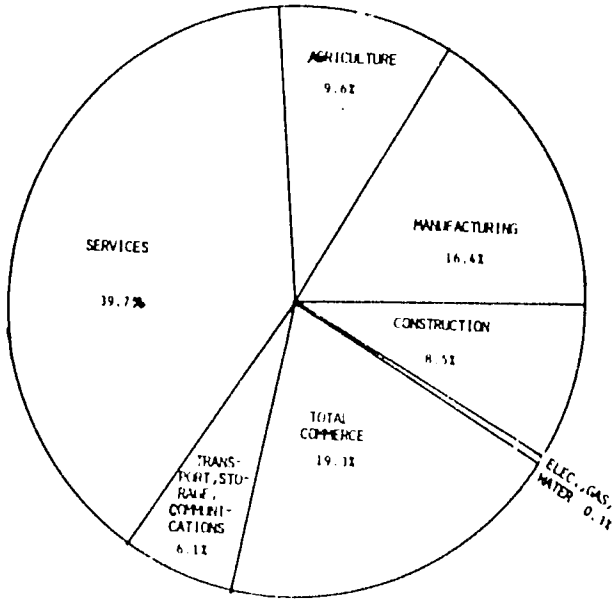
Imports: US$424 million,(1979); foodstuffs, consumer durables, machinery, fuels (World Factbook 1981:15).

Government budget (1979/80): revenues: US$174 million; expenditures: $197 million (World Factbook 1981:15).

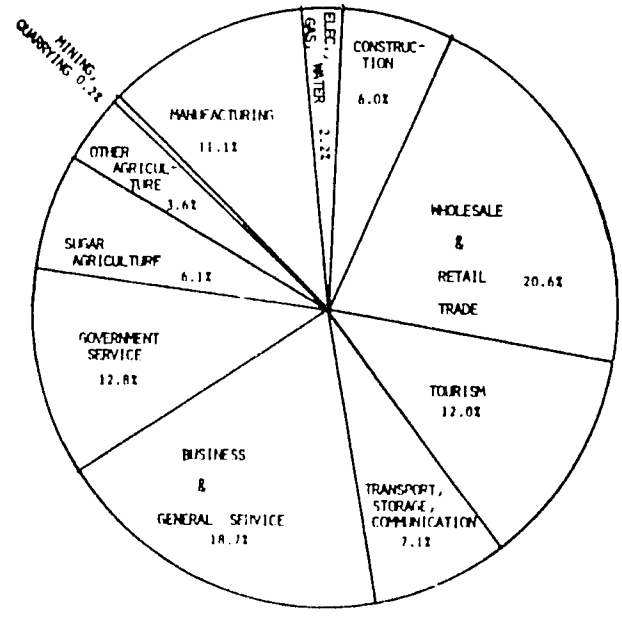
Monetary conversion rate: 2 Barbados dollars=US$1 (World Factbook 1981:15)

Rate of domestic inflation (World Bank 1979:1): 1975: 20%
1976: 5%
1977: 8.3%
1978: 9.5%

EMPLOYMENT BY SECTOR (1977) *
(World Bank 1979)



GDP BY SECTOR (1978)
(World Bank 1979)



The total active labor force in 1979 was 93,600. Unemployment is a serious problem in Barbados, running as high as 12% to 15% outside the harvest season (Europa Year Book 1981:1619-1629).

*Does not include mining and quarrying. The breakdown for 1979 was as follows: Agriculture: 9.2%; Mining, quarrying, construction: 8.5%; Manufacturing: 13.1%; Electricity, gas, water:1.0%; Transport, communications:7.0%; Commerce:25.4%; Financial institutions: 4.7%; Services (gov. and other):31.0% (Europa Year Book 1981: 1621).

3.2 General economic situation

The economy of Barbados is dominated by sugar and tourism, the latter of which has grown in importance as the former has continued to decline. Although the government's encouragement of agricultural diversification has brought about increases in food production, Barbados has been forced to rely on food and beverage imports to such an extent that they have had an adverse effect on its balance of payments (IDB 1980?:5).

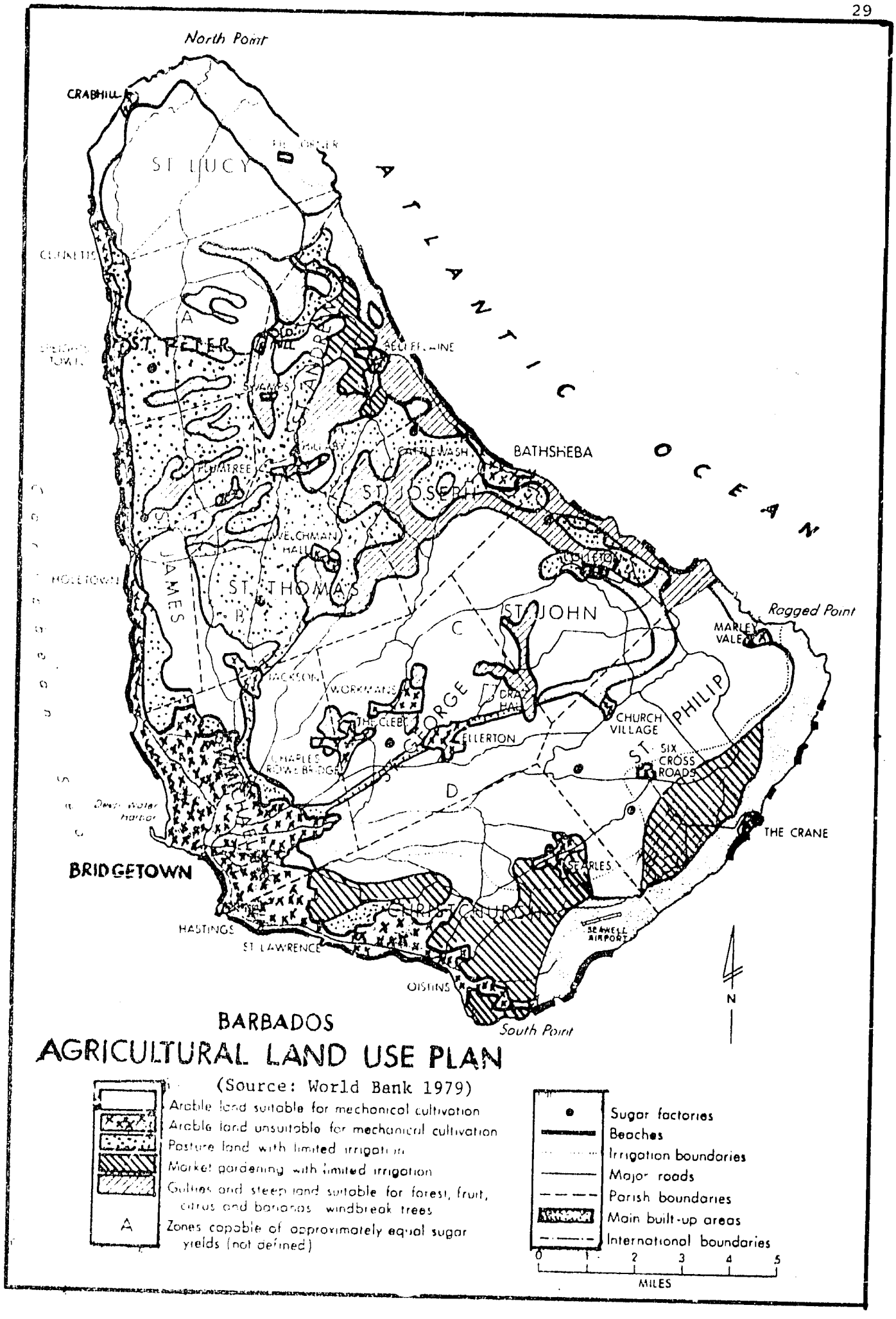
3.3 Agriculture

About a fifth of the total land area of Barbados is rocky or residential land, while an estimated 65% to 79% of total land area is under cultivation. Population density with regard to arable land is very high, about ten times higher than the average for the Caribbean Community (CARICOM) as a whole (IDB 1980?:3). The major planting is sugar cane (about 16,800 hectares), while 3,600 hectares produce food crops in rotation, 8,500 hectares are planted to other crops, and 3,600 hectares are pasture. Cotton cultivation, brought back in 1968, now covers some 283 hectares (Economist Intelligence Unit 1980: 29). The only cereal crop reported for Barbados is maize, about 1,000 hectares of which are planted each year with total production remaining constant at about 2,000 metric tons per year through the decade of the 1970's (FAO Production Yearbook 1978).

Sugar has been and remains the mainstay of the economy of Barbados, providing between 30% and 40% of total exports during most of the 1970's but declining to about 19% by 1979. It is mainly an estate crop employing about 18,000 workers in season, although an estimated 18,000 farmers grow sugar on a small scale (Economist Intelligence Unit 1980:29). Sugar cane (and most other agricultural products) are grown between January and May (CYB 1980:98).

The total area of Barbados planted to sugar cane declined over the decade of the 1970's, from a total of 20.1 thousand hectares in 1970 to about 17 thousand hectares at the end of the decade. The level of sugar production declined as well, dropping from 159.9 tons in 1973 to only 99.3 thousand tons in 1978, before rising to 130 thousand tons in 1980 (World Bank 1979:151; Europa Year Book 1981:1622). Weather conditions affect sugar production; low rainfall, for example, was to a large extent responsible for the drop in sugar production in 1978. World sugar prices can also adversely affect the sugar industry; depressed sugar prices in the 1970's contributed to the industry's decline during that decade (World Bank 1979:5; Europa Year Book 1981: 1620).

During the 1970's a significant amount of land was diversified and small-scale vegetable production in home gardens increased. At the same time sugar estates continued to intercrop root crops such as yams and sweet potatoes. These developments have resulted in an increase in the production of export crops such as onions, peanuts, and cotton as well as of vegetables such as beets, carrots, cucumbers, cabbage, and lettuce. Although most vegetable crops are grown by small producers, several large producers are now involved in intensive food crop production in the St. Philip and Christ Church areas (IDB 1980?:5; CYB 1980:98).



BARBADOS
AGRICULTURAL LAND USE PLAN

(Source: World Bank 1979)

- Arable land suitable for mechanical cultivation
- Arable land unsuitable for mechanical cultivation
- Pasture land with limited irrigation
- Market gardening with limited irrigation
- Gullies and steep land suitable for forest, fruit, citrus and bananas windbreak trees
- A — Zones capable of approximately equal sugar yields (not defined)

- Sugar factories
- Beaches
- Irrigation boundaries
- Major roads
- Parish boundaries
- Main built-up areas
- International boundaries

0 1 2 3 4 5
MILES

Fruit grown in Barbados includes mangoes, avocado pears, citrus fruits, golden apples, hog plums, gooseberries, watermelons, cantaloupes, cherries, and bananas. In the Scotland District is a fruit nursery which has been expanded to produce larger numbers and a greater variety of fruit trees. Bananas of the robusta strain have been introduced and are being grown in sheltered areas for local consumption (CYB 1980:96,98).

Livestock are owned mainly by smallholders, although most small farmers also keep a few animals. There are about 24 dairies rainging in size from 10 cows to 250 cows. Some of the dairies have introduced Friesians, Jerseys, and Ayrshires from Canada. Although pangola grass provides the bulk of the grass for grazing and hay, elephant grass and Guinea grass are also planted. Milk production, which is reported to be of high quality, increases about 10% per year (CYB 1980:98). Livestock numbers, as estimated by the Food and Agricultural Organization of the United Nations in 1978 were as follows: cattle: 18,000; sheep: 50,000; pigs: 38,000; goats: 27,000; chickens: 410,000; horses: 1,000; mules: 2,000; asses: 2,000.

Use of agricultural technology

Fertilizer use was reported at 179 kilograms per hectare in 1978, while tractor density was 16 per thousand hectares for the same year. No figures on irrigated hectarage were available (International Agricultural Development Service, Agricultural Development Indicators 1981:17).

Little data on the use of pesticides were found (the FAO Agricultural Production Yearbook, for example, providing no information on pesticides used in Barbados). Government import statistics, however, show imports of insecticides, fungicides, and herbicides, and it is clear from other sources that pesticides are used both in sugar cane production and in other branches of agriculture (Barbados. Statistical Service. Statistics of Monthly Overseas Trade, January and February 1978; CYB 1977:107).

Pesticide use is under the control of the Pesticides Control Board of the Ministry of Agriculture, created by law in 1973. Although no information on possible harmful effects to humans from pesticides use was available, a recent newspaper report recounts an incident in which a herbicide (chemical Esters) used in sugar cane production was carried by the wind to a nearby field, where it completely destroyed a multi-acre crop of tomato plants (JPRS 79291, October 23, 1981:24).

3.4 Industry (see also 2.8)

The major industry of Barbados is sugar processing, while the main secondary industries produce edible oils, soap, margarine, and lard compounds. There are eight industrial trading estates whose factories produce light consumer goods. In 1975 eight new enterprises were established: three in textiles and clothing and the remaining five in animal feeds, data processing, synthetic marble products, coin-operated meters, and assembly of steel frames for buildings. The year 1976 saw the establishment of a pork and vegetables processing plant. New industries get concessions under the Pioneer Industry Act, while the Barbados Industrial Development Corporation, established in 1969, promotes investment in local industry. (Economist Intelligence Unit 1980:29-30).

Sugar factories are scattered throughout the country. The eight industrial estates, administered by the Industrial Development Corporation to provide factory space for industries unable to provide their own facilities, are located at Seawell, Grazettes, Newton, Bridgetown Harbour, Pelican Village, Wildey, Pine, and Fairfield (CYB 1980:101).

Tourism has become increasingly important as a source of income for Barbados. Figures for 1979 indicate that there were 370,916 tourists who spent a total of 369.7 million Barbados dollars, up from 2[illegible],314 tourists in 1976 (Europa Year Book 1981:1624).

3.5 Energy

Petroleum production is covered is section 2.8. There is no coal. Kerosene is used for domestic fuel. A supply of natural gas is tapped and distributed by a state corporation; 12.6 million cubic meters were produced in 1977. Electricity is generated by the Barbados Light and Power Company for both industrial and private use; electricity generation in 1977 was 246 million kilowatt hours and in 1978 269 million kilowatt hours (Economist Intelligence Unit 1980:29).

3.6 Government development plans

The development plan of the government of Barbados for the period 1978-82 calls for an overal growth target of a real average annual GDP increase of 5%. Major elements of the plan are: expansion and diversification of agriculture and fishing in order to reduce food imports and provide a basis for food processing industries; identification of manufacturing activities to build on agricultural imports and/or take advantage of special trading relationships such as Caricom (Caribbean Common Market) and the European Community; choice of a development strategy for tourism which aims for high income visitors rather than the mass tourist market. The employment target for the manufacturing sector is 5,000 new jobs by 1982 resulting from projected investments of 24 million Barbados dollars, with manufacturing output growing at 19% per year and exports at 20% per year (Economist Intelligence Unit 1980:32).

4.0 ORGANIZATIONS WITH INTEREST IN ENVIRONMENT AND NATURAL RESOURCES

4.1 Central government organization

4.1.1 Central government structure

Under the constitution of 1966, Barbados has a government modeled on the British parliamentary system. The British Queen, who remains the head of state (Barbados has been a fully independent states since November 1966), is represented by a Governor General, who appoints an advisory Privy Council. Executive authority rests in the Prime Minister and his cabinet, who are collectively responsible to the bicameral legislature. The cabinet, required to consist of not fewer than five ministers in addition to the Prime Minister, had as of December 1981, fifteen ministerial posts (not including the Prime Minister and Deputy Prime Minister). The Parliament consists of an appointed senate with 21 members and an elected House of Assembly with 24 members serving five-year terms. The last election, held in 1981, resulted in the retention of power by the Barbados Labour Party under Prime Minister J.M.G. Adams (Kurian 1978:122; CYB 1980:82; National Foreign Assessment Center, Chiefs of State and Cabinet Members of Foreign Governments. December 1981).

4.1.2 Government Ministries

4.1.2.1 Ministry of Housing, Lands and Environment

The responsibilities of this Ministry, established in 1978, are housing, lands, surveys, the environment, and town planning. Important subdivisions of the Ministry are the Lands and Surveys Department, the Town and Country Planning Advisory Committee, the Caves Authority, the National Housing Corporation, and the Parks and Beaches Commission. The total provision for this Ministry in the 1980-81 budget was B$3,702,509, roughly 1% of the total budget (CYB 1980:84; Barbados. Accountant General. 1980:19).

Parks and Beaches Commission

Established by law in 1970, the Parks and Beaches Commission is charged with controlling, maintaining, and developing the public parks and beaches of Barbados. Its workers have the task of keeping beaches clean and are also responsible for the maintenance of park areas such as Queen's Park, Farley Hill National Park, Dover Park, and the Bay Street Esplanade. The Commission is also charged with advising the Minister of Housing, Lands, and Environment on matters pertaining to beach control and the protection of the sea coast from eorsion and sea encroachment, including the removal of coral and its possible contribution to sea encroachment. Furthermore, under the Marine Areas Preservation and Conservation Act of 1976, the Commission has been given control of the proposed underwater park at Folkestone, St. James. The Commission has been credited with contributing to public awareness of the marine environment and also played an essential role in bringing the Secretariat of the Caribbean Conservation Association to Barbados in 1974 (Caribbean Conservation Association 1977:38-41).

4.1.2.2 Ministry of Agriculture, Food, and Consumer Affairs

The Ministry has responsibility for agriculture, consumer affairs, cooperatives, fisheries, meteorology, and metrication. Under the aegis of the Ministry are the Meteorological Office, the Agricultural Credit Bank, the Agricultural Development Corporation, the Barbados Marketing Corporation, the Metrication Board, the Prices Commission, the Fancy Molasses Control and Marketing Board, the Sugar Factory Smoke Control Board, the Scotland District Soil Conservation Board, the Barbados National Standards Institute, the Fisheries Department, and the Public Utilities Board.

The 1980-81 budget for the Ministry--about B$12.1 million (including funds separately budgeted for the Meteorological Department and cooperatives development) or just over 3.1% of the total budget--provided for expenditures in the following areas, among others: land development and soil conservation; crop research and extension; sugar cane variety testing; horticultural and agronomic research; land and water use research; plant protection; livestock development; veterinary services; and plant propagation (CYB 1980:84-85; Barbados. Accountant General. 1980:15-16).

4.1.2.3 Ministry of Health and National Insurance

The Ministry is responsible for health services, medical services, national insurance, and sanitation. After the creation of the Ministry of Housing, Lands and Environment in 1978, the Ministry of Health and National Insurance retained its functions "in respect of health environmental matters," including (presumably) control of water, air, and solid waste pollution (BFNB, vol. 1, no. 4, Sept. 15, 1978:1).

The Ministry has periodically launched clean-up drives aimed at encouraging people to remove garbage and litter that have accumulated on their premises. Such a campaign, begun in November 1978, also involved "de-bushing"--the removal of unsightly bush growth following heavy rains. In initiating this campaign, the Minister pointed out, however, that trees were not to be felled; she called on the public to save trees, because they form an important part of the environment of Barbados (BFNB, vol. 1, no. 8, Nov. 24, 1978: 16).

The budget provision for this Ministry for the the 1980-81 fiscal year was B$51,151,330 (13.8% of the total budget), about 40% of which was slated for Queen Elizabeth Hospital in Bridgetown. Between then the Sanitation Authority Service and the Environmental Sanitation Unit accounted for just over 14% of the Ministry's Budget (Barbados. Accountant General.1980:19).

4.1.2.4 Ministry of Education and Culture

The Ministry bears the responsibility for education on all levels, industrial schools, archives, and public libraries. Research units, because they are concerned exclusively with agricultural matters, are not under the Ministry of Education and Culture but under the Ministry of Agriculture, Food, and Consumer Affairs. The budget provision for the Ministry of Education and Culture for the fiscal year 1980-81 was B$77,364,329 (20.1% of the total budget) (Barbados. Accountant General. 1980:18).

4.1.2.5 Ministry of Communications and Works

The Ministry of Communications and Works is responsible for electrical installations, highways and other roads, post office and postal services, public works, telecommunications, transport, and waterworks. The 1980-81 budget provided for B$30,302,956 (8.2% of total budget) for this Ministry; water resources matters, under this Ministry but separately budgeted, accounted for B$12,247,974 or 3.3% of the total budget (Barbados, Accountant General. 1980:17).

Barbados Water Authority

Established by law in October 1980, the Barbados Water Authority, a corporate body governed by a Board of Directors but operating under the aegis of the Minister of Communications and Works, is charged with a broad range of matters dealing with water resources, water supply, and sewerage.

As outlined in the Barbados Water Authority Act (1980-42), its functions are:

1) to obtain and analyze information and maintain records of the total water resources of Barbados;
2) to manage, allocate and monitor water resources with a view to ensuring their best development, utilization, conservation, and protection in the public interest;
3) to prepare and submit to the Minister proposals for the establishment of efficient, co-ordinated and economical water supply and sewerage systems capable of meeting the need for water and sewerage services throughout the country;
4) to prepare details of schemes for the development of water resources and for the supply of water and sewerage services and to construct, maintain, and operate such schemes;
5) to keep under constant review the quality, reliability and availability of water supply and sewerage services and the rates to be charged for these services;
6) to control and regulate the production, treatment, storage, transmission, distribution and use of water for public purposes;
7) to design, construct, acquire, provide, operate and maintain water works for the purposes of supply water for public purposes;
8) to design, construct, acquire, provide, operate and maintain sewerage works for the purpose of receiving, treating, and disposing of sewage;
9) to control and regulate the disposal of sewage through sewerage plants that are not part of the Authority's systems;
10) to conduct research programs and prepare statistics for its purposes;
11) to disseminate information and advice with respect to the management, collection, production, transmission, treatment, storage, supply and distribution of water and, where applicable, sewage;
12) to provide such facilities as may be necessary for training and educating its employees and for research;
13) to advise the Minister on matters referred to in 5) above and such other matters relating to water supply and sewerage services as the Minister refers to the Authority.

The Authority may furthermore define certain areas as areas of public water supply and restrict activities in those areas. It is also empowered to make regulations dealing with matters such as location of sewerage works and the content of sewage entering those works. The Authority is to be funded by allocations from the Parliament and by fees which it collects.

4.1.2.6 Other Ministries

The Ministry of Trade, Tourism and Industry (4.5% of total budget for 1980-81) is responsible for Caribbean affairs, industrial power, industry, minerals development, civil aviation, and tourism. The Minister of Finance and Planning, with responsibilities in such areas as economic and social planning, revenue collection, and public finances, is also responsible for government statistical services for which B$1,076,321 were budgeted in 1980-81 (about 0.3% of total budget).

4.2 Local government

Local government units in Barbados consist of eleven parishes which until 1959 were actually ecclesiastical parishes administered by rectors and church wardens. These parishes are: St. Michael, St. James, St. Peter, St. Lucy, St. Andrew, St. Joseph, St. Philip, St. George, St. Thomas, and Christ Church. As of September 1969, all local government services were assumed by the central government, which established statutory boards such as the Sanitation and Cemeteries Board and the Child Care Board to administer some of these services (CYB 1980:85).

4.3 Research

Scientific research in Barbados has concentrated almost exclusively on agricultural concerns, government supported research coming under the Ministry of Agriculture, Food, and Consumer Affairs (earlier designated as the Ministry of Agriculture, Science and Technology). Research activity within the Ministry is carried out at the Central Agronomic Research Station at Graeme Hall in Christ Church, at the Central Livestock Station, and at some seven district agricultural stations; it covers areas such as crop production, plant pathology, soil physics, agricultural engineering, animal nutrition, and sugarcane agronomy (OAS 1977:50-51).

In addition, research is carred out by the Agricultural Development Corporation, the Sugar Technology Research Unit of the Barbados Sugar Producers Association, the West Indies Sugar Cane Breeding Station, the Industrial Development Corporation, the Government Analyst Laboratory, and the Bellairs Institute (see below). As of 1977, the total number of professional staff involved in scientific research activities (both government and non-government) was no greater than fifty (OAS 1977:50-51).

Caribbean regional organizations carrying out research in Barbados are the Caribbean Meteorological Institute and the Caribbean Agricultural Research and Development Institute (attached to the University of the West Indies).

Bellairs Research Institute
St James

Established in 1954, the Bellairs Research Institute, which is attached to McGill University in Toronto, performs research and teaching in all aspects of tropical environment. Among its chief interests are the physiology of tropical organisms, coral reef ecology, and secondary productivity of fishing grounds (World of Learning 1980-81).

4.4 Higher education and training

University of the West Indies
Cave Hill Campus
P.O. Box 64
Bridgetown
Founded: 1963

Number of teachers: 270 (57 part-time); Number of students: 1,380 (World of Learning 1980-81).

The University, an integral part of the University of the West Indies, is intended to serve not only Barbados but also the Leeward and the Windward Islands. Its program offers a Bachelor of Law Degree and general degrees in the arts, natural sciences, and social sciences. Also located here are the North-Eastern Area of the School of Education (of the University of the West Indies) and the Eastern Caribbean Medical School of the Faculty of Medicine.

Attached Institutes: Institute of Social and Economic Research
Caribbean Agricultural Research and Development Institute.

Erdiston College

The College provides a two-year teacher training course. Agricultural science was scheduled to become part of the program offered by the college in 1977.

Samuel Jackman Prescod Polytechnic
Belmont Road
Bridgetown

The Polytechnic provides vocational and technical education. In late December 1978 it was announced that the Inter-American Development Bank (IADB) would be lending Barbados six million dollars for enlarging and moderning the facilities at the school. In conjunction with the expansion of the Polytechnic, the Ministry of Education and Culture also received funds to examine the development needs of the country and assist it in assuring that its academic, technical, vocational, industrial, and agricultural programs are in harmony with the country's plans for expansion and modernization of the economy (BNFB, vol. 1, no. 9, December 27, 1978:2-3).

4.5 Non-governmental organizations

Barbados National Trust
48 Blue Waters
Bridgetown

The Barbados National Trust was founded in 1961 under the guidance of the National Trust for the Preservation of Historic Buildings and Places of Natural Beauty in the United Kingdom and incorporated as a legal entity entitled to hold property in the same year. Soon afterwards the Trust purchased Welchman Hall Gully in St. Thomas, which it has preserved in its natural state because of the Gully's examples of such natural flora of Barbados as the bearded fig tree, the Jamaican ackee, and clove and nutmeg trees. The interests of the trust extend to projects such as the maintenance of a sugar wind mill at Morgan Lewis Plantation in St. Andrew and the acquisition of various buildings of architectural and historical interest. The Trust has been called upon by the government for advice on alteration to government buildings of historical interest and was also given the task of landscaping the East Coast Road when it was opened in 1966 (a job since handed over to the Parks and Beach Commission) (Caribbean Conservation Association 1977:35-38).

Barbados Museum and Historical Society
St. Ann's Garrison
St. Michael

Established in 1933, the Museum has among its collections objects illustrating the island's prehistory, history, natural history, and marine life. The Journal of the Barbados Museum and Historical Society, published annually, contains articles covering the history, culture, and natural history of the country.

Caribbean Conservation Association
Savannah Lodge
The Garrison
St. Michael

With its secretariat located in Barbados since 1974, the Association has, among other things, an Environmental Education Program that has worked to promote environmental consciousness among secondary school students. For World Environment Day 1976, the Association prepared for radio broadcast a series of talks on various aspects of the environment on the island. Transcripts of these talks were published on the occasion of World Environment Day 1977 (Caribbean Conservation Association 1977).

Barbados Family Planning Association
Bay Street
Bridgetown

5.0 Legislation Dealing with Environment and Natural Resources

Barbados has no legislation designed to deal with environmental problems in a coordinated manner. However, individual pieces of legislation deal with matters such as water resources, protection of wild birds, protection of marine areas and fisheries, prevention of air pollution from sugar factories, and soil conservation in the badly eroded Scotland District of the northeastern part of the island.

5.1 Water legislation

5.1.1 Underground Water Control 1953 (Laws of Barbados, Chapter 283)

Full title: An Act to make provision for the control and use of the underground sources of water supply in the Island and other matters connected therewith.

The act requires licenses to be obtained for a range of activities involving sinking wells, deepening existing wells, or abstracting underground water for any well. Enforcement of the law, once the responsibility of the Water Board, is now in the hands of the Barbados Water Authority. Offenses under the law are punishable by a fine of five hundred dollars or imprisonment for six months.

5.1.2 Barbados Water Authority Act, 1980-42 (October 8, 1980).

This act creates and defines the functions and administration of the Barbados Water Authority, with wide ranging powers in matters concerning water resources management and development, water supply, and sewerage (see 4.1.2.5 for details on these functions). The Act stipulates fines of $1,000 or a year's imprisonment or both for persons who, in public water supply areas defined by the Authority: swim or bathe, impair the quality or water, or cause the amount of water to be unduly diminished.

5.1.3 Irrigation Act, 1967 (Laws of Barbados, Chapter 263)

Full title: An Act to provide for the powers of the Chief Agricultural Officer with respect to irrigation and for related purposes.

The Act empowers the Chief Agricultural Officer to carry out investigations as to the necessity for and benefits of irrigation, to experiment with machinery and methods for irrigation, and to "irrigate, or cause to be irrigated, and land whatsoever and, for that purpose, distribute water or control or operate any irrigation works or any plant or machinery connected therewith."

5.2 Soils and vegetation

5.2.1 Soil Conservation (Scotland District) Act, 1959, (Laws of Barbados, Chapter 267)

The act establishes the Scotland District Soil Conservation Board, to be chaired by the Chief Agricultural Officer of the Ministry of Agriculture, Food, and Consumer Affairs, and details the measures to be taken for the improvement and conservation of soil and for the prevention of damage or deterioration by erosion in the Scotland District of Barbados (referred to in the law as the "conservation area").

As outlined in the act, the functions of the Board are generally to advise the Chief Agricultural Officer, the top enforcement authority for the act, on the utilization of lands in the conservation area "in such a manner as will tend towards the conservation of the soil and the prevention and mitigation of soil erosion." The Chief Agricultural Officer, in consultation with the Board, may make conservation proposals and may also issue soil conservation orders, to be published in both the Official Gazette and daily and weekly newspapers. Such orders may relate to any or all of the following measures for the whole or for parts of the conservation area: the use to which the land may be put; the crops, trees, grasses, shrubs, or plants to be grown or not grown; the preservation and protection of the source, course, and banks of streams; the prohibition or restriction of cultivation of any part of the land; the method of cultivation of the land; the number and type of stock to be maintained on the land and the manner of their watering, depasturing, and movement; the control of water, including storm waters; and the construction and maintenance of works for the conservation of the land. Fines are stipulated for land owners or occupiers failing to react to such orders.

The Chief Agriculture Office is assigned a wide range of powers for the enforcement of the law, including powers relating to water courses and defenses against water, the issuance of grants or loans for carrying out necessary conservation measures, the leasing of land, the seizure and sale of animals unlawfully on land in the conservation area; and the assessment of fees from landowners for conservation measures taken on their land. The Officer may also, with the approval of the Minister, make regulations which , among other things: set up Conservation Councils for any part of the conservation area; prohibit lighting of fires in the area; and regulate or prohibit the destruction of interference with trees, shrubs of grasses in the conservation area. The penalty for offenses under the law is a fine of one hundred dollars or imprisonment for six months.

5.2.2 Cultivation of Trees Act, 1951 (Laws of Barbados, Chapter 259)

The act promotes the cultivation of trees by providing "tax contribution payments" for owners or land on which specified trees such as mahagony or casuarina trees are grown and subsidies for growers of those fruit trees

designated by the Chief Agricultural Office of the Ministry of Agriculture, Food, and Consumer Affairs. The conditions under which such payments are to be made are detailed. Furthermore, no tree standing on land for which a "tax contribution" has been paid may be cut down without a license from the Chief Agricultural Officer; fines are specified for offenses against this provision.

5.2.3 Tree protection bill

According to a report dating from September of 1981, the Barbados Parliament was considering a bill requiring any person wishing to cut down a tree to get permission from the Chief Town Planner. The bill also empowers the Chief Town Planner to require certain land owners to plant trees for enhancing and preserving the attractiveness of vacant land. Permits for building construction may also require builders to deposit sums of money in a special account of the Treasury as security against any failure to plant trees and provide grass on open space as specified in the permit. Offenses against the provisions of the proposed law would result in a fine a B$1,000 or six months imprisonment or both (JPRS 79291, October 23, 1981, p. 24).

5.3. Wildlife

5.3.1 Wild Birds Protection Act 1907 (Laws of Barbados, Chapter 157)

The act applies to thirteen species of wild birds, making it an offense to kill or wound them knowlingly, to attempt to kill or wound them, or to be in possession of their dead bodies. It also prohibits the export of skins and feathers of these birds. Persons desiring to obtain specimens of any wild birds for the purposes of natural history research, however, are entitled to kill them under a license to be obtained from the appropriate Minister. The penalty for killing the birds or possessing their bodies is B$2.50 per wild bird killed; the penalty for exporting their skins or feathers is B$24. One half of the amount of the penalty is to go to the person giving information about the offense. See 2.5.3 for a list of the birds covered by the Act.

5.3.2 Fisheries Regulation 1904 (Laws of Barbados, Chapter 131)

Part I applies to the protection of sea turtles. It declares unlawful: the taking or capturing of any turtle or turtle eggs found on the shores of the island or within one hundred yards of the shore; setting nets or seines, etc. for taking, capturing or fishing for turtles; buying, selling offering for sale, or possessing any turtle of less than 30 pounds in weight which has been captured or taken in contravention of the provisions of this regulation. Persons committing offenses under these provisions are subject to confiscation of both their catch and their equipment and are liable on summary conviction to a penalty of $B100.

5.4 Fisheries

5.4.1 Fisheries Regulation Act 1904 (Laws of Barbados, Chapter 131)

Full title: An Act to consolidate the Acts of this Island relating to Fisheries.

The act provides protection for sea turtles (see 5.3.2) and "black sea eggs," regulates whaling, and prohibits the use of explosives or poisons in fishing.

5.5 Minerals

5.5.1 Mines Regulation Act 1899 (Laws of Barbados, Chapter 350)

The Act sets rules for worker safety in mining operations.

5.5.2 The Quarries Act 1963 (Laws of Barbados, Chapter 353)

The Act, which requires licenses for quarrying operations, deals with the safety of quarry workers and requires that quarries be reasonably fenced off in order to prevent accidents.

5.5.3 Petroleum Winning Operations Act 1951 (Laws of Barbados, Chapter 281)

Full title: An Act to vest in the Crown the property in petroleum and natural gas within the Island and to make provision with respect to the searching and boring for and getting of petroleum and natural gas, and for purposes connected with the matters aforesaid.

Article 5 stipulates that a licensee under the act "shall adopt all practicable precautions (which shall include the provision of modern equipment) to prevent pollution of the coastal waters by oil, mud, or any other fluid or substance which might contaminate the sea water or shore line of Barbados."

5.6 Coastal Zone

5.6.1 Territorial Waters Act (1977-26, June 23, 1977)

This act, scheduled to come into effect as of January 1, 1979, extends the territorial waters of Barbados from three to twelve miles.

5.6.2 Marine Areas (Preservation and Enhancement) Act, 1976 (Laws of Barbados Chapter 232A)

Full title: An Act for the preservation and protection of marine life in certain submarine areas of Barbados and for the establishment of underwater parks and art centers in connection therewith.

Under this act the Minister of Housing, Lands, and Environment may designate any portion of the marine areas of Barbados as a restricted area if it is considered necessary for: 1) the preservation and enhancement

of the natural beauty of the area; 2) the protection of flora and fauna (defined to include any part of a coral reef or other deposit in its natural condition); 3) the promotion of public enjoyment; 4) the promotion of scientific study and research.

The Parks and Beaches Commission, the agency responsible for the management and control of all restricted areas and of underwater parks and arts centers established under the act, may enter into agreements for the use and control of any land required for the purposes of the act and may issue regulations providing for the protection of the flora and fauna and wrecks in the designated areas and prescribing the conditions under which the areas are to be used.

Penalties for offenses under the act are fines running as high as $1,000 or imprisonment for a term not exceeding six months.

5.6.2.1 Marine Areas (Preservation and Enhancement)(Barbados Marine Reserve) Regulations), 1981 (Official Gazette, February 26, 1981)

The regulations specify measures to be taken to ensure protection of the Barbados Marine Reserve (see 5.6.4). Enforcement is in the hands of the Barbados Defence Force Coast Guard or persons authorized by the Parks and Beaches Commission. The penalty for contravention of the regulations is a fine of one thousand dollars or imprisonment for six months or both.

5.6.3 Parks and Beaches Commission Act 1970 (Laws of Barbados, Chapter 233A)

The Act creates the Parks and Beaches Commission (see 4.1.2.1) as the instrument for controlling, maintaining and developing the public parks and beaches of Barbados.

5.6.4 Beach Protection Act 1890 (Laws of Barbados, Chapter 222)

The Act, last amended in 1967, provides for the protection of beaches by laying down the conditions under which "sand, stones, shingle, or gravel" may be removed from the foreshore of the island. It also prohibits the fouling of the foreshore by the depositing of "offal, garbage, or other waste." A penalty of $B250 is specified for offenses against the provisions of the Act.

5.6.5 Oil in Navigable Waters Act 1927 (Laws of Barbados, Chapter 293)

Full title: An Act to make provision against the discharge or escape of oil into navigable waters.

5.6.6 Marine Boundaries and Jurisdiction Act 1978?

The Act establishes a marine zone known as the exclusive economic zone, which lies outside the territorial zone and stretches up to two hundred miles from the low water line. Within this zone the government of Barbados claims all rights and jurisdictions in respect of exploration,

exploitation, and conservation of all resources, both living and non-living. Thus fishing, mining, drilling, and salvaging as well as control and supervision of scientific research, the protection of the marine environment, and the regulation and safety of shipping within this zone fall under the jurisdiction of the government of Barbados.

Under part III of the act all persons fishing within the exclusive economic zone must either be citizens of Barbados, hold valid permits granted by the government of Barbados, or be operating under and agreement with the government of Barbados.

The act designates "marine conservation officers" to ensure compliance with the law. These include Fisheries Officers, members of the Defense Force, members of the police force, Customs Officers, and Officers of the Coast Guard (BNFB, vol. 2, no. 1, Jan. 31, 1979:8-9).

5.7 Land use

Town and Country Planning Act 1965 (Laws of Barbados, Chapter 240)

Full title: An Act to make provision for the orderly and progressive development of land in both urban and rural areas and to preserve and improve the amenities thereof, for the grant of permission to develop land, and for other powers of control over the use of land, to confer additional powers in respect of the acquisition and development of land for planning, and for purposes connected with the matters aforesaid.

The Act provides for the preparation of development plans which may deal with, among other things: allocation of lands as open spaces whether public or private; allocation of lands for communal parks, for bird and other sanctuaries, and for the protection of marine life; allocation of lands for preservation or protection of forests, woods, trees, shrubs, plants, and flowers; and preservation of buildings, caves, sites and objects of artistic, architectural, archaeological or historial interest. Implementation of the Act is in the hands of the Chief Town Planner (of the Ministry of Housing, Lands, and Environment) and the Town and Country Planning Advisory Committee created by the Act.

Town and Country Planning Regulations, 1972

Caves Authority Act 1975 (Laws of Barbados, Chapter 233)

Full title: An Act to provide for the control, conservation, development, and operation of caves in Barbados.

The Act creates the Caves Authority (under the Ministry of Housing, Lands, and Environment. It stipulates penalties for certain acts such as removing flora or fauna from caves, dynamiting or quarrying operations in or near caves, interfering with or polluting waters courses, waterfalls or watersheds in a cave, depositing waste in a cave, or breaking or sampling calcite formations in a cave.

5.8 Pesticides

Pesticides Control Act 1973

Full title: An Act to provide for the control of the importation, sale, storage and use of pesticides.

The Minister of Agriculture, Food, and Consumer Affairs is empowered to issue regulations which, among other things: prohibit or control the manufacturing, packaging, importation, advertisement, sale or use of particular pesticides or classes of pesticides; control the use of pesticides in agriculture generally or on particular crops or pests; control the use of pesticides on produce during its storage and transportation; prescribe the permissible level of any pesticide in any particular kind of produce at the time of marketing; protect workers against the risk of poisoning or other injury by pesticides.

The Act established a Pesticides Control Board to advise the Minister on the making of regulations under the act and to carry out the provisions of the act and its regulations. The Minister may appoint inspectors to assist the Board in performing its functions under the act. The powers of these inspectors include the right to enter certain premises, seize certain articles, and to take samples.

The Board's membership is to consist of a Deputy Chief Agricultural Officer as Chairman, the Chief Medical Officer, the Government Analyst, and two other persons, one of whom may be a public officer. The Board is to meet "at such times as may be necessary or expedient for the transaction of business...."

Penalties for offenses under the act include fines not to exceed $B250 plus $B50 per day for each day for which the offense continues.

5.9 Fertilizers

Fertilizers and Feedings Stuffs Act 1967 (Laws of Barbados, Chapter 261)

The Act covers: registration, sale and consignment of fertilizers and feeding stuffs; inspection and sampling; and penalties.

5.10 Air pollution

Registered Sugar Factories Smoke Control Act 1962

Full title: An Act to provide a means whereby sugar factories may be safeguarded against actions of nuisance and applications for interlocutory injunctions in respect of nuisances occasioned by the emission of smoke and to regulate the emission of smoke from sugar factories afforded such protection.

The Act provides for the registration of sugar factories meeting certain general conditions for the prevention of nuisances from smoke emissions. Certificates of registration, valid for a maximum of two years, protect

registered factories against civil actions alleging nuisances occasioned by smoke emissions; such complaints are to be directed instead to the Sugar Factory Smoke Board established by the Act.

The Sugar Factory Smoke Board consists of a chairman and four additional members, two of whom are to be appointed by the Barbados Sugar Producers' Association. The Board is empowered to register sugar factories and to handle complaints arising from the emission of smoke from registered installations. In the performance of its duties, the Board is empowered to enter both registered factories and those applying for registration to inspect any plant or machinery with the aim of determining measures to be taken to prefent smoke emissions. It may prescribe measures to be taken in order for the factory to quality for a certificate of registration. The Board may also revoke certificates if conditions are not met.

5.11 Radiation Protection

Radiation Protection Act 1971 (Laws of Barbados, Chapter 353A)

Full title: An Act to give effect to Article 10 of the Radiation Protection Convention 1960, Convention No. 115 of the International Labor Conference, relating to the protection of workers against ionizing radiations.

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