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DRAFT

ENVIRONMENTAL PROFILE

ON

BELIZE

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THE UNITED STATES NATIONAL COMMITTEE FOR MAN AND THE BIOSPHERE
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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), Office of Forestry, Environment, and Natural Resources (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 AID 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 AID 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 USMAB and ST/FNR and should be addressed to either:

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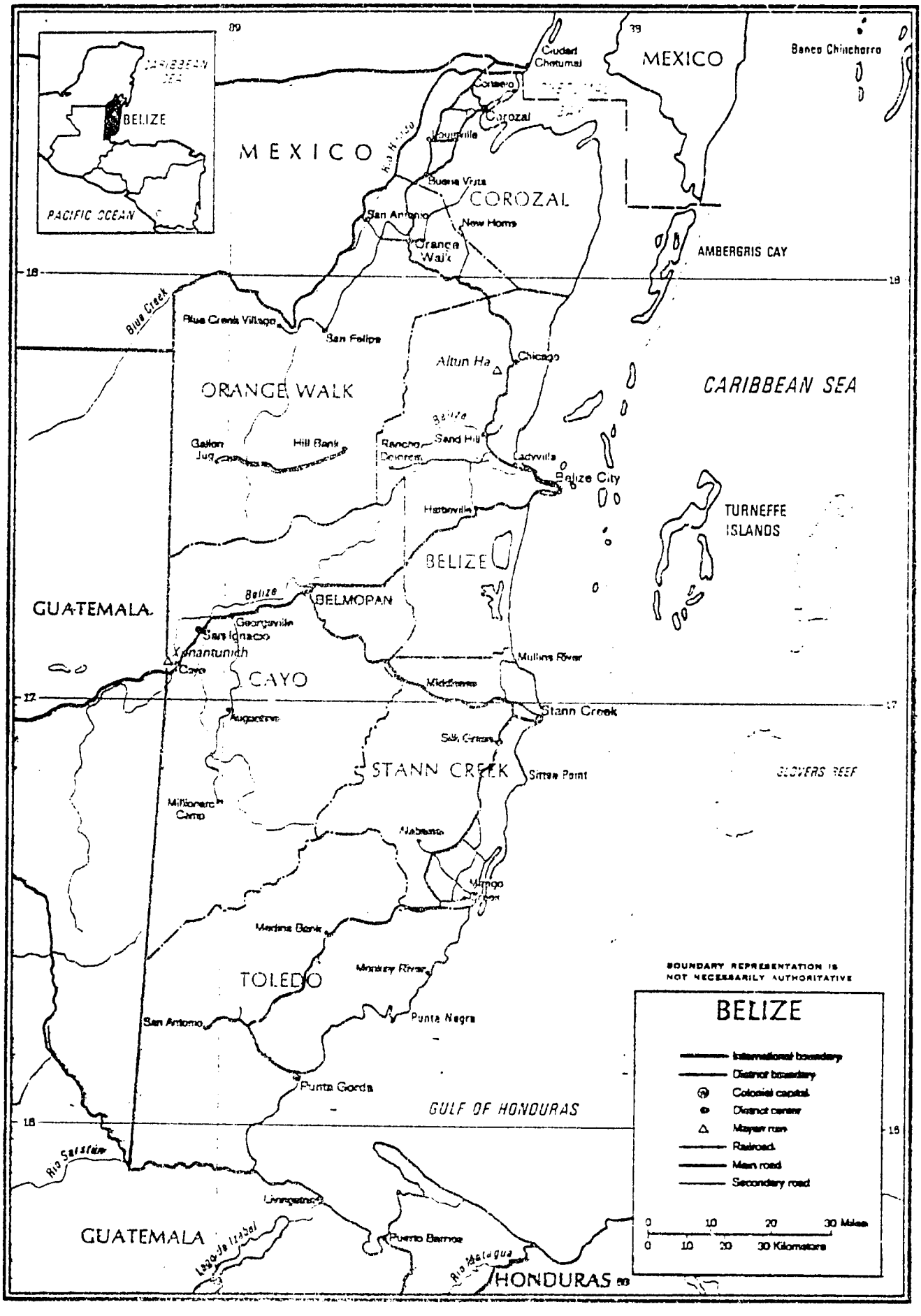
BELIZE
CARIBBEAN SEA
PACIFIC OCEAN
MEXICO
Ciudad Chetumal
Corozal
Orange Walk
Belize
Cayo
Stann Creek
Toledo
Punta Gorda
San Antonio
Punta Negra
Puerto Barrios
Livingston
Rio Sarstun
Rio Motagua
Blue Creek
Blue Creek Village
San Felipe
Altun Ha
Chicago
Gallon Jug
Hill Bank
Rancho Dolores
Sand Hill
Ladyville
Belize City
Hattieville
BELMOPAN
Georgeville
San Ignacio
Xunantunich
Augustine
Mullins River
Middlesex
Silk Grass
Sittee Point
Millionaire Camp
Nabalamo
Mango Creek
Medina Bank
Monkey River
GUATEMALA
HONDURAS
GULF OF HONDURAS
CARIBBEAN SEA
AMBERGRIS CAY
TURNEFFE ISLANDS
GLOVERS REEF
Banco Chinchorro
BOUNDARY REPRESENTATION IS NOT NECESSARILY AUTHORITATIVE
BELIZE
International boundary
District boundary
Colonial capital
District center
Mayan ruin
Railroad
Main road
Secondary road
0 10 20 30 Miles
0 10 20 30 Kilometers

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SUMMARY

The remarkable growth of the timber industry and the corresponding failure of agriculture to expand until relatively recently are vital to an understanding of the environmental problems in Belize. Further, these factors have caused environmental problems in Belize that are less acute than in neighboring Latin American countries. For over 200 years exploitation of forests in Belize was the only reason for the existence of a British settlement in Central America. Timber was the basis of the economy, and without it the region would have held little attraction to colonists. The strong economic base of timber provided little incentive for people to become involved in agriculture. Ultimately, the timber industry executed a social as well as an economic influence on the attitudes of laborers, further contributing to a lack of interest in agriculture. By the early part of the twentieth century accessible stands of forest with valuable trees were nearly exhausted and the timber indutry began a sharp decline. Consequently, Belize found itself without a viable economic base, insufficient agricultural production to feed its population, and a very small labor force. Additionally, participation in agriculture was discouraged by the excessive land speculation of a few wealthy landowners. Finally, in an effort to encourage development of the agriculture sector, and in order to keep land prices affordable to small landholders, a Rural Land Utilization tax was introduced in 1966, and followed by the Aliens Landholding Ordinance in 1973. This landmark legislation was designed to attract greater participation in agriculture, and if successful, it will have a significant impact on land use and the environment.

The chief environmental concerns in Belize are:

Deforestation - Reforestation. Logging of the most commercially valuable trees--mahogany, logwood, and pine--has been extensive. In most areas that are accessible to the logging industry nearly all of the large, harvestable specimens of these trees have disappeared. Progress in reforestation has been limited, and hampered by the loss of extensive areas of coastal forest to destructive hurricanes. Associated environmental problems of the pine logging industry include disease protection and fire protection.

Resettlement. The relocation of the country's capital seat from Belize to Belmopan, and the subsequent population surge in newly founded Belmopan will create an environmental impact that should be monitored. Likewise, the drive by the government to encourage greater participation in the agricultural sector, and the government's efforts to stimulate immigration to augment the small labor force could cause serious problems to the environment unless these phenomena are monitored closely. On the contrary, the small labor force in agriculture has encouraged adoption of modern production methods and use of the most productive lands. The introduction of newer technolgies is not likely to put exploitational pressure on marginal or unsuitable agricultural lands. Chemical pest control in agriculture already may be a problem, or could become one in the future.

Lack of Parks and/or Preserves. Although not an environmental problem per se, the absence of any officially protected parks or preserves is of concern. Thirteen designated sanctuaries currently (October 1979) have not received protection.

1.0 Introduction

This draft environmental profile summarizes information available in the United Sates on the natural resources and environment of Belize. The report reviews the major environmental problems of Belize and the impact of the development process upon resources and the environment. This draft report represents the first step in developing an environmental profile for use by the U.S. Agency for International Development (U.S. AID) and government officials of Belize. The next step in this process should be a field study to evaluate the informaton presented here, obtain additional information, and define the issues, problems, and priorities in greater detail. This entire process should help provide direction in future efforts to deal with the management, conservation, and rehabilitation of the environment and natural resources.

The information and interpretations in this report are preliminary and are not intended to attain the detail and accuracy required for development planning. The report represents a cooperative effort by the Man and the Biosphere (MAB) project staff of the Arid Lands Information Center (ALIC). The primary research, writing, and analysis were done by Steven L. Hilty through the resources of ALIC and the University of Arizona Library. The text was edited by Robert G. Varady. The cooperation of James Corson, AID/MAB Project Coordinator, and other AID personnel is gratefully acknowledged.

2.0 General Description

2.1 Relief and Climate 1/

2.1.1 Relief

The former British Crown Colony of Belize is located along the eastern shore of Central America, immediately below the Yucatan Peninsula. It occupies a rectangular mainland area measuring only about 279 km (170 miles) from north to south and 98 km (60 miles) from east to west. The total land area is about 22,963 sq km (8,866 sq miles), including a number of cays (keys) lying off the the coast, and is only slightly larger than Massachussetts. Belize is, in fact, the second smallest nation in the Americas, being only slightly larger than El Salvador. It is separated along its northern boundary from Quintana Roo, Mexico, by the Rio Hondo. It is bordered on the west and south by Guatemala, the western boundary being approximately a straight north-south line. The southern boundary is formed by the Rio Sarstun. The Caribbean Sea lies to the east of the mainland.

The coastline is fringed by a spectacular barrier reef that extends the length of Belize. In most places it is only about 25 km from the coast. Referred to as the Barrier Reef, it is second in length only to the Great Barrier Reef of Australia. Hundreds of tiny mangrove-covered cays (keys) dot the reef and shallow sea and a number of coral reef islands, including Clovers Reef, Lighthouse Reef, and the Turneffe Islands lie beyond the barrier reef.

The northern half of Belize is low and rather flat, although a few hills near the western boundary exceed 150 m (500 ft) (Fig. 1). Most of the larger streams of this region flow north or northeastward toward the Bahia de Chetumal.

The eastern lowlands are flat and form a narrow strip 16 km (10 miles) wide along the southern half of the country. Most of this region is swampy with many lagoons. At many points terraces approximately 13-15 m (42-50 ft) in elevation mark the inland limit of the coastal swamps.

Inland from the coastal plain and south of the Belize River are the low Maya Mountains. The higest point is Victoria Peak, which rises to 1,104 m (3,684 ft) and forms an important part of a ridge called the Cockscomb Mountains. Many ridges and peaks within the Cockscomb range exceed 950 m (3,000 ft) in elevation. The mountain slopes are steepest along

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1/ Sources: Floyd. 1972b.
Russell. 1964.
U.S. Dept. of State. 1980.

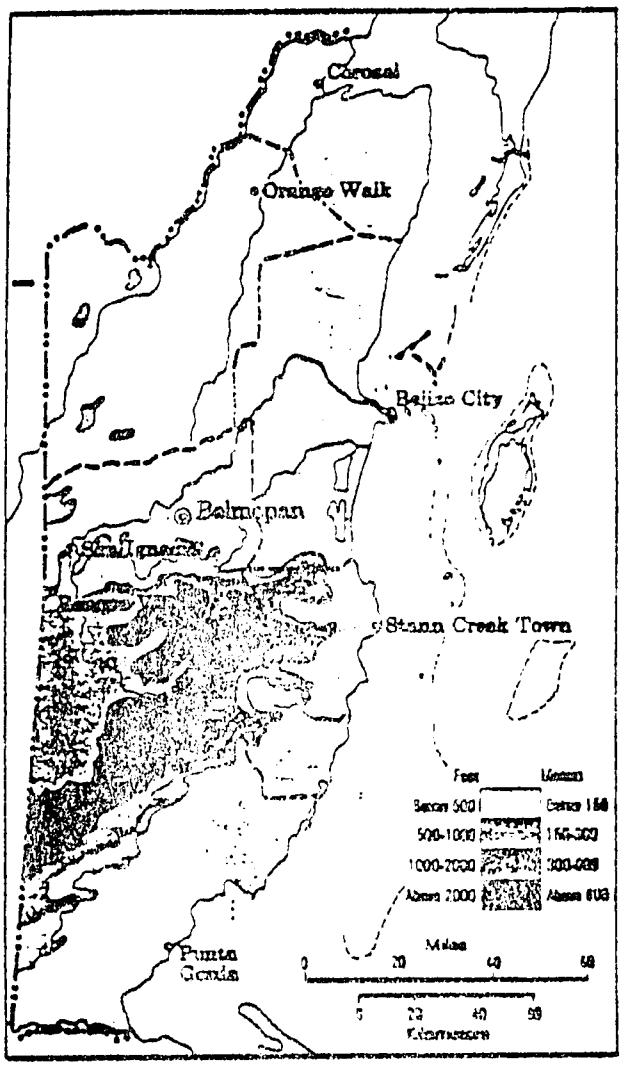

Figure 1. Relief

Source: Floyd. 1972a.

their northern, eastern and southern boundaries, and are drained by a rather straight river flowing in steep narrow valleys. The western slope of the mountains is gentle with an extensive area at an elevation of about 500 m (1,600 ft). Most of the western slopes drain into the Belize River. Only one stream flows into Guatemala. The Mountain Pine Ridge, covering about 324 km (125 sq mi), forms the northwestern portion of the Maya Mountains.

Belize's three chief geographical regions may be characterized as follows:

1) the flat northern half, which is the driest, the most densely populated, and the most important for agriculture;

2) the southeastern coastal strip, which consists primarily of swamps, and is the second most populous region; and

3) the central-southern mountain region which is forested, very sparsely populated, and contains approximately 40 percent of the total land area.

2.1.2 Rainfall 2/

The climate of Belize is characterized by rainfall that is seasonal and varies considerably from one part of the country to another. Precipitation is least in the north (Fig. 2) and gradually increases, southward. As an illustration, Corozal in the extreme north, has an annual rainfall of 1,300 mm (51 in); at Orange Walk, a little to the south, it is 1,550 mm (61 in), and at Belize City, 1,850 mm (73 in). Inland and in the central portion of the country in the Mountain Pine Ridge at Augustine and at Cayo, the mean annual rainfall is about 1,650 mm (65 in). Gallon Jug, just north of the Mountain Pine Ridge and situated within a region of tall luxuriant forest, receives only about 1,500 mm (59 in) per year. The southern portions of the Maya Mountains and Toledo District in the extreme south are reported to receive in excess of 4,060 mm (160 in) annually.

The seasonal distribution of rainfall in Belize (Fig. 2) is marked in the northern half of the country where a Wet/Dry Tropical, or Savanna, climate prevails. The southern sector is much less seasonal, being classified as Wet Tropical. January through April or May are the "dry months" in the northern localities; the remaining months are "wet" (e.g., > 100 mm per month). In the southern region the dry season is

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2/ Sources: Floyd. 1972b.
Russell. 1964.
U.S. Dept. State. 1980.

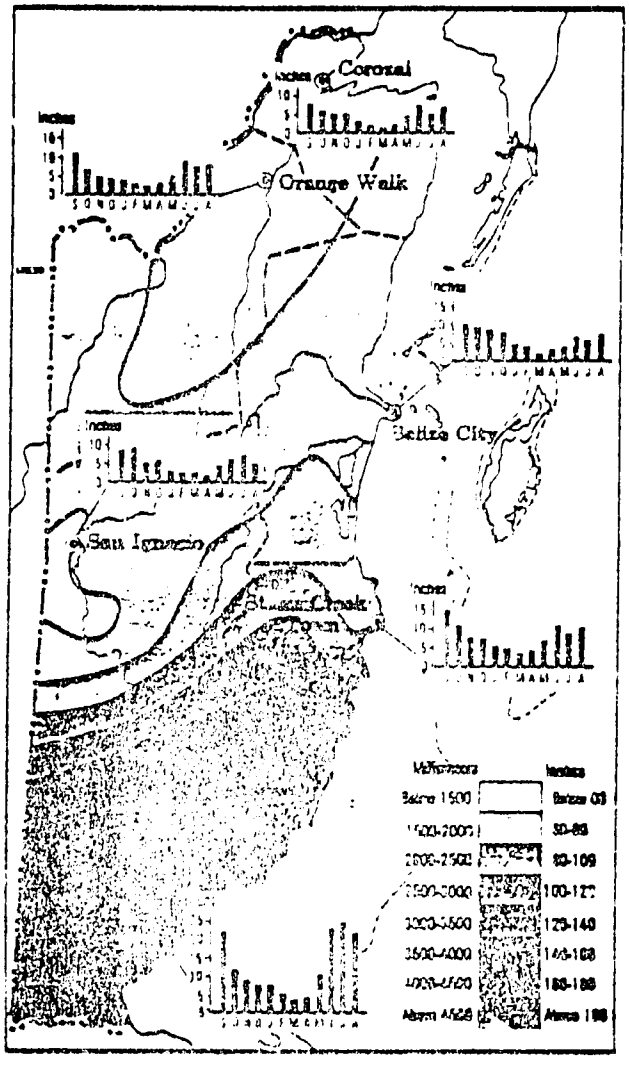

Figure 2. Rainfall

Source: Floyd. 1972a.

somewhat shorter, occurring primarily during February, March, and April. At Belize City, Gallon Jug, and Augustine, the four driest months receive only about 10 percent of the annual rainfall. At Punta Gorda in the extreme south the three driest months receive slightly less than 11 percent of the annual rainfall. There is usually a short "dry" season in August. The averages shown in Figure 1 disguise marked variations in monthly rainfall from year to year, as well as the degree of intensity of precipitation. The number of days with rain also varies considerably from place to place: San Ignacio averages 125 mm; Belize City, 171 mm; Stann Creek, 183 mm; and Punta Gorda in the extreme south, over 200 mm. Seasonal variations in rainfall are directly influenced by easterly trade winds that blow most strongly from the Caribbean Sea during December to April, the "dry" months. Both the seasonal and daily variability in rainfall have significant bearing on forestry, agriculture, and transportation.

2.1.3 Temperature 3/

The climate of Belize is warm tropical, with temperatures determined primarily by elevation, rather than by time of year. In general, the climate is hot and humid in the lowlands, and decidedly cooler in the mountians. The annual mean shade temperature in Belize is about 26°C (79°F). The mean daily maximum is about 30°C (86°F) and the daily minimum is about 22°C (71°F). The highest temperature reported at Belize City is 35.5°C (96°F); the lowest was 9.4°C (49°F). The mean monthly average is 24°C (75°) in January and 27.2°C (81°F) in July. In the interior at San Ignacio, west of the Mountain Pine Ridge, readings of over 37.8°C (100°F) are not uncommon in April, while in the uplands, December nights may dip to below 4.4°C (40°F), with the northern winter months slightly cooler than the summer months. Freezing temperatures are unknown in Belize.

Relative humidity is high, but usually not oppressive. It is most noticeable in the coastal cities such as Belize City, Stann Creek, and Punta Gorda. In Belize City, the mean monthly relative humidity varies between 78 percent and 91 percent. Both heat and humidity are mitigated somewhat by the easterly trade winds and diurnal sea breezes.

3/ Sources: Floyd. 1972b.
Russell. 1964.

2.1.4 Hurricanes 4/

Belize lies squarely within the "Hurricane Belt," and the entire eastern coastline is subject to major hurricane storms. Belize City, less than 0.7 m (2 ft) above sea level, was severely damaged by a hurricane in 1931 when some 1,000 lives were lost, and again in October 1961, when Hurricane Hattie struck the coast from Belize City to Point Placentia, claiming 275 lives. Chiefly because of Belize City's vulnerable location, the capital seat was moved to Belmopan, about 50 km (30 mi) inland. Hurricane Hattie, with winds reaching 300 km per hour and tides of 5 m (15 ft) also devastated agriculture and timber areas and destroyed thousands of hectares of banana, citrus, coconut and forest plantations and forest reserves. The lowlands were flooded and forested regions covering several hundred square kilometers were totally destroyed by winds and rain. Foresters estimated that 100 years would be required for the tall nonconiferous forests to return to pre-hurricane status. The hurricane season is principally July to October. Fortunately, severe storms such as Hattie are rare, and hurricanes of lesser magnitude are likely only every two or three years.

2.2 Population 5/

2.2.1 Historical and Political Background

Parts of present-day Belize were occupied by Mayan Indians long before the first Europeans arrived. The Mayan civilization is believed to have flourished in Belize between A.D. 300 and 900, but thereafter declined, and for reasons unknown, a major migration to Yucatan occurred. Their former presence in Belize is clearly indicated by numerous ruins of stone buildings in the western parts of the country, notably those at Altun Ha and Xunantunich. The Mayas are known to have developed advanced techniques for cultivation of maize, one of their principal agricultural products. Evidence for this may be found in the presence of canals and terraces, which are now largely obscured by the forest.

Europeans arrived in 1502, when Columbus explored the coast of Honduras. The barrier reef apparently discouraged attempts to colonize the coast of Belize. However, pirates

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4/ Sources: Floyd. 1972b.
Russell. 1964.

5/ Sources: Floyd. 1972b.
U.S. Dept. State. 1972.
U.S. Dept. State. 1980.
Wilk. 1981.

frequented the region, attracted by the protection the reef afforded from surprise attack and by opportunities to prey upon Spanish ships laden with dye-producing logwood extracted from adjacent coastlines. The first recorded European settlement was established in 1638 by a shipwrecked Scottish buccaneer, Peter Wallace, who was exploring the region in search of logwood.

During the next 150 years a number of English settlements were established despite vigorous Spanish efforts to retain a monopoly on logwood trade. The history of the region during this period was turbulent and marked by pirating, indiscriminate logging, and sporadic attacks on the English colonists by Indians and Spanish settlers. Eventually, the foundling Belize Bay colony enlisted help from the English Navy based in Jamaica. In 1786 an Anglo-Spanish treaty granted logging concessions to the British but maintained Spain's sovereignty over the region. The British gained effective control of the coastline in a decisive battle with the Spanish off St. George's Cay in 1798. By the early nineteenth century Britain exercised de facto control of the region, but did not assert its sovereignty until Belize formally became the Colony of British Honduras in 1840.

Prior to that, Mexico and the Central American Federation each had claimed the territory now comprising Belize after securing their own independence in 1821. The British contested this claim and a long, complicated history of disputes ensued between Great Britain, Guatemala, and Mexico over the status of the region. The situation was further complicated by a prolonged immigration between 1848 and 1858. During this period, a large number of Mexican refugees, fleeing an Amerindian uprising in Yucatan, entered British Honduras. Many of these immigrants were white descendants of Spanish colonists, or Mestizos, who settled permanently in Corozal and Orange Walk. In 1862, in an attempt to solidify its claim to the territory, the British declared the region a Crown Colony.

Mexico and Guatemala, however, continued to ignore this declaration and the consequent diplomatic uncertainty remained the main impediment to complete independence for Belize. Complete internal self-government was granted in 1964. This was followed nine years later by the renaming of British Honduras to Belize, a word which may be an indigenous corruption of the name of the Scottish buccaneer Wallace (or Wallis), or a derivation of either the French word balise, meaning buoy, or of the Mayan world Be-Likin, meaning "land of the road toward the sea."

2.2.2 Cultural Background 6/

The ethnic composition of Belize's population is highly varied, partly due to its turbulent history. The major ethnic groups are Black, Mayan Indian, Latin American, Hispano-Indian, Black Carib, European, Syrian, East Indian, and Chinese. Blacks, or those of part-black ancestry, are usually called Creoles; those of mixed Spanish or Spanish-Indian origin are usually called Mestizos.

The dominant group is the Creoles, or Afro-Belizeans, forming about 70 percent of the population. They comprise the largest proportion of the inhabitants of Belize. Next most numerous are Mayan Indians, comprising about 17 percent of the population. They are distributed primarily in the north, west, and south and are employed in agriculture or forestry-related activities. The Mopan and Ketchi Indians of the south remain the most isolated. Black Caribs represent about seven percent of the population and are distributed primarily in Punta Gorda and Stann Creek Town, where they outnumber all other ethnic groups. Physically they are almost indistinguishable from Creoles, but cultural divisions are sharp. Black Caribs maintain their Indian-derived traditions and language and infrequently intermarry with other ethnic groups. The remaining ethnic groups, Spanish-speaking Whites, Mestizos, and East Indians, are concentrated primarily in the north. Most notable among recent immigrants are the Mennonites from Canada and Mexico. They are a close-knit religious community, successful in agriculture, and confined to a few settlements in the northwestern region. Their total population is about 2,000-3,000 persons.

English is the official language of the colony and is spoken by everyone. Approximately 40 percent of the population are native Spanish speakers, and Spanish is spoken by another 20 percent as a second language. Various Indian groups have retained their original languages, and a Creole dialect is spoken by many Blacks. About half of the population is Roman Catholic, the remainder belong to a number of other religions.

2.2.3 Population Growth and Distribution 7/

Based on the 1980 census, Belize's population is about 144,650. An average density of 6.3 persons per sq km (15 per

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6/ Sources: Dobson. 1973.
Floyd. 1972.
U.S. AID. 1979.
U.S. Dept of State. 1980.

7/ Sources: U.S. AID. 1979.
U.S. Dept. of Commerce. 1980.
U.S. Dept. of State. 1980

sq mi) is the lowest in Central America and is less than one-tenth that of similar-sized El Salvador. The annual growth rate is only one percent, due primarily to a very high emigration rate. The national rate of increase is about three times the annual growth rate.

The crude birth rate was an estimated 34 per 1,000 in 1970 but rose to 38-40 per 1,000 in 1976 (U.S. AID 1979; U.S. Dept. State 1980). As in most developing countries the population is young; almost half (49 percent) were under 15 years of age in 1970 (U.S. AID 1979). Because the population density is very low, Belize has not implemented a national policy to reduce the birth rate.

The population of Belize is markedly uneven (Fig. 3). More than half (54 percent) of the 1960 population was urban (U.S. AID 1979). Fully one-third of the country's residents live in Belize City. An additional 17 percent of the population is concentrated in six small towns: Corozal, Orange Walk, San Ignacio, Stann Creek Town, Punta Gorda, and Benque Viejo. The remainder of the population is scattered in over 100 isolated villages. These villages are concentrated in the north between Corozal and Orange Walk, the extreme south in Toledo District, along the coast south of Belize City, and westward along the Belize-San Ignacio road. Much of the remainder of the country--including southern Orange Walk District, the coast north of Belize City, southern Cayo, and northern Toledo District--remains virtually uninhabited, averaging fewer than one person per sq km.

2.2.4 Health and Nutrition [8/]

The number of health centers and hospitals is probably adequate for the population although most facilities suffer from inadequate financing and a shortage of trained personnel. There are few health services in remote areas.

The five leading causes of death in 1972 were: heart diseases (12.4 percent), malignant neoplasms (10.2 percent), influenza and pneumonia (9.4 percent), enteritis and diarrheal diseases (8.5 percent), and perinatal mortality (5.8 percent). A malaria eradication program had largely brought the disease under control until a recent upsurge. The number of reported cases rose from an annual average of 93 in 1972-1975 to over 1,000 in 1978. One malarial vector, the mosquito Aedes aegypti, is believed eradicated in Belize but remains epidemic in many neighboring Middle American countries and thus could reappear at any time.

8/ Source: U.S. AID. 1979.

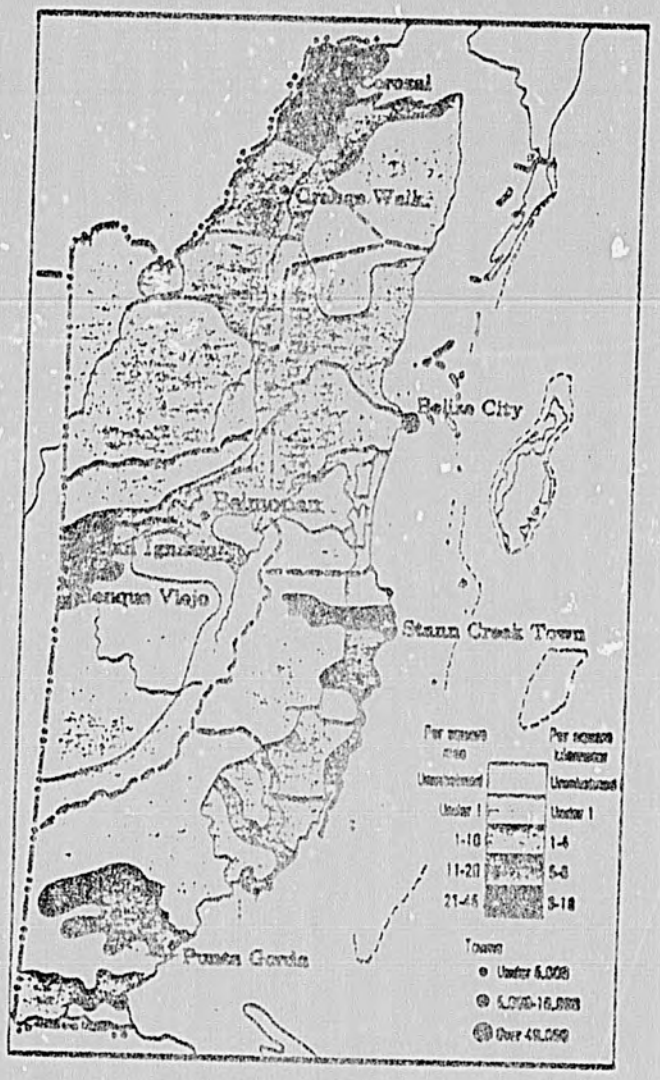

Figure 3. Population Density

Source: Floyd. 1972a.

Other important health problems in Belize include bacillary dysentery, infectious hepatitis, tuberculosis, various infectious and parasitic diseases, and venereal diseases. Encephalitis, rabies, and leishmaniasis have also been reported.

Nutritional health of the Belizean population is reported by U.S. AID (1979) to be below the level of much of the Commonwealth Caribbean. Adequate nutrition should be possible when full agricultural potential is realized. Poor or inadequate nutrition among infants often results from chronic diarrhea caused by feeding them condensed milk mixed with unsterile water. Among eight- to nine-year olds, physical growth patterns are significantly below normal (U.S. AID).

Safe water supplies exist in the new capital city of Belmopan, but in Belize City which has one-third of the country's population, water supplies are unsafe and treatment facilities primitive. Rural water supplies are generally unsafe. There are projects underway to provide potable water to Orange Walk, Corozal, and San Pedro. These have been financed entirely by the United Kingdom.

2.3 Land Use 9/

2.3.1 Background and Trends

Land use trends in Belize are similar to those in neighboring Latin American countries. According to FAO data compiled between 1961 and 1976, land use trends show a decreasing exploitable forest base and an increase in the amount of land under cultivation or permanent pasture (Table 1). Data from U.S. AID (1979), the most current available to this study, suggest that agriculture accounts for 38 percent of land use in Belize. Only about 5 percent of agricultural land is in cultivation. Of the remaining land, 46 percent is exploitable forest and 16 percent is urban. These values correspond closely to the 1976 values published by FAO.

A detailed land use map entitled, "British Honduras Potential Land Use Map" (2 sheets), published by Wright et al. (1958) shows detailed land use in Belize. Portions of the map, especially northern regions where agriculture is increasing, may be somewhat out of date.

9/ Sources: FAO. 1976.
U.S. AID. 1979.
Wright et al. 1958.

Table 1. Land Use, 1964-76

Use	Estimated Area (1,000 ha)						
	1964	1966	1968	1970	1972	1974	1976
Total Arable and Perm. Crop	31	38	47	47	47	49	49
a) Arable	21	27	26	26	28	30	30
b) Perm. Crop	10	11	11	21	19	19	19
Perm. Pastures	16	17	17	18	18	21	21
Forest & Woodland	1,052	1,049	1,048	1,047	1,012	1,012	1,012
Other	1,197	1,192	1,184	1,184	1,219	1,214	1,198
Total Land (approximate)	2,327	2,334	2,333	2,343	2,343	2,345	2,329

Source: FAO. 1976.

2.3.2 Forests and Crops [10/]

Until the last two decades, the primary economic activity in Belize was forest exploitation. As recently as 1955, over 60 percent of the country's export revenues were derived from lumber and chicle. By 1968 the once important commercial stands of mahogany, tropical cedar and pine were so depleted that their value declined to only 5 percent of total export revenues. At the same time that lumber production was declining, the amount of land under cultivation, and hence, farm production, began to increase. In 1968 agricultural products, mainly sugar and citrus crops, accounted for nearly 60 percent of the country's export revenues. The production of subsistence crops such as beans and rice also increased markedly. Despite this rapid shift in land use and economic base, forest and cutover land still cover much of the country and a substantial amount of food is imported.

10/ Sources: Evans. 1973.
Johnson and Chaffey. 1973.
West and Augelli. 1976.

Within the commercial agricultural sector, the fastest developing farming sectors are in the northern districts of Orange Walk and Corozal where sugar cane is predominant. The Rio Hondo area is now extensively devoted to sugar cane and hundreds of smaller plantations are expanding southward along the alluvial soils of the New River.

Forty miles south of Belize City lies Stann Creek, another highly developed agricultural valley. This region has undergone a number of agricultural booms including the introduction of bananas at the turn of the century, followed by citrus orchards. Due to its proximity to the coast, the region has suffered repeated hurricane damage.

Other areas of concentrated agricultural activity include the Belize River flood plain in Cayo District, an important citrus growing area, and the Sibun River Valley southwest of Belize District, where cacao groves are established. The cacao groves have been subject to extensive damage from hurricanes. Another area of intensive agriculture is inland from Punta Gorda in Toledo District in the southern part of the country; this is predominantly a rice growing area. A few sizable rice farms also occur in various sections of Belize District near the former capital of Belize City.

One of the principal goals of agriculture in Belize is to make the country self-sufficient. Presently about 25 percent of the foodstuffs still have to be imported. To attain these goals, more land will almost certainly need to be brought into cultivation, creating an even greater need for a strong and effective land use policy that integrates agricultural and forestry sectors.

The Mountain Pine Ridge, one of the three largest forest reserves in Belize (see section 3.3.5), is currently managed for multiple use. Five major land uses can be identified, all compatible at present use levels and all spatially integrated. The two most important uses are timber production and in-forest cattle grazing. The other three important uses are public recreation, military training, and biological field studies. Each of these land uses is discussed below, except timber production which is treated in greater depth in section 3.3.5.

1) In-Forest Grazing. Slightly over a third of the reserve (12,000 of 30,000 ha) is licensed as a cattle range. A maximum stocking of 4,000 head (in 1973) is probably higher than the optimal carrying capacity for prudent long-term management.

2) Public Recreation. The Mountain Pine Ridge is acknowledged to be both scenically and climatically the most attractive region in mainland Belize (Johnson and

Chaffey (1974). Nevertheless, recreational use is low, in large measure because of the distance and difficulty of travel from Belize City and other large cities. There is one hotel and one overnight facility at Augustine. The latter is managed by the National Forest Service. Increased public recreational use is not presently encouraged because by increasing the risk of fire it conflicts with other uses, particularly timber production.

3) Biological Field Studies. A minor use at present, biological field work can be expected to increase substantially if it is encouraged by the Forest Service.

4) Military Training. The Mountain Pine Ridge is regularly used as a training area by the Belizean Armed Forces. These exercises are an important cause of fire because of the use of flares and explosives, and careless disposal of cigarettes.

Armed forces training has otherwise had a relatively minor effect on the environment of the Mountain Pine Ridge and these activities, at present levels, appear to be compatible with the Forest Service's program of multi-use for the area.

Information on several land use topics was not available for this study. Among these topics are: farm size distribution, breakdown of farmland by area of crops, farming methods (e.g., slash and burn, hillsides, etc.), pesticide use, land under irrigation, and current administrative policies and their enforcement.

2.3.3 Cattle 11/

There are an estimated 607,000 hectares (1.5 million acres) of land suited for cattle rearing in Corozal and Cayo Districts. Not all of this area has been converted to cattle land, nor have herd inventories or facilities been built up. Nevertheless, it is likely that Belize's livestock industry will continue to expand.

In 1970 the national herd numbered about 32,000 head. Since then there has been a substantial increase in imported stock from Jamaica, Costa Rica, Guatemala, Mexico and the United States, increasing herd size at a rate of three to four percent per year. At the government controlled Central Farms

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11/ Sources: Evans. 1973.
Floyd. 1972a.
Johnson and Chaffey. 1973.
West and Augelli. 1976.

Experimental Station, there are Brahmans, Red Polls, Jamaica Blacks, Herefords, and Brown Swiss. Cattle auctions at the farm now provide an outlet for the purchase and sale of livestock by small farmers. Hog production is currently small, but is being encouraged; Hampshires, Durocs, and Large Whites are the most popular breeds.

3.0 Environmental Resources

3.1 Geology and Soils

3.1.1 Geological Formations 12/

Belize may be subdivided into two broad geomorphological units: a low-lying and generally flat plain occupying the northern half of the country, and an elevated mountain mass to the south which is bordered eastward by a narrow, low, coastal strip. The northern half is an extension of the Peten lowlands of Guatemala and is similar to it in geological structure. These lowlands form a tropical plain whose average elevation is less than 70 m (200 ft). A few hills near the western boundary exceed 190 m (600 ft). The rocks of this half of the country are young, primarily Cretaceous to Eocene limestones derived largely from marine sediments. These are overlaid in many places with white marls and gypsum of Eocene age (Fig. 4) Karst has developed over the Cretaceous carbonates. Near the coast these formations often give way to alluvial deposits of the Quaternary. Flat lowlands also form a narrow strip about 16 km (10 mi) wide along the southern half of the country. Most of this lowland is overlain with alluvial deposits typical of those associated with river valleys.

Inland from the coastal lowlands and south of the Belize River lie the Maya Mountains, which reach their highest elevation only 32 km (20 mi) from the sea. The northern and southern portions of the mountains extend westward, giving the range a crescent shape. Parts of the Maya Mountains exceed 900 m (3,000 ft) in elevation, and the highest point is Victoria Peak at 1,023 m (3,700 ft). The Maya Mountain region is covered by a peneplain but isolated ranges such as the Cockscomb Mountains rise well above the general level of the peneplain. Deeply incised river valleys dissect the peneplain and are especially prominent along the northern, eastern, and southern slopes.

Historically, the Maya Mountains of Belize are of considerable interest. They are perhaps the oldest portion of an ancient landscape that exists in Central America today. Having remained above water since the Cretaceous, the Maya Moutains lie at the southern margin of a stable Precambrian platform that underlies the present Gulf of Mexico. They are a small block-faulted fragment of the ancient Antillean geanticline that extends westward from the stable platform. The northeast corner of the Maya Mountains is probably the oldest fragment within the range.

12/ Sources: Lloyd. 1972b.
Russell. 1964.
Weyl. 1980.

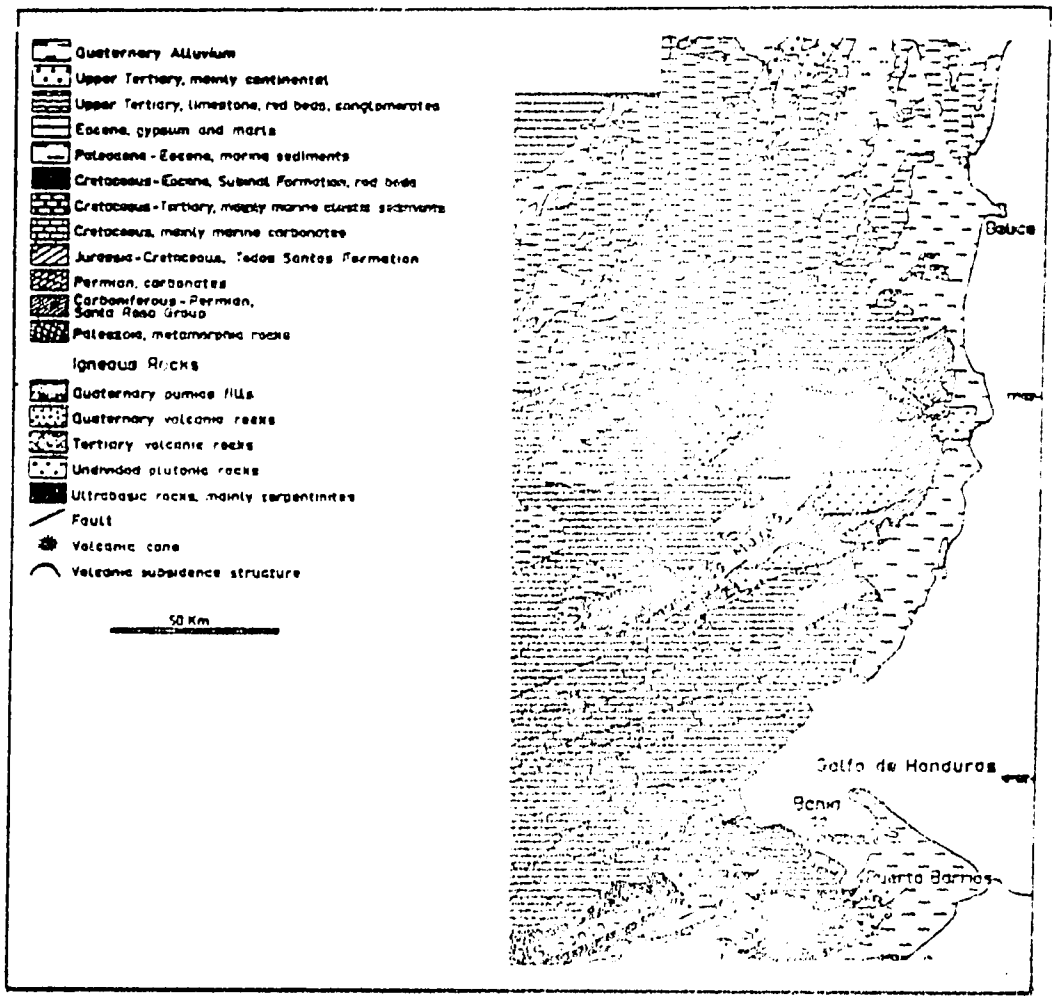

Figure 4. Geology of the Southern Two-Thirds of Belize

Source: Weyl. 1980.

The uplifted block-fault of the Maya Mountains consists of a synclinorium ridge running generally east-west and sloping gently to the west at about 10 degrees. The region is bounded on the north and south by major faults (Fig. 5). The eastern boundary of the uplift is probably also formed by a major fault parallel to the coastline. The rocks of the higher ridges are Paleozoic and include granite, quartzites, slates and shales, many of which are extensively folded. These old rocks, the Santa Rosa Group, dip beneath more recent and gently folded Cretaceous-Eocene limestone toward the west and completely obscure the western boundary of the fault. This simple structure is complicated by the intrusion of granitic masses in the eastern, southern and western part of the region, and of several faults within the uplift. Some of the faults have considerable throw.

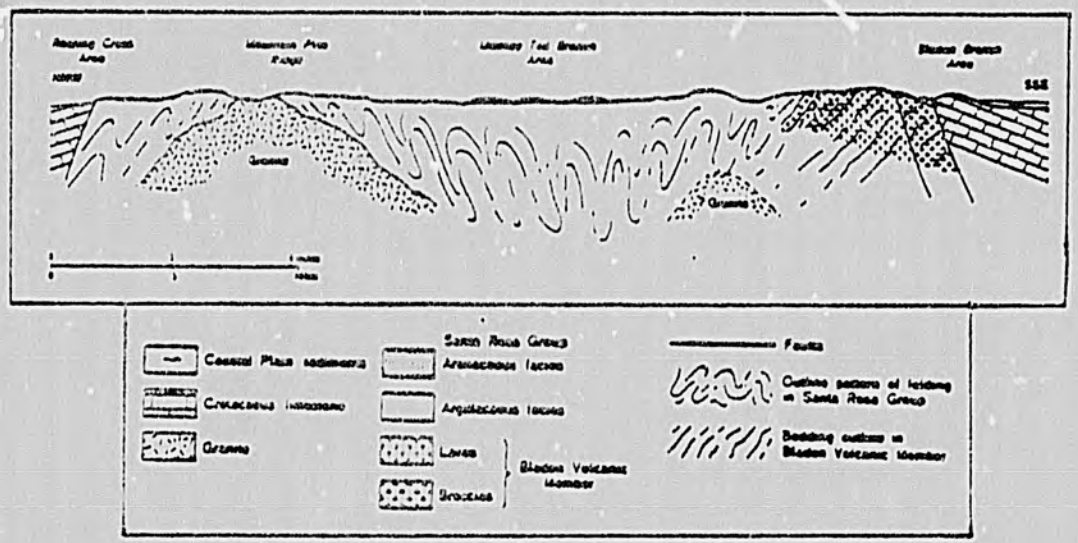

Figure 5: Generalized North-South Geological Cross-section of the Western Flank of the Maya Mountains

Source: Batson and Hall. 1980.

The Santa Rosa rocks, oldest of the Maya Mountains, are believed to be of Pennsylvanian to Middle Permian age. The most notable rocks of the Santa Rosa Group are conglomerates with pebbles of hard sandstone and quartzite, some phyllite and contact-metamorphosed sediments. However, fine-grained agrillaceous rocks compose the largest proportion of the Santa Rosa Group. The are frequently interrupted by dark limestone bands composed primarily of crinoids, bivalves, and in some cases both solitary and colonial corals.

The southern boundary of the Maya Mountains uplift block is formed by the Badden Volcanic Member (Figs. 5-7), a group of volcanic rocks that interlock with the more extensive Santa Rosa Group. The Badden Member appears to be a variegated sequence of acid rhyolitic lavas, pyroclasts, and volcanic sediments dating from the Upper Carboniferous to the Permian.

The intrusive rocks of the Maya Mountains occur as three separate granite masses (batholiths): the Mountain Pine Ridge granite, the Cockscomb-Sapote granite, and the Hummingbird-Mullins River granite (Fig. 6). The chemical compositions of these three regional granites indicate that they are distinct from the Caribbean Islands granites.

The region south of the fault forms the southern boundary of the Maya Mountain uplift and is primarily composed of Cretaceous or Cretaceous-Tertiary limestones derived from marine sediments (Fig. 4). This small region forms the southern tip of the country. Geologically, these limestones are closely allied to those along the western and northern boundaries of the Maya Mountains, and like them have the characteristic erosional features of tropical karst.

The single most characteristic geomorphological feature of Belize is probably the succession of coral reefs and atolls that lie about 30 km (19 mi) offshore and run virtually the length of the seacoast. The seas here are dotted with hundreds of small strand islets known locally as cays (pronouced keys). These reefs are of considerable importance as tourist attractions, and also as constraints on shipping because of the shallow water depth offshore. These latter topics are treated in greater detail in section 3.4.7.

3.1.2 Mineral Deposits and Petroleum Reserves

Over the last decade there has been considerable interest in potential mineral deposits. Prospecting rights for gold, silver, copper, lead and raw earth have been issued to a Canadian firm of consulting geologists. Several "encouraging" discoveries reportedly have been made.

In 1968, 21 oil prospecting licenses were granted to Belize Chevron Oil Company, a subsidiary of Standard Oil of California (Floyd 1972a). Although no important reserves have yet been discovered, the possibility of oil being discovered in Belizean waters still exists. Also, because offshore areas from Honduras to Jamaica have been leased to various oil companies many feel that important oil discoveries will be made somewhere in this region. It is also possible that significant oil deposits may be found in the northern Belizean lowlands, as there are now large proven reserves in the adjacent Peten lowlands of Guatemala.

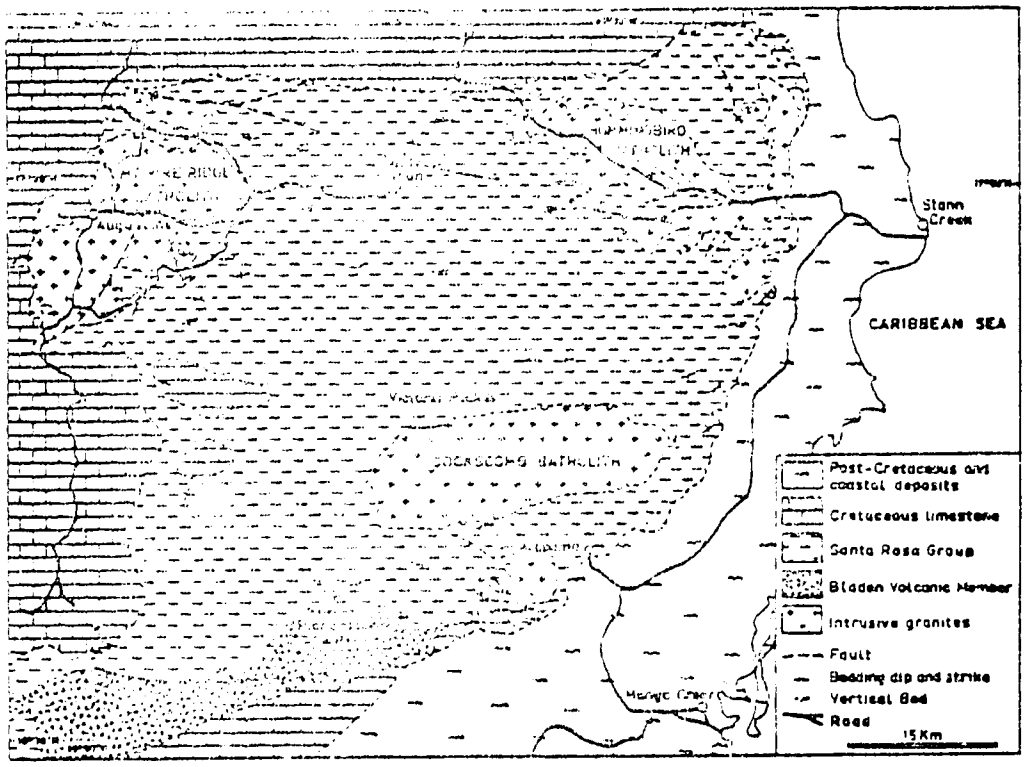

Figure 6. Geological Map of the Maya Mountains

Sources: Hall and Bateson. 1972.
Kesler et al. 1980.

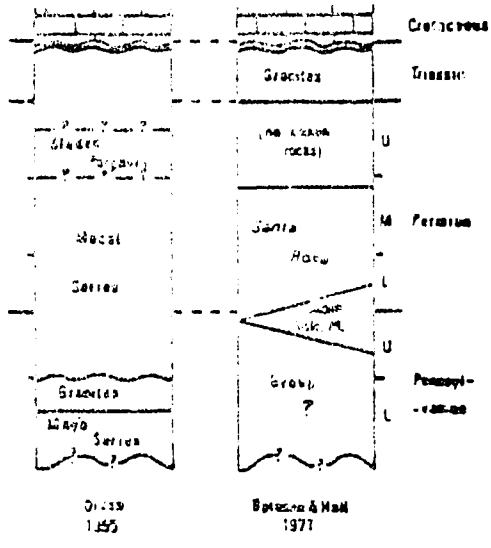

Figure 7. Stratigraphical Correlation of the Maya Mountains

Sources: Dixon. 1955.
Bateson and Hall. 1971.

By 1977 one well was drilled offshore and two more were planned onshore. After completing a geological survey of the 1562 square mile onshore area, Esso drilled one of the two onshore wells at Seal Cay but abandoned the effort in May 1977, at a depth of 10,322 feet. No wells were drilled in 1976, and according to World Oil (1977) Belize has no established production or reserves. More recent data may be available in the Quarterly Economic Review of the Caribbean which includes Belize, but this publication was not available to the author.

3.1.3 Soils [13/]

The distribution of the major soil association in Belize are relatively well known although a number of information sources were not available to this study. The following account is derived primarily from the FAO Soil Map of the World, Vol. III (1975), and the accompanying 1:5,000,000 map. Those wishing greater detail may refer to the British Honduras Provisional Soil Maps of the British Directorate of Overseas Surveys (1958). Other references on soil may be found in the bibliography.

Belize's soil distribution conforms closely to the major geomorphological units of the country, and consists of:

1) soils of the northern half of the country that are formed under conditions of constant or intermittent lime enrichment,

2) mountain soils formed under conditions of continuous acid leaching, and

3) recent coastal soils, primarily alluvium and saline organic soils.

A generalized soil map (Fig. 8) shows the distribution of the soils discussed in the following sections.

3.1.3.1 Limestone soils of the northern lowlands

A belt of hard white crystalline limestone soils begins in southeast Mexico and the Peten lowlands of Guatemala, swings eastward across northern Belize and wraps around the northern side of the Maya Mountains. These soils have not been thoroughly studied but are the dominant soil in Belize. They are lithic chromic cambisols associated with hard pinkish limestone and dolomitic limestone. Along the western border of Belize and near the mountains, serpentinized ultrabasic

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13/ Sources: FAO. 1975.
Directorate of Overseas Surveys. 1958.

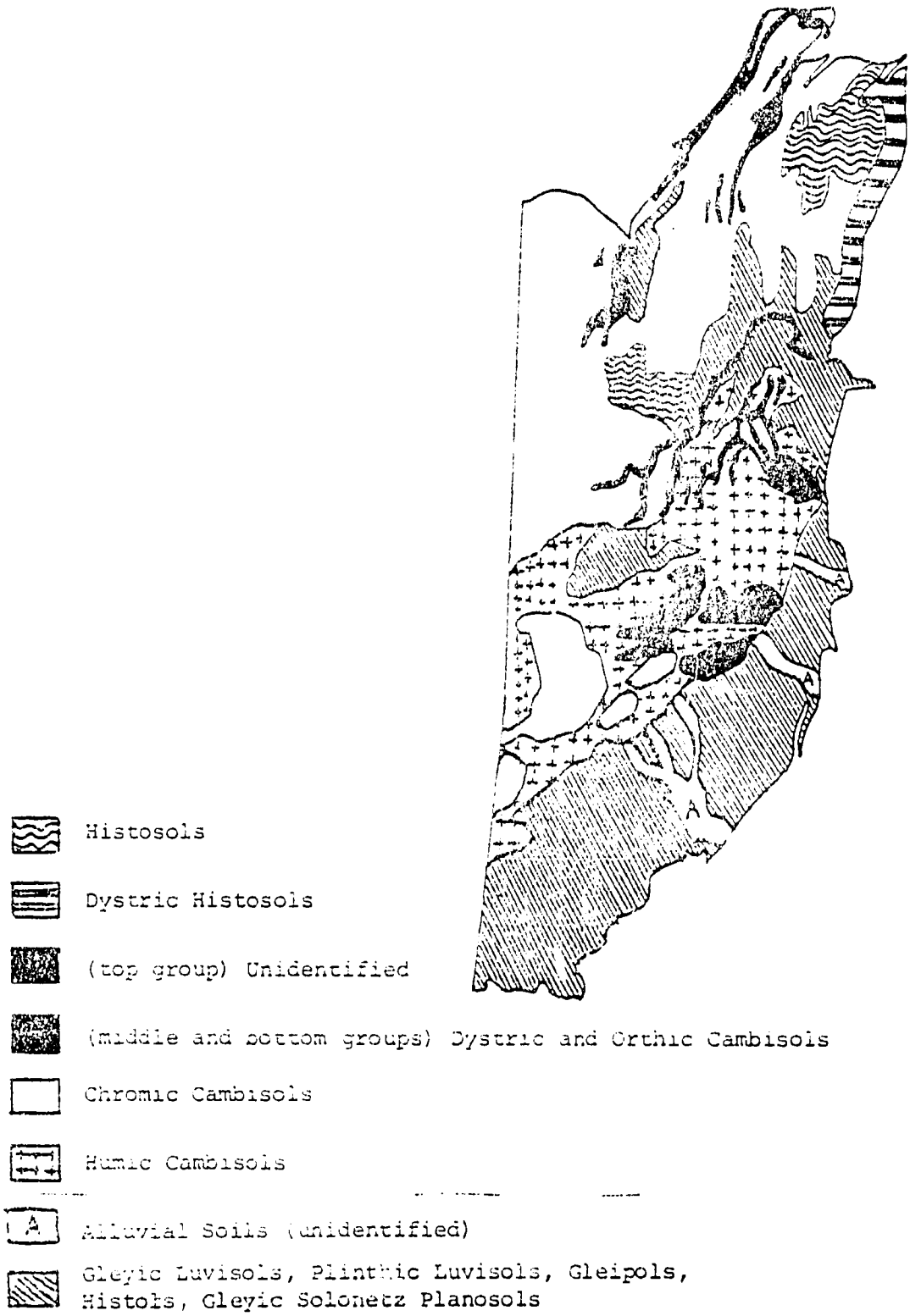

Figure 8. Provisional Soil Map

Source: Adapted from Wright et al. 1958.

rocks occur mixed with limestone. Here the soils assemblages include lithic dystric cambisols and orthic luvisols, reflecting a close association with the mountains.

The lithic phase chromic cambisol soils that characterize much of northern Belize overlay calcareous parent rocks and contain volcanic minerals in the form of tuff. These soils are most frequently used to grow subsistence crops by traditional slash and burn methods. Under these conditions, production of maize and beans is moderate, and only fair for bananas, plantains, and root crops. Soil resting periods of 5-8 years between crops are normally required. Under more intensive management, regular additions of phosphates are required because excessive ferrous iron and aluminum compounds bind and restrict the availability of soil phosphates. Nutmeg, avocado, citrus, coffee, and cocoa can be grown satisfactorily with supplemental phosphate.

3.1.3.2 Soils of the Maya Mountains

This small but geologically distinct region is a very old mass of Jurassic quartzites, phyllitic shales, and sandstones with three batholithic granite core centers. The northern and oldest region is underlain mainly by granitic rocks while the lower western slopes are partially overlapped by Cretaceous limestones typical of the northern portion of the country.

The soils of the northern Maya Mountains are the oldest and least eroded of this ancient massif, and are largely humic cambisols similar to those occurring in Sao Paulo, Brazil. Other soils of the region are similar to humic acrisols; plinthic and gleyic luvisols occur alongside. Along the steep eastern slopes of the Maya Mountains there are lithic dystric cambisols, as well as lithic humic cambisols, lithic orthic acrisols (from sandstones and quartzites), and lithosols. In the south and west the soils are more varied and include rendzinas, lithic entric cambisols, chromic and dystric cambisols and lithosols.

The humic cambisols of the northern Maya Mountains are very limited in Central America, occurring only on the Costa Rica-Panama border. They are very acidic, usually high in free aluminum, and are not suitable for agriculture. The dominant natural vegetation cover over these soils is an open pine savanna. The humic acrisols, probably the second most widespread soil association of the Maya Mountains, are also not widely used in agricultural crop production because of nitrogen, phosphate, and potash deficiency, and because of the long time required for them to regain fertility. They are used chiefly as pasture land for grazing. Plinthic and gleyic luvisols are likewise of low natural fertility and are used mainly for rough pasturage.

3.1.3.3 Soils of the coastal lowlands

The narrow coastal lowland strip from Belize City north to Quintana Roo consists almost entirely of very recent (Quaternary) alluvial soils derived as alluvial outwash from parent soils of the interior northern half of Belize. The dominant soils are histosols.

The soils of the southern coastal strip south of Belize are more varied and complicated. The lowlands of this region are confined to a narrow coastal strip broken occasionally by low terraces. Further inland a foothill zone of Tertiary rhyolitic and basic volcanic tuff, or sandstones and shales gradually merge with the highlands of the interior. The soils of this zone include: gleyic luvisols, plinthic luvisols, gleysols, histosols, gleyic solonetz and planosols. The physical properties of all of these soils are rather similar and several, especially solonetz, the gleysols and histosols, are often found in association, as are gleyic and plinthic luvisols. In general all have low natural fertility and are easily compacted, which causes poor internal drainage. Because of the slow drainage they are easily flooded and subject to erosion. Planosols are further characterized by an almost impervious clay horizon in the upper part of the subsoil. Because planosols usualy occur on flattish terrain they also tend to remain waterlogged for considerable periods of time.

For the most part these soils can support rough pasturage but are difficult to use for nonirrigated crops. Some rice-growing experiments on plinthic luvisols are in progress. Considerable research on the improvements of solonetz soils (in the literature) suggests that successful agriculture on the soils depends upon replacing sodium by calcium in the exchange complex.

3.2 Water Resources

Water resources data are based on Smith in van der Leeden (1975) and are very incomplete. No data were obtained for total area under irrigation, water use for irrigation, drinking and industrial supply, hydroelectric generation, or of available groundwater or stream discharge. Data for the larger municipal water systems, mostly drawn from groundwater sources, are shown in Table 2. Only two of six towns for which data exists rely on treated river water for municipal supply. Approximately 48 percent of the urban population has piped water via house connections; an additional 27 percent reportedly have "easy access" to piped water. The situation in rural areas is very different. Fewer than six percent of the rural residents have piped water connections to their homes; an additional 3.4 perent have easy access to piped water supplies. Thus, only about nine percent of the rural population has ready access to piped water supplies.

Table 2. Municipal Water Supply Systems[1]

Municipality	Source of water	Description of system
Belize City (Pop. 40,000)	Ground water	Water pumped from 3 shallow wells 10 miles from city to 400,000 gallon cap. storage tank in Belize City.
Belmopan	Surface water	Water from Belize River is treated and distributed.
Benque Viejo del Carmen	Ground water	Spring water pumped to storage reservoir.
Corozal Town	Ground water	Water from 2 wells 1 mile west of town stored in 50,000 gallon cap. storage tank.
San Ignacio	Surface water	Water from Mopal River pumped into 2 reservoirs with total cap. of 200,000 gallons.
Stann Creek Town	N.A.	Capacity of system 150,000 gallons.
Punta Gorda	Rain water and ground water	Rain water augmented by well; total storage cap. 360,000 gallons.

1) Total population in urban areas served by public water systems: 33,000 (about 80% of urban population).
N.A. – Not available.

Source: van der Leeden. 1975.

3.3 Vegetation

3.3.1 History of Botany in Belize

The flora of Belize is notably rich but because there are no high mountains, the forest types are rather undiversified. The flora of Belize has not been completely inventoried. One of the earliest and most complete publications dealing with the flora of Belize is Standley and Record (1936); other works include Lundell (1940, 1942), Bartlett (1935), Beard (1953), and Charter (1941). Several important regional inventories have been completed by Johnson and Chaffey (1973). The major vegetative communities are summarized in Russell (1964). There are numerous studies treating various timber species of Belize; some of the more important are: British Honduras Forest Dept. (1946), Frith (1963), Shank (1948) and Hunt (1962, 1970).

3.3.2 Floral Diversity and Biogeography 14/

Although the flora is still incompletely known there are possibly 4,000 vascular plant species in Belize, a large number considering the size of the country. Families with the greatest number of species include: Gramineae, Leguminosae, Cyperaceae, Rubiaceae, Compositae, Melastomataceae, Orchidaceae, Euphorbiaceae, Myrtaceae, Bignoniaceae, Moraceae, Acanthaceae, Solanaceae, Palmae, and Convolvulaceae. From an economic standpoint the most important families are Leguminosae, Meliaceae, Palmae, and Sapotaceae. Mahogany (Swietenia macrophylla) is the most valuable and widely sought tree but now occurs in very low density, typically about 2.5 trees of useful size per hectare (one per acre).

A majority of the plants of Belize are species widely distributed in the West Indies and along the Caribbean slope of Mexico and Central America. There are also many that are restricted in range, some even occurring only in Belize. With the exception of the pine, marsh, and swamp areas, the Tropical Dry Forests of the northern half of Belize are similar to those in Campechi, Quintana Roo, and northern Peten in adjacent Mexico and Guatemala. The pines of the central and southern highlands have their closest affinity with species in Cuba and south Florida. The tall "rainforests" (Tropical Moist and Tropical Wet Forests) of the southernmost portion of Belize are closely allied to those of adjacent Guatemala and Honduras, and contain many relict species of considerable age.

The age and high degree of endemism of the south central highlands flora, as well as the affinity to West Indies flora, doubtlessly reflects the age of the region. The south central mountain mass is believed to have been continuously above water since at least the Cretaceous. During the Cretaceous and subsequent periods it is also known to have been connected by a very broad land bridge with Central America (including Mexico), the northern West Indies, and South America. The presence of this very ancient land mass, and the former land connections help explain the antiquity of some plants, and the close relationship of the flora to these other areas. It is noteworthy that several South American plant species are known from Belize and/or the Yucatan Peninsula.

14/ Sources: Charter. 1941.
Holdridge. 1967.
Johnson and Chaffey. 1973.
Lyndell. 1942.
Russell. 1964.

3.3.3 Vegetation Formations and Communities

The life zones of Belize may be described according to the Holdridge classification (Holdridge 1967), a system based on average annual temperature, rainfall, and evapotranspiration rates.

The vegetation of most of the northern half of Belize is Tropical Dry Forest, bounded by the 24°C (75°F) isotherm and receiving 1,000-2,000 mm (39-79 in) of rainfall annually. Most of the southern half is Tropical Moist Forest, receiving between 2,000 and 4,000 mm (79-157 in) of rainfall annually. The vegetation of a few very small, local areas in the southern part of the country receives more than 4,000 mm of rainfall annually and may be classified as Tropical Wet Forest.

Russell's (1964) general summary of the vegetation types in Belize covers all of the major plant formations and summarizes pertinent work of others. Russell's summary forms the basis for the following discussion. The principal vegetation formations, communities, and associations include: mangroves, wet savannas, pinelands, and Dry, Moist, and Wet Tropical Forest (Fig. 9). The latter three forest types, popularly known as "rain forest," are not true rain forest as defined by Holdridge (1967) because there is insufficient rainfall. They do, however, embody most of the features commonly associated with "rain forest"--very tall buttressed trees, lianas, epiphytes, emergent trees, many canopy leaves with uniform "drip-tip shape," many lower story species with very large leaves and generally luxuriant appearance.

Tropical Dry Forest. The northern half of Belize south to the Sibun River and El Cayo receives about 1.650 mm (65 in) of rainfall per year. The vegetation of this region may be classified as Tropical Dry Forest (Holdridge 1967). The forest is not "virgin," but rather represents an advanced secondary stage. This region, as well as those elsewhere in Belize that are covered by limestone, were all believed to have been cleared for agriculture at one time or another by the Maya. Locally the forests are called "high ridge," or broken ridge. These terms refer to more luxuriant, and more open growth, respectively, and have nothing to do with elevation. Specifically, broken ridge is an open wooded cover bordering pinelands in coastal areas.

The dominant tree of the Tropical Dry Forest zone is Achras zapota (chicle). Other less numerous but characteristic trees of the Dry Forest community are listed in Table 3.

Tropical Moist Forest and Tropical Wet Forest. The southern half of Belize is much wetter than the northern half, and has annual average rainfall as high as 4,300 mm (170 in) at Punta Gorda. Tropical Wet Forest covers, or formerly covered, most

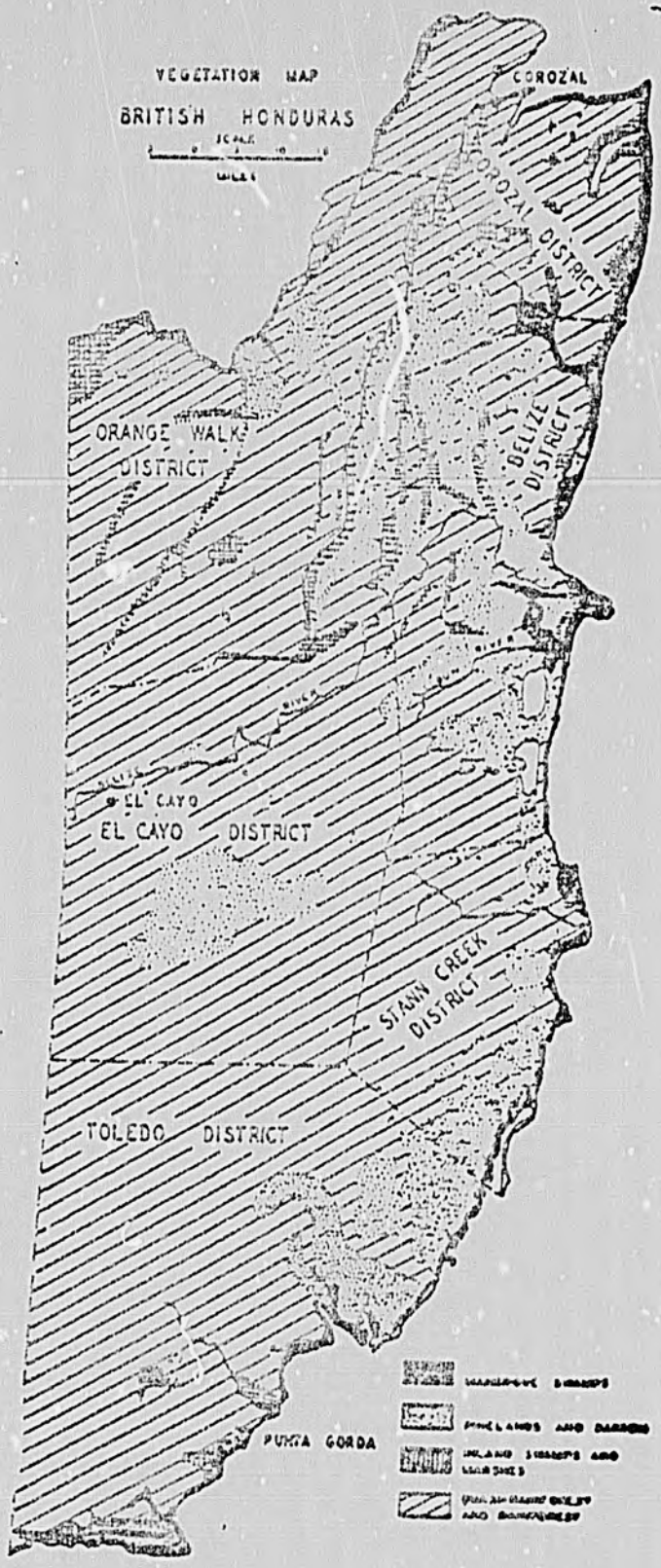

Figure 9. Vegetation Map of Belize

Source: Lundell. 1942.

of this region. In the central portions of the country where rainfall is somewhat lower, the Tropical Wet Forest gives way to a vegetation community called Tropical Moist Forest that is intermediate between that of dry and wet zones.

Throughout the southern half of the country, the combination of greater rainfall, greater relief, and more varied geological formations, has produced forests that are considerably more diverse than in the north. The most characteristic trees of the limestone region, and of the Toledo shales in the more central metamorphic region are shown in Table 4. The trees of the latter region are poorly known compared to other areas of Belize.

Pine Forest. Because of extensive modification by fire, Belize's pinelands do not readily fit into the life zone classification of Holdridge (1967). Upland pines of the Mountain Pine Ridge would fall roughly within the Premontane Moist Forest category, however, they appear to represent a fire and edaphic climax.

Pinelands are distributed on sandy, siliceous soils with poor external and internal drainage in areas where there is a distinct dry season. They occur in the lowlands, and in the Mountain Pine Ridge district of the uplands. At all elevations the pinelands are rather open and are often called pine savannas. Fires sweep most of the pineland periodically and sometimes stands are decimated over large areas. Where this has occurred and only barren treeless land remains, the areas are referred to as dry savannas. The most extensive pinelands (locally called pine ridges even though they may be flat) occur between the Rio Hondo and the New River, between the New and the Belize Rivers, between the Belize and Sibun Rivers, and in the coastal areas south to Deep River.

Pinus caribaea is the pine of the lowlands. It grows in stands resembling those of Slash Pine in the southern United States. According to Charter (1941), all pinelands in Belize formed after sheet erosion occurred over old sandy soils, and represent a stage of succession from savanna to pine to mixed broadleaf/pine forest to pure broadleaf forest. Clay underlies the sandy soils where pines grow and most drainage is by surface runoff. Oaks (Quercus oleorides) are the most frequent tree associates, followed by yaha (Curatella americana), craboo (Brysonima crassifolia), and pine. Palmetto clusters (Acoelorraphe wrightii) are numerous in the most poorly drained areas. The herbaceous cover is largely grassy and sedgy, but there are many other perennials, including Polygala, Utricularia, Panicum, and Paspalum.

Broken pine ridge is a local term applied to the scrubby marginal growth that borders the lowland pine savannas. The term "ridge" is a misnomer because no ridge or slope is evident. This zone is characterized by low forest, including

Table 3. Common Trees of Tropical Dry Forest in Northern Belize

Dry Forest	Wetter Alluvial Areas in Dry Forest Zone
Achras zapota (dominant species) (sapodilla) or chicle	Orbigyna cohune (Cohune palm)
Borsimum alicastrum	
Swietenia macrophylla (mahogany)	
Cryosophila argentea	
Bursera simaruba	
Protium copal	
Matayba oppositifolia	
Dipholis salicifolia	
Dialium guianense (ironwood)	
Metopium brownei	
Mosquitoxylum jamaicense	
Spondias mombin	
Calophyllum brasiliense (Santa Maria)	
Lucuma spp. (mamey cedrilla)	
Sideroxylon spp.	
Sabal spp.	
Coccoloba spp.	
Nectandra spp. (timber swect)	
Ocotea spp.	
Lonchocarpus spp.	
Zanthoxylum spp.	
Trichilia spp.	
Sebastiania spp.	
Ficus spp.	
Cordia spp.	

Source: Lundell. 1942.

Table 4. Common Trees of Tropical Moist Forest and Tropical Wet Forest in Southern Belize

Limestone Area	Central Metamorphic Region and Toledo Shales
Achras zapota	Terminalia obovata
A. chicle	Calophyllum brasiliense
Sabal spp.	Symphonia globulifera
Dipholis stevensonii	Vochysia hondurensis
Drypetes brownii	Aspidosperma megalocarpon
Ilex belizensis	Licania hypoleuca
Terminalia obovata	Tetragastris stevensonii
Swietenia macrophylla	Mountain Cabbage Palm
Pseudolmedia spp.	Podocarpus pinetorum
Sebastiania standleyana	Schizocardia belizensis
Vitex gaumeri	Ficus spp.
Sideroxylon spp.	Virola spp.
Trichilia spp.	Dialium guianense
Cufodontia lundelliana	Dalbergia stevensonii
Cymbopetalum penduliflorum	many shrubs (family Melastomataceae)
Protium spp.	
Calophyllum brasiliense	
Ficus spp.	
Bourreria oxyphylla	
Orbignya cohune	
Cryosophila argentea	
Brosimum alicastrum	

Source: Lundell. 1942.

many thorny species, and dense undergrowth. Russell (1964) reported the following trees in broken pine ridge near Hill Bank: Acacia riparioides, Parathesis obovata, Eugenia winzerlingii (?), Miconia pteropoda, Calliandra houstoniana, and Xylosoma anisophylla. The "broken pine ridge" is a marginal growth area and is not identical to "broken ridge" which may be a tall mahogany-sapodilla forest (Russell 1964).

Pines occur in the uplands only in the Mountain Pine Ridge, the San Pastor Pine Ridge, and other smaller areas of pine ridge in Belize. Only Pinus caribaea occurs up to about 600 m (2,000 ft). Above this height, it is rapidly replaced by P. oocarpa. Much of the Mountain Pine Ridge is at about 600-700 m (2,000-2,300 ft) and the forest represents a transitional phase with both species occurring in pure stands and mixed with each other. Pineland covers most areas of the Mountain Pine Ridge when the limestone has been eroded away and granite is exposed. When limestone remains, as in peripheral areas of the Mountain Pine Ridge, tall humid broadleaf forest occurs rather than pines.

Fire is a critical factor in the ecology of the Pine Ridge. In the absence of periodic burning, broadleaf species invade, notably oak (Quercus spp.). These form a principal component of the understory. However, Pinus caribaea is not well adapted to resist fire and young trees up to about 3 m (10 ft) are easily killed by scorching. Larger trees are more fire resistant although they do not have protective scales over their buds. Pinus oocarpa, by contrast, is not fire-resistant, and normally is found in forest, rather than as a component of pine savannas where fires, at least before fire protection measures, may have occured almost annually.

Several other distinctive vegetation types occur in Belize, but their distribution is very limited. They are discussed under the following headings.

Brackish and Freshwater Savanna. These savannas comprise only about three percent of Belize. Brackish savannas occur above the tidal limits and are dominated by sedges, such as Fuirena and Mariscus (Standley and Record 1936). Freshwater savannas occur primarily within pine savannas where sandy depressions lie over impermeable clays. Drainage is impeded in these areas and occurs principally by evaporation. Consequently, freshwater savannas suffer a continuous cycle of flooding followed by desiccation. Sedges predominate, but the grass Panicum barbinode is also present. Other plants often present in freshwater savannas include a palm, Acoelorraphe wrightii, and two trees, Cresentia cujete and Cameraria belizensis.

Coastal and Inland Swamp. Above the tide line and the mangrove forests, a swamp formation often predominates. Trees of this zone include: Laguncularia racemosa, Avicennia

nitida, Conocarpus erecta, Chrysobalanus icaco, Pachira aquatica, and Pterocarpus officinalis. Manicaria saccifera dominate the swampy estuary of the Temash River. Inland swamps are more diverse, with species present being largely determined by edaphic conditions (Lundell 1942).

Mangrove. Mangroves occur along the entire length of coastal Belize (Fig. 9). Red Mangrove (Rhizophora mangle) is the dominant tree of the mangrove forests. It occurs on most of the keys, tidal lagoons, and brackish canals (Russell 1964). In the north, mangrove forest occurs far inland along the tidal shores of Lopez Creek and the Northern River, and along the Sibun River, south of Belize City.

Palm Breaks and Elfin Woodland. These vegetation types occur only on the upper slopes of the Cockscomb Mountains and are extremely limited in distribution, being confined to a vertical distribution of a few hundred feet. On the highest slopes, which are frequently blanketed by clouds, the vegetation resembles Elfin Woodland. The tallest trees attain heights of about 6 m (20 ft) and have slightly stilted roots. Virtually all bark surfaces are covered with moss, and even surface rocks and cliffs are coated with moss, ferns selaginellas, lycopodiums, and lichens. Elfin Woodland in Belize occurs near the summit of Victoria Peak and slightly lower at 790 m (2,570 ft) on one other peak. Below the mossy Elfin Woodland there is a narrow zone dominated by palms (Russell 1964). It is similar to the Palm Brake described by Bend (1944).

Keys (Cays). Most of the keys are level, sandy, and rise only a few feet above the surface of the ocean. The natural vegetation of the keys is dominated by Red Mangrove and several other broadleaf species such as Cordia sebestena, Bursera simaruba and Bumelia retusa. The larger keys may support a limited woodland dominated by Achras spp. (sapodilla). Much of the natural vegetation on the keys has been cleared and replaced by coconut palms (Cocos nucifera). Harvesting coconut fruit is a major occupation on the keys (Russell 1964).

3.3.4 Timber and Forest Reserves 15/

For three centuries the economy of Belize has depended upon the exploitation of its forests. Indeed for most of this period forest exploitation was the only reason for the existence of the British settlement in Central America. In 1925 timber production reached an output of 0.65 million cubic meters (23 million cu ft) of mahogany, cedar, pine,

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15/ Sources: Belize Forest Service. 1972.
Johnson and Chaffey. 1973.

and rosewood, but since then production has experienced a steady decline. As recently as 1955, lumber and chicle still accounted for over 60 percent of the country's revenue. More recently, lumber output has dropped sharply, and the once extensive stands of mahogany, cedar and pine were so decimated by 1968 that forest product exports accounted for only five percent of the country's revenues.

In an attempt to reverse this alarming trend, some steps have been taken, and forest exploitation should continue to play an important role in the economy of Belize. For example, shortly after World War II, about 325 ha (803 acres) of pine and 80 ha (198 acres) of mahogany were planted each year for 12 years. Although some of these stands were damaged in 1961 by Hurricane Hattie, commercial harvesting may be possible by 1990. In all, the damage to Belizean forests caused by Hurricane Hattie was immense, amounting to over 7,770 sq km (3,000 sq mi) and because hurricanes are frequent along the coastline of Belize, similar destruction can be expected again.

The principal forest areas where significant exploitable timber remains are in Chiquibul, the Mountain Pine Ridge, and the coastal plain. Sizable forests also remain in the Maya Mountains, but these are presently subject to considerable exploitative pressure. In this report the only region for which a major forest inventory was available is the Mountain Pine Ridge (Johnson and Chaffey 1973). This report concludes, as of 1973, that because the standing volume of pine in the Mountain Pine Ridge is very low and the proportion of the growing stock near the minimum exploitable size is very small, resumption of forest exploitation in the Mountain Pine Ridge will not occur for another 10-15 years. The possibility of using logs below minimum sawlog size for such purposes as pulp, particle board, and cement bonded building board has been proposed. Forestry estimates suggest that even uses of this type would be economically small-scale because of the small inventory of pine in the Mountain Pine Ridge. To put into perspective the present volume of standing material of diameter at breast height (d.b.h.) of 7.6 cm (3 in) and larger, the Mountain Pine Ridge inventories represent about a year's supply for a pulp mill (300 ton/day), or a ten years' supply for a particle board plant (30 ton/day) (Johnson and Chaffey 1973).

Exploitation of the Mountain Pine Ridge began on a significant scale in 1955. Table 5 shows the amount of sawn lumber produced between 1959-70. It is clear from the table that the volume of sawn lumber peaked during the period 1961-65, and it was during this period that most of the larger-sized material was cut. By the end of the decade only small logs were entering the mills, and at such a reduced volume the operations were suspended in 1971.

Table 5 also shows that sawn lumber production was mainly from pine, but that other species were taken. These include primarily secondary hardwoods, such as nargusta, cypress, billy webb, and yemeri, but also primary hardwoods such as mahogany and cedar.

Pine production from thinnings is shown in Table 6 for 1967-70, the only period for which data were available in the Mountain Pine Ridge. As can be seen, the quantity of pine from thinnings was very small compared to sawn mill production.

Forest Preseves and Total Country Lumber Production. The total production of sawn lumber for the period 1967-71 is shown in Table 7. The marked year-to-year variation in production of the four wood types seems remarkable. Because most of the accessible stands of mature pine had been harvested by the early 1970s, total pine production has declined. Concurrently, total hardwood harvest has increased sharply during this same period. More recent data were not available for this study but this trend will probably not be reversed until more road-building gives access to new stands of forest, and until forest plantations begin production.

Forest reserves managed by the Belize Forest Service in 1971 are shown in Table 8. The best remaining stands of mature pine remain in the Deep River Forest Reserve, largely because of the scarcity of roads. As of 1971 the major areas lacking a forestry inventory were the Columbia Reserve and the hardwood section of the Deep River Forest Reserve.

A relatively large number of sources on timber resources and forest plantations are shown in the bibliography but were unavailable for this report. Consequently, no data were found on rate of loss of pine and hardwoods, estimated loss due to fire, loss due to clearing, fuelwood gathering or other agrarian purpose, or data on timber production at any of the major forest reserves except the Mountain Pine Ridge.

Table 5. Total Sawn Lumber Production, Mountain Pine Ridge, 1955 - 1970

Year	Pine			Primary hardwoods/			Secondary hardwoods/		
	Sawnwood	Roundwood equivalent		Sawnwood	Roundwood equivalent		Sawnwood	Roundwood equivalent	
	'000 bdft	m^3	ft^3	'000 bdft	m^3	ft^3	'000 bdft	m^3	ft^3
1955	1 137	4 500	159 200						
1956/7	1 214	4 810	170 000						
1958	1 070	4 240	149 800						
1959	1 269	5 030	177 700						
1960	1 471	5 830	206 000						
1961	2 555	10 120	357 700				18	70	2 500
1962	4 669	18 570	656 500						
1963	4 412	17 470	617 700				80	320	11 200
1964	3 970	15 720	555 800				358	1 420	50 100
1965	2 617	10 360	366 400	15	60	2 200	848	3 380	118 700
1966	2 224	8 810	311 400	11	40	1 500	471	1 870	65 900
1967	2 152	8 520	301 300	4	20	800	166	660	23 200
1968	2 157	8 540	302 000				69	270	9 700
1969	1 758	6 950	245 800				179	710	25 100
1970	1 278	5 060	178 900	18	70	2 500	316	1 250	44 200
Total	33 971	134 539	4 756 000	48	190	6 800	2 505	9 930	350 600

* Roundwood equivalents based on FAO conversion factor: 1 000 bdft = 3.96 m^3 (Forestry Commission, 1960)

/ The absence of data in some years indicates 'no recorded production'

Source: Belize Forest Department. 1972.

Table 6. Total Pine Lumber Production from Thinnings, Mountain Pine Ridge, 1967 - 1970

Year	Sawnwood	Roundwood equivalent	
	'000 bdft	m^3	ft^3
1967	91	360	12 700
1968	121	480	16 900
1969	143	570	20 000
1970	128	510	17 900
Total	483	1 920	67 500

* Roundwood equivalents based on FAO conversion factor:
1 000 bdft = 3.96 m^3 (Forestry Commission, 1960)

Source: Belize Forest Department. 1972.

Table 7. Total Sawn Lumber Production, 1967-1971

Species	1967	1968	1969	1970	1971
	Total Production (cu ft)				
Mahogany	353,537	810,665	359,720	630,000	490,756
Cedar	79,641	80,114	70,188	172,521	34,686
Pine	319,970	460,722	459,500	416,100	263,881
Hardwoods	96,672	365,876	326,710	300,000	441,400
Totals	849,820	1,717,377	1,216,118	1,518,621	1,230,723

Source: Belize Forest Dept. 1972.

Table 8. Forest Reserves Managed by the Belize Forestry Service, 1971.

Region	Area	
	Sq km	Sq mi
A - Northern Division		
1. Freshwater Creek	300	116
B - Western Division		
1. Mountain Pine Ridge	583	225
2. Chiquibul	1,865	720
C - Southern Division		
1. Sibun	179	169
2. Manatee	458	177
3. Grant's Work	75	29
4. Silkgrass	28	11
5. Commerce Bight	52	20
6. Deep River	591	228
7. Swasey - Bladen	62	24
D - Toledo Division		
1. Machaca	52	20
2. Columbia	448	173
E - Totals	3,810	1,912

Source: Belize Forest Dept. 1972.

3.4 Fauna and Conservation

The native terrestrial vertebrates of Belize have been partially inventoried. The most complete distributional study of any vertebrate group in Belize is Russell's 1964 work, A Distributional Study of the Birds of British Honduras. For mammals, there exist several inventories, including Hershkovitz (1951), Laurie (1953), Murie (1935) and Kirkpatrick and Cartwright (1975). Reptiles and amphibians are known through a number of inventories, including Neill and Allen (1959a, 1959b, 1960, 1961a, 1961b, 1962), and Schmidt's (1941) The Amphibians and Reptiles of British Honduras. The freshwater ichthyofauna are not as well inventoried as in some other regions of Central America, namely Guatemala and Panama. Two reports dealing with the ichthyofauna of Belize are those of Hubbs (1935) and Miller (1966).

3.4.1 Mammals

Six species of mammals are listed as endangered by the U.S. Dept. Interior (1980); one additional species, the Black Howler Monkey (Alouatta pigra) is considered threatened (Table 9). The IUCN Red Data Book (1975) lists only four mammals for Belize. Two of these, the Giant Anteater (Myrmecophaya tridactyla) and Caribbean Manatee (Trichichus manatus) are not shown on the U.S. Dept. Interior (1980) list. The combined lists show a total of nine species either threatened or endangered in Belize. All are large forest-dwelling mammals with the exception of the anteater, primarily a savanna species, and the manatee, a water-dweller. The seeming absence of small mammals, especially rodents, is doubtless due partly to incomplete documentation of the distribution and abundance of many members of these groups, as well as to the lack of any current or updated information useful for comparisons. Furthermore, the fact that all of the species listed are larger is certainly a reflection of their greater vulnerability, and in an absolute sense, a lower density than the smaller animals. It is not certain if the information upon which the listed species are included is current, or whether it is based upon work undertaken in Belize or in neighboring countries. In either case, it is likely that if inventories were complete the list of mammal species would be even larger. A current list of the mammals (Kirkpatrick and Cartwright 1975) of Belize may be found in Appendix III.

3.4.2 Birds

Only one bird, the Harpy Eagle (Harpia harpyja), is listed by the U.S. Dept. Interior (1980), and none are listed by the IUCN Red Data Book (1979). The fact that only one bird is listed almost certainly reflects an absence of recent information. Russell (1964) recognizes a total of 465 species recorded in Belize, of which 309 definitely breed, and another 19 possibly breed. The remainder are transients or vagrants.

Table 9. Vertebrates Listed by the U.S. Dept. Interior and the IUCN Red Data Book as Endangered or Threatened[1]

Common Name	Scientific Name	Status* Dept. Interior	Status* IUCN
Mammals			
Jaguar	Panthera (Felis) onca	E	X
Black Howler Monkey	Alouatta pigra	T	
Howler Monkey[2]	A. villosa	E	
Ocelot	Felis pardalis	E	X
Giant Anteater	Myrmecophaga tridactyla		X
Caribbean Manatee	Trichechus manatus		X
Margay	Felis wiedii	E	
Central American Tapir	Tapirus bairdii	E	
Birds			
Harpy Eagle	Harpia harpyja	E	
Reptiles/Amphibians			
Central American Caiman	Caiman crocodilus fuscus		X
American Crocodile	Crocodylus acutus	E	X
Morelet's Crocodile	C. moreletii	E	X
Green Sea Turtle	Chelonia mydas	T	
Hawksbill Sea Turtle	Eretmochelys imbricata	E	
Kemp's (=Atlantic) Ridley	Lepidochelys kempi	E	
Leatherback Sea Turtle	Dermochelys coriacea	E	
Loggerhead Sea Turtle	Caretta caretta	T	
Fish			
None			

1 T = Threatened, E = Endangered (Fed Reg.), X = listed by IUCN.

2 This species (?) not listed by Kirkpatrick and Cartwright (1975); apparently merged with A. pigra.

Sources: U.S. Dept. Interior (1980).
IUCN. 1969.
-----. 1975.
-----. 1978.
-----. 1979.

Because Belizean forests are continuous with forests of the Caribbean slope of Central America both to the south and to the northwest, the birds that occur in Belize are similar to those of adjacent regions of Mexico, Guatemala, and Honduras. There are no endemic species in Belize, although there are five endemic subspecies (below). Nevertheless, four species, the Ocellated Turkey (Agriocharis ocellata), Yucatan Poorwill (Otophanes yucatanicus), Yucatan flycatcher (Myiarchus yucatensis), and Black Catbird (Melanoptila glabrirostus) are restricted to the drier portions of the Yucatan Peninsula (including northern Guatemala) and the northern part of Belize. Two of these, the poorwill and flycatcher are not likely to face pressure from human activity in the near future. However, the long-term status of the turkey and catbird is less certain. Russell (1964) reported the turkey to be fairly common at the time of his work (1955-1963), although it was restricted to the northwestern section of the country. In the past two decades this region has been subject to a marked increase in agricultural activity and to an increase in human population. The Black Catbird, according to Russell, has not been reported in Belize since 1931, although it was once more widespread. Likewise, there are no recent records of it from the cays, though it was previously reported from three cays off Lighthouse Reef. Further, the species is local in the Yucatan Peninsula, although common on Cozumel Island off the Yucatan coast. Considering the continued advent of deforestation and disruption of other habitat types in northern Belize, it is likely that both the Ocellated Turkey and Black Catbird are candidates for inclusion on the threatened/endangered list in Belize. The turkey, at least for the short-term, is stil numerous locally in the Peten of northern Guatemala.

Even more importantly, of a total of about 238 breeding species in the Yucatan Peninsula and northern Belize, 46 are represented by endemic subspecies, and 32 of these occur in Belize (Table 10). This represents a significant number of endemic forms for which current information is largely lacking.

Five subspecies are endemic to Belize, Rallus longirostris belizensis, Centurus aurifrons turneffensis, Dendrocopus scalaris leucopitilurus, Vireo solitarius notius, and Dendroica graciae decora. The last three occur only in the pinelands.

The status of some other groups of birds that are found only in limited habitats or localities within Belize is of interest. For example, four species--Slate-colored Solitaire (Myadestes unicolor), Shining Honeycreeper (Cyanerpes lucidus), Common Bush Tanager (Chlorospingus ophthalmicus), and Stripe-tailed Hummingbird (Eupherusa eximia)--are known only from the Cockscomb Mountains. All are forest or

Table 10. Thirty-two Subspecies of Birds Endemic to Northern Belize and the Yucatan Peninsula*

Buteo magnirostris conspectus
Ortalis vetula intermedia
Caprimulgus salvini badius
Campylopterus curvipennis pampa
Amazilia yucatanensis yucatanensis
Pteroglossus torquatus erythrozonus
Centurus aurifrons dubius
Centurus pygmaeus rubricomus
Sittasomus griseicapillus gracileus
Xiphorhynchus flavigaster yucatanensis
Thamnophilus doliatus yucatanensis
Attila spadiceus gaumeri
Platypsaris aglaiae yucatanensis
Myiarchus tuberculifer platyrhynchus
Platyrinchus mystaceus timothei
Psilorhinus mexicanus vociferus
Cissilopha yucatanica yucatanica
Thryothorus maculipectus cannobrunneus
Uropsila leucogastra brachyura
Mimus gilvus leucophaeus
Ramphocaenus rufiventris ardeleo
Cyclarhis gujanensis yucatanensis
Granatellus sallaei boucardi
Icterus chrysater mayensis
Icterus gularis yucatanensis
Icterus cucullatus igneus
Habia rubica nelsoni
Habia gutturalis peninsularis
Saltator atriceps raptor
Saltator coerulescens yucatanensis
Richmondena cardinalis flammigera
Arremonops rufivirgatus verticalis

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* Does not include five species that are endemic only to Belize (see text)

Source: Russell. 1964.

woodland species, and the loss of a major portion of forest from this region would almost certainly threaten these species in Belize. The pinelands constitute a second major habitat that harbors birds found nowhere else in Belize. Further, as seen in Table 11 some species occur only in the low elevation pinelands, others only in the Mountain Pine Ridge in Belize. A larger number are found in both pinelands. Significantly, the pinelands of Belize constitute the only habitats of any size in Belize that are isolated from other similar areas in Central America. Thus, the loss of a species from land that has been undisturbed by man is probably more significant than the loss of one from humid lowland forest

which is more or less continuous with similar habitat elsewhere in Central America.

The birds that breed on the numerous cays scattered offshore comprise yet another group that is vulnerable to the activities of man. According to Russell (1964), 31 species are believed to breed on the cays. Eight of these (Table 12) have not been reported nesting there since 1862. Further, because many of the cays are potential locations for tourist facilities and increased tourism and because the cays are frequently ravened by hurricanes, some of these species eventually may also be candidates for inclusion by the U.S. Dept. Interior and the IUCN Red Data Book. At present most of the species breeding on the cays also breed on the mainland. All of this latter group have fairly large breeding ranges that also encompass portions of North and Central America.

Belize, because of its geographical proximity to the northern hemisphere breeding grounds, serves as an important wintering ground for long-distance north temperate migrants. Since species that breed over the entire eastern two-thirds of North America winter primarily in a far smaller area of the Caribbean, Mexico, and Central America, the preservation of wintering habitat becomes particularly germane. Further, since the majority of these species winter in forest or woodland habitat the loss of a hectare of forest on the wintering grounds is magnified severalfold when compared to a loss of breeding ground. The rapid loss of forestland in Belize, as well as in the rest of Central America, when viewed in this light is not just of local concern, but of global concern and could ultimately have adverse consequences as far away as the northern breeding limits of the migrants.

Data from Table 1 suggest a steady decline in forestland in Belize. The forestland which remains represents an important resource for the wintering population of migratory birds and deserves high priority in rational long-term management and preservation. Lastly, because of increasing human population pressure, more intensive land use practices, and unrelenting deforestation, it is likely that a number of birds neither mentioned by Russell (1964), nor listed by the IUCN Red Data Book, deserve review. Most of the species in this group are large, relatively high-visibility, low density birds of forested regions or wetlands and are sensitive to environmental disturbances. Some of these have certainly been removed from portions of their former range in Belize, including: Jabiru (Jabiru mycteria), Muscovy Duck (Cairina moschata), King Vulture (Sarcoramphus papa), Black-and-white Hawk-Eagle (Spizastur melanoleucus), Ornate Hawk-Eagle (Spizaetus ornatus), Great Curassow (Crax rubra), Scarlet Macaw (Ara macao), Yellow-headed Parrot (Amazona ochrocephala) and Keel-billed Motmot (Electron carinatum). This list could doubtless be extended if current information were available.

Table 11. Species of Birds Occuring in the Pinelands

Species occurring in pinelands at all elevations

Amazilia cyanocephala	Pirangra flava
Melanerpes formicivorus	Loxia curvirostra
Cistothorus platensis	Ammodramus savannarum
Vireo solitarius	Aimophila ruficeps
Dendroica graciae	Spizella passerina
Icterus chrysater	

Species occurring only in pinelands at low elevations

Colinus nigrogularis	Pyrocephalus rubinus
Columbina minuta	Sturnella magna
Amazona xantholora	Aimophila botteri
Dendrocopos scalaris	

Species occurring only in pinelands of the Mountain Pine Ridge

Buteo jamaicensis	Sialia sialis
Contopus pertinax	Basileuterus rufifrons
Thryothorus modestus	Spinus notatus

Source: Russell. 1964.

Table 12. Species of Birds Known to Have Bred on the Cays Offshore

Pelecanus occidentalis	Anous tenuirostris
Sula sula	Columba leucocephala†
Phalacrocorax auritus*	Crotophaga sulcirostris†
Fregata magnificens	Anthracothorax prevostii
Leucophoyx thula*	Amazilia rutila
Cochlearius cochlearius	Centurus aurifrons
Eudocimus albus*	Tyrannus melancholicus
Pandion haliaetus	Elaenia martinica†
Rallus longirostris	Melanoptila glabrirostris†
Charadrius wilsonia*	Mimus gilvus
Sterna dougallii*	Vireo pallens
Sterna anaethetus*	Vireo magister
Sterna fuscata	Dendroica aestiva
Sterna albifrons*	Cassidix mexicanus
Thalasseus sandvicensis*	Icterus cucullatus
Anous stolidus	

* No breeding evidence since 1862

Source: Russell. 1964.

3.4.3 Amphibians, Reptiles, and Fish

No amphibians are listed as threatened or endangered in Belize by the IUCN Red Data Book (1975) or the U.S. Dept. Interior (1980). Inventories and information for this group of vertebrates in Belize, however, appears very scanty. The reptiles listed fall into two groups: (1) crocodiles and caimans, and (2) sea-turtles. Among members of the first group, the status of Morelet's Crocodile may be of greatest concern, because of its restricted distribution. Formerly it was found along the Caribbean shore from southeastern Mexico to Honduras and on the Pacific coast in the Iztapa region of Guatemala. Its present distribution is scarcely known, although there are thriving populations in Veracruz, Province of Mexico, and near Iztapa, Guatemala. In the wild, the species may be difficult to distinguish from the American Crocodile (Ciacutus). No information on the status of any of the three Crocodylidae in Belize is known to the author.

The situation in Belize with respect to the various species of sea-turtles is equally uncertain. Breeding sites in Belize, if present, are not reported in literature available to this study.

No freshwater or marine fish in Belize are listed by the IUCN Red Data Book (1969) or by the U.S. Dept. Interior (1980). Surveys of the river systems are incomplete but the ichthyofauna of the coastline and coral reefs is essentially undisturbed and considered to be of world significance.

3.4.4 Commercial Fisheries [16/]

Belize has good fishing resources which are exploited by over 500 members of five well-organized fishing cooperatives. The cooperatives supply both domestic and export markets. The export markets are expanding and have considerable growth potential. The most important export product of the fisheries industry is Rock Lobster (crawfish) which is shipped primarily to the United States. Other products include frozen and salted red snapper, shrimp and conch, and a limited amount of sea-turtle meat. In an average year (based on pre-1972 data) 0.68 million kg (1.5 million pounds) of fish products are exported, valued at about $2 million. Two-thirds of these export earnings are from lobster tails. Substantial gains in the industry's revenue may be expected in the future (Floyd 1972a). Since 1966 Belizean fishermen have been exploiting the rich shrimp beds at the mouth of the Sarstoon River in the extreme southern part of the country.

16/ Sources: Collar and Collar. 1972.
Floyd. 1972a.
U.S. AID. 1979.

There are several freezing and packing plants for fish, lobster, conch, and shrimp in Belize City. Fishing resource potential beyond the barrier reef is believed to be extensive because there are abundant feeding grounds for fish. This promising area remains virtually untapped.

3.4.5 Wildlife Protective Legislation

Belize has protective legislation for its wildlife but none of the tropical forest areas have been designated as natural parks or preserves. Forest is estimated to cover about 65 percent of the country at present but the amount of forestland may be gradually reduced as the agricultural sector increases.

3.4.6 Reserves and Protected Areas

Belize has no national parks or equivalent reserves at present, although several areas have been recommended for preservation by the IUCN (n.d.) and by La Bastille (1978). Under the authority of the Crown Lands Ordinance (Chapter 110 of the Laws of Belize, revised ed. 1958, sec. 6), the Minister of Agriculture and Lands has the power to reserve from sale or lease, blocks of national land for special purposes. Also, forest reserves, fisheries and marine resources can be established by the Minister of Trade and Industry. Responsibility for the administration of areas formerly known as Crown Reserves lies with the Commissioner of Lands; forest reserves are administered by the Chief Forest Office; fishery and marine resources are handled by the Fisheries Administration; the Commisioner of Land has now delegated administrative responsibility of the nine reserves to the Belize Audubon Society. Table 13 lists nine reserves and their present sizes. These are administered by the Belize Audubon Society, but none has yet received official legislative status.

According to La Bastille (1978) the two areas worthy of greatest protection are the Chiquibul/Maya Mountain Forest Reserve and the Belize Barrier Reef Reserve. At present neither area has been officially designated as a reserve. The Chiquibul/Maya Mountain Reserve, as presently perceived, would encompass 186,480 ha of undisturbed broadleaf and pine forests in the southcentral portion of the country. The area reportedly has the highest density of "spotted" cats (jaguar, ocelot, margay, etc.) of any Central American region. In addition to its potential as a faunal and floral reserve, a number of Mayan ruins dating from ca. 800-1200 A.D. are situated within the projected preserve boundaries. None of these ruins have been restored, although it is believed that some may equal those of adjacent Tikal, Guatemala in significance. In fact, the region would be worthy of protection on archaeological grounds alone. La Bastille (1978) has suggested that ideally the area should be

Table 13. Designated Protected Areas

Name	Size (ha)	Description
1. Unnamed Mangrove Caye	0.4	A red mangrove (Rhizophora mangle) cayland breeding site for Great Egret (Egretta thula), 3 mi NNE Monkey River Town in southern Belize.
2. Unnamed Mangrove Caye	0.8	A red mangrove caye and breeding site for Roseate Spoonbill (Ajaia ajaja) off northern coast of Belize (17°57'N, 88°06'W).
3. Unnamed Mangrove Caye	0.4	An inland red mangrove lagoon and breeding rookery for Great Egret, Cattle Egret (Bubulcus ibis), Boat-billed Heron (Cochlearius cochlearius), Anhinga (Anhinga anhinga) and Neotropical Cormorant (Phalacrocorax olivaceus) in central Belize (17°20'N, 88°20'W).
4. Bird Cage Crown Reserve (Bird Sanctuary)	0.8	Red mangrove and coconut palm (Cocus nucifera) island with breeding rookery of waders as in No. 3, and additionally, White Ibis (Endocimus albus), and an inland lagoon. Central Belize (17°32'N, 88°17'W).
5. Man-O-War Caye Crown Preserve (Bird Sanctuary)	0.8	A small red mangrove caye in Tobacco Range, on western side of barrier reef, 12 mi SE Dangriga Town, Stann Creek District. Breeding site for White-crowned Pigeon (Columba leucocephla), Magnificent Frigatebird (Fregata magnificens), and the only Belize nesting site of Brown Booby (Sula leucogaster).

Name	Size (ha)	Description
6. Little Guana Caye (or Cayo Pajaros) Crown Reserve (Bird Sanctuary)	1.8	Mangrove swamp (3 species of mangroves) and only place in Belize where Reddish Egret (Dichromanassa rufescens) and Tricolored Heron (Hydranassa tricolor) breed together. Largest breeding colony of Reddish Egrets in Caribbean. Roseate Spoonbills formerly bred in colony also. West of Ambergris Caye, northern Belize (18°02'N, 87°58'W).
7. Doubloon Bank Caye Crown Reserve (Bird Sanctuary)	0.8	Mostly a red mangrove island lagoon. Large mixed rookery, notable for large concentration of Wood Storks (Mycteria americana). Northern Belize (18°03'N, 88°27'W).
8. Guanacaste Park Bird Sanctuary	21.0	Small remnant of Tropical Moist Forest with mixed flora and fauna, including one exceptionally large Enterolobium cyclocarpum (monkey-ear tree) at confluence of Belize River and Roaring Creek, in central Belize.
9. Half-Moon Caye Natural Monument	15.0	The southeastern part of Lighthouse Reef, a coral atoll (one of only 3-4 in Caribbean). Features very high quality coral formations, sandy beaches, variety of trees, and breeding colony of white phase Red-footed Boobies (Sula sula), estimated to be 3,000-5,000 individuals. Rich intertidal and subtidal zones.

Name	Size (ha)	Description
10. Mountain Pine Ridge Forest Reserve	69,112.0	Mixed broadleaf/pine forest in highlands.
11. Columbia Forest Reserve	52,500.0	
12. Chiquibul Forest Reserve	186,480.0	Predominantly broadleaf, evergreen, Tropical Wet Forest in Maya Mountains. Representative flora and fauna.

Sources: IUCN. n.d.
La Bastille. 1978.

designated a MAB Biosphere Reserve and should include Victoria Peak, the highest point in Belize.

The second area of major importance is the barrier reef that extends the entire length of the Belize coastline and is continuous northward to Yucatan and southward into Guatemalan waters. The reef is noted for a rich diversity of fish (second only to the South Pacific), phenomenal water clarity, and remarkable coral formations. The Belize barrier reef is exceeded in size only by the Great Barrier Reef off northwestern Australia.

According to La Bastille (1978) the two finest areas are Lighthouse Reef Cay, and Glover's Reef, both of which are self-contained coral complexes that lie outside the main barrier reef line. The cays, in effect, resemble the fringing reefs of the South Pacific. Lighthouse Reef Cay harbors the American Crocodile, and is a nesting location for Red-footed Boobies. Glover's Reef is reported to have the best coral formation in the entire Barrier reef.

Other areas that have attracted attention and have been proposed as faunal and floral reserves include the Mountain Pine Ridge Forest Reserve and the Columbia Forest Reserve. The Mountain Pine Ridge Forest, located in the west central mountain region, contains the largest zone of highland pine in Belize. Much of the Mountain Pine Ridge has been subjected to extensive logging, primarily long-term selective cutting of pine (see Section 3.3.4). No information is available on the proposed Columbia Forest Reserve for this report.

3.4.7 Tourism and Other Related Uses of the Environment 17/

The greatest natural asset of Belize is its cays, and they have not been fully exploited for tourism. Considered second only to the Great Barrier Reef in beauty, the area offers unprecedented opportunity for fishing, snorkling, scuba diving, and sailing. Prominent sport fish include tarpon, pompano, barracuda, wahoo, marlin, sailfish, mackerel, bonefish, snook, snapper, and grouper, as well as shark, lobster, and crab. There are a large number of habitats ranging from open sea to sheltered reefs, saltwater lagoons and freshwater rivers, usually all in close proximity. The barrier reef offers protection from weather and rough seas. There are abundant opportunities for beachcombing, boating, sailing, spear fishing, and exploring shipwrecks and numerous uninhabited cays. The region is well known to divers, but is not used extensively for other tourist activities. The chief drawback to extensive use of the cays as tourist resorts is the frequency of hurricanes and reluctance by builders to establish large permanent settlements on the cays. Nevertheless, the region remains a substantial though little exploited natural resource for tourists.

On the mainland, tourist activities that utilize the natural environment include bird-watching, spelunking, hunting, and sightseeing at Mayan ruins. Jaguar and small cat hunting still attract attention, though international import-export restrictions have reduced this activity. Some wildlife are also hunted for local consumption, and can be purchased in local markets. Those used for food include peccary, paca, armadillo, raccoon, and rabbit. Other animals frequently sold in markets for pets include various species of monkeys and parrots. There is little crocodile hide hunting presently, although this was formerly widespread.

17/ Sources: Collar and Collar. 1972.
Floyd. 1972a.
U.S. AID. 1979.

4.0 Environmental Problems 18/

This section reviews environmental problems in Belize. The major problems are similar to those facing its developing Latin American neighbors, with the important exception that in Belize these problems are far less acute. For example, deforestation has been extensive in portions of the country, but major reserves still remain. In addition, there are significant natural and cultural resources, and a very low population. Further, the old British Colonial system left a fairly well-organized forestry management program and there are strict hunting regulations. The chief problems are related to soil conservation, water quality, management of flora and fauna, and effective preservation and exploitation of natural resources. Remarkably, the very low population is also a problem within the agriculture sector, primarily because of labor-intensive methods still employed. The first section discusses land use problems and policy and environmental law; the second section treats problems arising from urban and rural development, especially development resettlement, health, and related topics.

4.1 Rural Land Use Problems

4.1.1 Historical and Cultural Uniqueness of Land Use

Belize is faced with land use problems that are unlike those of neighboring countries. The important difference is that the problems at present, remain minor and are overshadowed by others of a more socioeconomic nature. The two most important problems are: (1) the gradual change from a forest-based economy to an agriculture-based economy, and (2) Belize's very low rural population.

Forestry was the only economic activity of any importance well into the 20th century. As the available timber supply gradually diminished, agricultural activity has increased. Sugar is now the principal export, but efforts are underway to increase the acreage of rice, bananas, tropical fruit, and land available for cattle for export. Virtually all of these activities are occurring on the flat northern plain, or in the coastal region. There is currently little pressure from the population to expand into marginal lands, or into steep slopes for agriculture. Indeed, of approximately 0.89 million hectares (2.2 million acres) of land that is considered arable, only a fraction is presently being exploited. It is estimated that about 0.61 million

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18/ Sources: Belize Forest Service. 1972.
Evans. 1973.
Floyd. 1972b.
Johnson and Chaffey. 1973.
La Bastille. 1979.
Shane. 1978.

hectares (1.5 million acres) in the Corozal and Cayo Districts alone have suitable grasslands for cattle-rearing.

Coupled with the very low pressure for exploitation, Belize may also be anomalous in that, according to Shane (1980), its soils are reported to be of better quality than those of the adjacent Peten of Guatemala. The traditional milpa (slash and burn, or shifting cultivation) method of farming in Belize may aid in maintaining the soil in relatively fertile condition as well. Most of the Mayan Indians practice this method of farming. Consequently, at any one time only about one-fifth of their land is under actual cultivation, the rest being idle and allowed to regenerate through regrowth of forest. Presently about 113,000 hectares (280,000 acres) of land are farmed by the milpa method (Floyd 1972b).

Secondly, with respect to the change from a forestry-dependent to an agriculture-dependent economy, it is important to note that the Belize Government has enacted the Aliens Landholding Ordinance of 1973. This legislation is aimed at curbing land speculation by non-Belizeans because most of the largest land owners are non-resident foreigners. The law requires non-Belizeans to develop a portion of the land they purchase according to a specified program before obtaining clear title to plots of more than 4.05 ha(10 acres) in rural areas, or 0.20 ha (1/2 acre) in urban areas. The legislation is economic in orientation, in that it is intended to: (1) break up the large landholdings that are held primarily for speculation rather than for development, and (2) encourage greater participation in the agriculture sector by laborers who were formerly employed in the forestry setor. The long-term results will surely bring much presently undeveloped land into agricultural production, but perhaps more importantly from an ecological standpoint, this program will bring greater pressure to bear on the land and the environment.

Of critical importance is whether the land use policy that is eventually implemented is effective, whether long-term agricultural practices adopted by new landowners are rational, and whether such land use policies are enforceable.

The second factor of importance, with respect to land use problems in current agriculture is the very low rural population. This small rural population exerts relatively little pressure to exploit marginal lands. In fact, the low rural population and small labor force has encouraged the introduction of modern labor-saving technology. The government has been actively encouraging foreign immigration into Belize in an effort to provide a larger labor force and a stronger economic base. These attempts have not met with notable success, except for the special case of the Mennonite settlers who have established a large agricultural community in the northwest. For the long-term, the country's low

population will doubtless remain an asset, encouraging the introduction of modern labor-saving technology, reducing pressures to exploit unsuitable agricultural lands, and permitting greater flexibility in national planning and management of natural resources. As the agricultural sector strengthens, significant environmental problems will doubtless emerge. These can be expected to include: soil erosion and infertility; difficulties in water quality regulation, and consequent reduction in water quality; and toxic chemical poisoning resulting from pest control measures. These problems may be the most important ones to affect the long-term economic health of newly independent Belize.

4.1.2 Forestry Management Problems

Well into the 20th century forestry remained an economic mainstay of Belize, but in the past few decades its importance has decreased markedly. Mahogany has been the most important forestry export, followed by cedar wood, rosewood and pine. Selective cutting of these tree species has nearly exhausted supplies in the northern plain where most hardwood cutting has occured. Likewise, few pines of harvestable size remain in the Mountain Pine Ridge which, because of its extensive road system, has the most accessible stands of pine forest in the country. The main cutting for pine at present is in the government's Chiquibul Forest Reserve in the Maya Mountains.

Against this background, it is clear that forestry exploitation cannot continue indefinitely unless some attempts are made to allow the valuable mahogany, pine and other products to regenerate.

Development of a workable and enforceable program of forest management may be the most pressing management concern facing the Belize Forest Service. As noted in Section 3.3.4, a program begun in 1948 has achieved only modest success and suffered a serious setback when in 1961, Hurricane Hattie destroyed over 800 hectares (2,000 acres) of plantations and 1,160 sq km (3,000 sq mi) of forest.

According to La Bastille (1979) Belize has a "fairly well-organized forestry management program." Efforts in the Mountain Pine Ridge are probably representative of the degree of government involvement in many parts of the country where significant exploitable forest lands remain. In the Mountain Pine Ridge, fire protection measures were established in the mid-forties, and between 1948 and 1961 five forest fire lookout towers were erected, an impressive road-building program was begun, and two airstrips were constructed. In 1956 a Forest Management Working Plan was drawn up for the entire Mountain Pine Ridge Forest Reserve and the Chiquibul Forest Reserve. These management plans were particularly

significant because prior to that time there had been no recognized management plan, and the only form of management was fire protection.

A final forest management problem of some importance is disease control of the Caribbean pine (P. caribaea). Two pathogenic parasites affect this species: the dwarf mistletoe (Arceuthobium globosum), and the cone rust (Cronartium conigenum). The mistletoe attacks trees of all ages, but particularly affects seedlings and saplings. The vigor of the host tree is reduced, the seed crop is adversely affected, and ultimately the tree becomes highly susceptible to insect and fungal attack. Because spread is normally very slow it can be controlled by clear cutting affected areas. The dwarf mistletoe is also an important pathogen in the western United States. A true mistletoe (Psittacanthus) that occurs on pine in Belize is harmless.

The second important pathogen is cone rust, a parasite particularly prevalent at middle elevations (600-750 m) in the Mountain Pine Ridge. Reportedly, the incidence of infection can run as high as 15 to 25 percent, and an average number of infected cones per tree may reach eight percent. The alternate hosts of cone rust are oak species, and control can be effected by removing the oak from pine stands. The seriousness of the disease is well known in the southeastern United States where cone rust regularly destroys up to 20 percent of the cone crop of slash pine (P. elliottii).

4.1.3 Pollution and Agricultural Pesticides

No information was available to the author on the extent (if any) of poisoning or pollution due to the use of toxic chemicals in agriculture. Areas that should be monitored are the middle and upper Stann Creek Valley where there are extensive citrus groves, primarily in large estates, and in the Cayo District where lesser amounts of citrus are grown. Data on the extent of chemical pest control used in production of the main food crops--maize, beans, and rice--, were similarly unavailable for this report. Cotton, which traditionally requires massive infusions of chemical control, and has been linked to serious environmental and human health problems in Central America (e.g., in Guatemala), is not an important cash crop in Belize.

4.1.4 National Land Use Policy

Two significant and remarkably bold land use policies have been implemented in Belize. The first was a Rural Land Utilization Tax, introduced in 1966. This tax, aimed at encouraging rural land development, placed a levy on private holdings of woodland or forest (but not pine ridge or savanna) of 40.5 ha (100 acres) or larger. Further, the tax

rate increases progressively over both space and time. For example, land within two kilometers of a passable road is taxed at a higher rate than land at a greater distance from the road. And, for each year that the land remains undeveloped the tax rate per acre increases. If a landowner is unwilling or unable to undertake the regional developments, his estate may be sold on the open market, or may ultimately revert to the government which acts as an agent for the property (Floyd 1972b). No information on the success of this bold legislation is available to this report. The hope is to bring more medium-sized land holdings into productivity and thereby, ultimately to boost the nation's economic growth.

The second important land use legislation is the Aliens Landholding Ordinance of 1973 (See 4.4.1, above). This ordinance was intended to reduce land speculation by foreign investors, and in turn prevent speculation from driving the price of land beyond the means of residents engaged in agricultural activities. The ordinance requires non-Belizeans to complete a development program on land they purchase before obtaining clear title to plots of more than 4.05 ha (10 acres) in rural areas or half an acre in urban areas. The success of this legislation, to date, is not known.

Long-term policies of the Forest Service appear to be similar to those originally established in 1954. As stated in the 1972 Annual Report of the Belize Forest Department (1972), the policy:

> ... makes provision for the reservation of forest land in perpetuity to conserve water, prevent soil erosion, and to insure a continuous supply of timber on National and private land. In addition it recognizes the need to maintain the forest law, increase the value of timber and other forest produce growing on forest land, expand forest industries and maintain an adequate number of trained technical and professional nationals.

4.2 Urban and Rural Development Problems [19]

4.2.1 Resettlement

The town site of Belize City has a number of serious shortcomings. Originally a loading point for logwood and

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[19] Sources: Dobson. 1973.
Evans. 1973.
U.S. AID. 1979.

mahogany at the mouth of the Belize River, the town is now a bustling metropolitan center of nearly 50,000 people. Unfortunately, the town is built over a series of sand dunes and swampland less than 60 cm (2 ft) above sea level. As a result, the town is faced with problems of protection from hurricanes and flooding, sewage disposal, lack of drinking water, and even scarcity of building stones. When Hurricane Hattie struck Belize City in 1961, over 260 persons lost their lives, approximately three-quarters of the houses were destroyed, and the town was inundated to depths of between 1.5 m (5 ft) and 4.5 m (15 ft) for several days. In 1962, following the hurricane, plans were made to move government offices to a new resettlement site much further inland. Construction on the first stages of the new capital site, Belmopan, was completed in 1970. The first stage included government offices, a small hospital, and about 700 houses. Construction costs of these buildings were paid by the British Colonial Development and Welfare Fund. Ultimately Belmopan may have 30,000 inhabitants or more by 1990, but many people have been reluctant to leave Belize City. Consequently, the various environmental and health-related problems that have plagued Belize City still remain, and appear to have few financially viable solutions.

4.2.2 Immigration

Government planners, managers of commercial enterprises, foreign investors, and educators have long argued that a large-scale influx of immigrants would greatly benefit the economy of Belize. In the context of a labor-intensive economy that relies primarily upon agriculture, forestry, and fishing, these observers argue that more people are needed to develop the economy. Some reports have suggested that a population twice the present size would be necessary to provide the economic work force to meet the social, technical, and financial commitments of an independent country (Floyd 1972b).

Conversely, it is argued that large-scale immigration might disrupt established political parties, and that the process of assimilation could cause serious social and economic problems. Immigrants are most likely to come from Caribbean Commonwealth countries but most of these immigrants would likely have few technical skills, little education, no capital, and would place an even greater burden on the Belizean economy.

Efforts to attract immigrants have not achieved measurable success. In fact, with the notable exception of the Mennonite settlement in the western region, Belize has had little success in attracting skilled or unskilled immigrants. It is likely that efforts to significantly increase the labor force will be unsuccessful unless there is clear evidence of a strengthening economy.

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Appendix I

U.S. AID Programs to Belize

24 Mar 1981

COUNTRY/BUREAU OTHER WEST INDIES-EASTERN CARIBBEAN REG.
PROJECT NUMBER 538000700
PROJECT TITLE FOOD CROP PRODUCTION (CARDI)
PROJECT SUMMARY MOST CARICOM STATES DO NOT HAVE MANPOWER, RESOURCES, OR INSTITUTIONS TO ADDRESS AGRICULTURAL DEVELOPMENT PROBLEMS, INCLUDING THOSE OF SMALL FARMER FOOD PRODUCERS. THIS PROJECT PROVIDES REGIONAL COMMON SERVICE, WITH EMPHASIS ON LDCS, FOR RESEARCH AND EXTENSION, DEMONSTRATION AND TRAINING. AID GRANT FUNDING PROVIDED TO CARDI WILL BE USED FOR ESTABLISHMENT OF OPERATIONAL/DEMONSTRATION CENTERS IN BELIZE, ST. KITTS, AND ST. LUCIA FOR CONDUCTING ADAPTIVE RESEARCH AND RELATED PROMOTIONAL/EXTENSION/TRAINING ACTIVITIES IN SELECTED FOOD CROPS. FUNDS WILL BE USED FOR COMMODITIES, STAFF SALARIES, AND OPERATION COSTS OF THESE CENTERS. CARDI FUNDS WILL SUPPORT COSTS OF DOCUMENTATION/INFO CENTER OR ST AUGUSTINE CAMPUS OF UWI.

COUNTRY/BUREAU REG OFFICE CEN AMER & PANAMA-ROCAP
PROJECT NUMBER 596001202
PROJECT TITLE DEVELOPMENT INSTITUTIONS HIGHER EDUC
PROJECT SUMMARY GRANT AND TECHNICAL ASSISTANCE PROVIDED TO THE FEDERATION OF PRIVATE UNIVERSITIES OF CENTRAL AMERICA (FUPAC) TO IMPLEMENT A REGIONAL, INTEGRATED, HIGHER EDUCATION SYSTEM OF CURRICULA AND ADMINISTRATIVE REFORMS DESIGNED TO IMPROVE PRIVATE, POST-SECONDARY EDUCATION. AS A REGIONAL ORGANIZATION, FUPAC CONSISTS OF 5 UNIVERSITIES FROM GUATEMALA, EL SALVADOR, NICARAGUA, PANAMA AND BELIZE. @PROJECT WILL ESTABLISH AND SUPPORT THE OPERATION OF FUPAC'S GENERAL SECRETARIAT IN GUATEMALA CITY. THE SECRETARIAT WILL SERVE AS THE MECHANISM FOR THE INTEGRATION OF REGIONAL, PRIVATE, HIGHER EDUCATION AND WILL PUBLISH A COMMON REGIONAL CATALOGUE, STATISTICAL BULLETINS AND QUARTERLY NEWS BULLETINS, CONDUCT EVALUATIONS OF THE REGION'S SYSTEM OF PRIVATE, HIGHER EDUCATION AND COORDINATE THE CONTINUING PROCESS OF UPGRADING CURRICULUM AND ADMINISTRATIVE TECHNIQUES OF THE REGION'S POST-SECONDARY EDUC INSTITUTIONS. THE SECRETARIAT WILL ALSO DESIGN COMPREHENSIVE YEARLY WORK PLANS FOR ITS MEMBERS AND ATTEMPT TO ACHIEVE 100% MEMBER FINANCING FOR ITS PROGRAMS. @FUPAC'S PROGRAMS WILL BE DESIGNED TO: 1. REGIONALLY INTEGRATE THE EDUCATION SYSTEM; 2. TRAIN ACADEMIC PERSONNEL AND ADMINISTRATORS IN CURRICULA AND ADMINISTRATIVE REFORM TECHNIQUES; 3. DEVELOP SPECIALIZED REGIONAL SCHOOLS INSUCH DISCIPLINES AS SANITARY ENGINEERING, VETERINARY MEDICINE AND AGRICULTURAL SCIENCES TO TRAIN MANPOWER FOR CURRENT AND FUTURE DEVELOPMENT NEEDS; 4. IMPROVE METHODS OF STUDENT TRANSFERS BETWEEN SCHOOLS; 5. INTEGRATE ADDITIONAL PRIVATE UNIVERSITIES AND INSTITUTIONS OF HIGHER LEARNING INTO FUPAC; 6. UPGRADE MEMBER SCHOOLS' LIBRARIES; 7. PROVIDE A COMMON CURRICULUM FOR FIRST 2 YEARS OF UNDERGRADUATE STUDY. @PROP OF 10/9/70 IMPLEMENTS A SERIES OF SEMINARS OF FUPAC MEMBERS AND OUTSIDE EXPERTS AND SPONSORS A REGIONAL FOOD MARKETING INSTITUTE TO MEET SPECIFIC REGIONAL MANPOWER NEEDS AND TO SERVE AS A MODEL FOR COORDINATING SPECIALIZED EDUCATION PROGRAMS IN FUPAC REGION. @PROAG 6/19/74 EXTENDED FINAL CONTRIBUTION DATE TO 9/31/74. @PROJECT'S PRIMARY BENEFICIARIES ARE THOSE BEING TRAINED UNDER FUPAC'S REGIONAL PROGRAMS. SECONDARY BENEFICIARIES WILL BE THE REGIONAL CITIZENRY SERVED BY THE TRAINED EXPERTS.

COUNTRY/BUREAU REG OFFICE CEN AMER & PANAMA-ROCAP
PROJECT NUMBER 596010000
PROJECT TITLE HUMAN RESOURCES DEVELOP
PROJECT SUMMARY @GRANT FOR PARTICIPANT TRAINING IN US AND CONTRACT TECHNICAL ASSISTANCE TO INCREASE SUPPLY OF CIVIL SERVANTS AND VOCATIONAL WORKERS IN BRITISH HONDURAS (BH). TO IMPROVE GOVERNMENT DEVELOPMENT PLANNING AND ADMINISTRATION, MIDDLE- AND UPPER-LEVEL CIVIL SERVANTS WILL BE TRAINED IN THE US IN THE AREAS OF AGRICULTURE, ECONOMICS, INDUSTRIAL DEVELOPMENT, AND CIVIL ADMINISTRATION. TRAINING WILL BE NON-DEGREE, LASTING LESS THAN 12 MONTHS. 20-30 PARTICIPANTS WILL BE TRAINED PER YEAR. ROCAP (REGIONAL OFFICE-CENTRAL AMERICA AND PANAMA) WILL ASSIST BH IN IMPROVING ITS TRAINEE SELECTION AND FOLLOW-UP PROCEDURES. @VOCATIONAL SKILLS SUCH AS MASONRY, CARPENTRY, ELECTRICITY, AND PLUMBING WILL BE IMPROVED BY ASSISTING THE NEWLY ESTABLISHED BELIZE VOCATIONAL INSTITUTE. USAID WILL PROVIDE CONTRACT INSTRUCTORS TO THE INSTITUTE - BOTH TO TEACH AND TO IMPROVE THE TEACHING SKILLS OF THE PRESENT STAFF. A REVOLVING LOAN FUND WILL BE ESTABLISHED TO PROVIDE 80-120 ADULT VOCATIONAL STUDENTS WITH A SMALL WEEKLY ALLOWANCE DURING THE 3-4 MONTH TRAINING PROGRAMS. @THE BH GOVERNMENT WILL MANAGE THE TRAINING PROGRAMS. CANADA AND THE UK WILL SUPPORT UNDERGRADUATE PARTICIPANT TRAINING FOR CIVIL EMPLOYEES AT THE UNIVERSITY OF THE WEST INDIES AS WELL AS GRADUATE TRAINING IN CANADA AND THE UK. @PROP 9/7/72 PROVIDES FOR THE ESTABLISHMENT OF AN INVESTMENT PROMOTION CENTER TO HELP STIMULATE FOREIGN AND DOMESTIC INVESTMENT IN BH. THOMAS H. MINER AND ASSOCIATES WILL BE CONTRACTED TO WRITE PRE-INVESTMENT FEASIBILITY STUDIES AND PROMOTIONAL BROCHURES. MINER & ASSOC WILL ALSO DEVELOP TRAINING MATERIALS IN INVESTMENT PROMOTION AND HELP TRAIN THE TWO GOVERNMENT EMPLOYEES HEADING UP THE CENTER. @PROP ALSO PROVIDES FOR LIMITED ASSISTANCE TO PRIVATE ORGANIZATIONS. FOR EXAMPLE, ONE MONTH OF TEMPORARY DUTY ASSISTANCE MIGHT BE PROVIDED BY A USDA EXPERT TO TRAIN MEAT GRADERS FOR THE BELIZE MEAT PACKING COMPANY. SUCH ASSISTANCE WOULD NOT EXCEED $2,000 FOR A SINGLE ACTIVITY. THE VOCATIONAL TRAINING ACTIVITIES ARE

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BEING SUCCESSFULLY TERMINATED.

COUNTRY/BUREAU REG OFFICE CEN AMER & PANAMA-ROCAP
PROJECT NUMBER 596010003
PROJECT TITLE HUMAN RESOURCES DEVELOPMENT
PROJECT SUMMARY ●BRITISH HONDURAS (BELISE) PROVIDED WITH GRANT, TECHNICAL ADVISORY ASSISTANCE, ON-JOB AND U.S. PARTICIPANT TRAINING TO STRENGTHEN INVESTMENT PROMOTION SKILLS AND ESTABLISH PERMANENT ADMINISTRATIVE STRUCTURE WITHIN GOVT TO IDENTIFY AND PROMOTE PRIVATE INVESTMENT OPPORTUNITIES. U.S. TECHNICAL ADVISORS WILL COLLABORATE WITH MINISTER OF TRADE AND INDUSTRY IN ORGANIZATION AND STAFFING OF INVESTMENT PROMOTION CENTER. INVESTMENT PROMOTION OFFICER, ADMINISTRATIVE ASSISTANT AND OTHER APPROPRIATE OFFICERS WITHIN MINISTRY WILL BE TRAINED. ●CENTER'S WORK WILL CONCERN IDENTIFICATION AND PROMOTION OF SPECIFIC INDUSTRIAL OPPORTUNITIES. CENTER WILL CONDUCT 6-8 WEEK SURVEY TO DETERMINE INVESTMENT PRIORITIES, POTENTIAL AND GENERAL INVESTMENT CLIMATE. PRE-INVESTMENT STUDIES OF OFF-SHORE INDUSTRY, TOURISM, LIVESTOCK PRODUCTION AND MECHANIZED FIELD CROPS WILL ALSO BE MADE. PROMOTIONAL BROCHURES AND INVESTMENT GUIDE WILL BE PREPARED. FOLLOWING PRELIMINARY STUDIES, THERE WILL BE AGGRESIVE SEEKING-OUT OF NEW INVESTORS IN WHICH CENTER WILL COOPERATE WITH SUCH GROUPS AS DEVELOPMENT FINANCE CORPORATION, BELIZE AND MICHIGAN PARTNERS OF ALLIANCE, CHAMBERS OF COMMERCE AND LOCAL BANKS. U.S. AND CANADIAN INVESTMENTS WILL BE ENCOURAGED. INVESTMENT PROJECTS WILL BE FULLY DEVELOPED AND PRESENTED IN FORMAT ACCEPTABLE TO POTENTIAL INVESTORS. CENTER WILL PREPARE 3-5 YR RECRUITMENT PLAN. ●USAID FUNDING WILL BE CHANNELED THROUGH ROCAP. HONDURAS WILL PROVIDSTAFF SERVICES, OFFICE SPACE AND LONG-TERM MAINTENANCE. ●PRIMARY BENEFICIARIES ARE HONDURAN CIVIL SERVANTS WHO RECEIVE TRAINING. SECONDARY BENEFICIARIES INCLUDE JOB-HOLDERS RESULTING FROM NEW INVESTMENTS. UNDP ALSO PROVIDED TECHNICAL ADVISORS.

COUNTRY/BUREAU OTHER WEST INDIES-EASTERN CARIBBEAN REG.
PROJECT NUMBER 538002200
PROJECT TITLE CARIBBEAN REGIONAL NUTRITION (CFNI)
PROJECT SUMMARY ●GRANT AND TECHNICAL ASSISTANCE (TA) PROVIDED TO THE CARIBBEAN REGIONAL NUTRITION INSTITUTE (CFNI) TO IMPROVE THE CAPABILITY OF ENGLISH-SPEAKING CARIBBEAN COUNTRIES IN DESIGNING NATIONAL FOOD AND NUTRITION PROGRAMS, THEREBY INCREASING FOOD AVAILABILITY AND NUTRIENT INTAKE AT THE HOUSEHOLD LEVEL. ●PROJECT COMPONENTS INCLUDE: 1. EXPANDING THE TYPE AND LEVEL OFTECHNICAL COOPERATION (ADVISORY SERVICES) ALREADY BEING PROVIDED TO COUNTRIES IN THE DEVEL OF FOOD AND NUTR POLICIES. 2.BROADENING THE SCOPE AND INCREASING THE NUMBER OF TECH GROUPMEETINGS AND TRNG COURSES (BOTH IN-SERVICE AND INTENSIVE) WHICH CFNI HAS CONDUCTED IN THE PAST; IN PARTICULAR, THE GRANTWILL ENABLE CFNI TO UNDERTAKE THE 2ND STAGE OF THE TRNG PROGRIN THEIR OVERALL STRATEGY TO TRAIN MIDDLE-LEVEL PERSONNEL (EXECUTIVE RATHER THAN POLICY) TO IMPLEMENT POLICIES AND PROGRAMS. 3. DETERMINING THE MANPWR AND TRNG NEEDS OF THE REGION FOR MIDDLE-LEVEL PERSONNEL IN FOOD AND NUTRITION. 4. EXPANDING THE PRODUCTION OF PRINTED AND AUDIO-VISUAL MATERIALS FOR USE IN THE REGION TO RESPOND TO THE INCREASED DEMAND FOR SUCH MATERIALS IN ALL TERRITORIES. ●BENEFICIARIES WILL BE THE HOUSEHOLDS IN CARIBBEAN COUNTRIES SERVED BY CFNI WHICH ARE: ANTIGUA, BARBADOS, BELIZE, BRITISH VIRGIN ISLANDS, CAYMAN IS,DOMINICA, GRENADA, GUYANA, JAMAICA, MONSERRAT, ST. KITTS-NEVIS-ANGUILLA, ST. LUCIA, ST. VINCENT, SURINAM, TRINIDAD AND TOBAGO, TURKS AND CAICOS ISLANDS. SECONDARILY, CFNI WILL BE BENEFITTED BY A STRENGTHENED CAPABILITY. ●OTHER DONORS TO PROJ (CFNI) INCLUDE FOOD AND AGR ORGANIZ (FAO), WILLIAMS-WATERMAN PROGRAM OF THE RESEARCH CORP, UNIV OF WEST INDIES, AND THE GOVTS OF JAMAICA, TRINIDAD AND TOBAGO. DONORS WHO HAVE CONTRIBUTED OVER THE YEARS INCLUDE UNICEF (1972 TO PRESENT), ROCKEFELLER FDN (1970-73), FREEDOM FROM HUNGER (1971-74), AND THE FORD FDN (1974 TO PRESENT). ●USAID PROVIDES PERSONNEL (SALARIES PLUS TRAVEL), SHORT-TERM CONSULTANTS, TRNG, EDUC MATERIALS, PROGRAM SUPPORTS COSTS, INFL/CONTGNCY. HOST COUNTRY PROVIDES PERSONNEL (SALARIES PLUS TRAVEL), INFL/CONTGNCY. OTHER DONORS PROVIDE PERSONNEL AND TRAINING.

COUNTRY/BUREAU OTHER WEST INDIES-EASTERN CARIBBEAN REG.
PROJECT NUMBER 538001000
PROJECT TITLE REGIONAL AGRI-BUSINESS DEVELOPMENT
PROJECT SUMMARY GRANT & LOAN ARE PROVIDED TO THE CARIBBEAN DEVELOPMENT BANK(CDB) TO ESTABLISH AN AGRIBUSINESS DEVELOPMENT FUND WHICH WILL PROVIDE LOANS & EQUITY INVESTMENTS TO AGRIBUSINESS & OTHER LABOR INTENSIVE ENTERPRISES IN THE CARIBBEAN REGION. THE CDB WILL HAVE PRIMARY RESPONSIBILITY FOR OVERALL PROJ ADMIN & COORDINATION. THE CDB WILL SELECT THE RECIPIENT ENTERPRISEON THE BASIS OF THEIR POTENTIAL BENEFIT TO SMALL FARMERS & RURAL POOR OF THE BARBADOS AND OTHER LDC'S IN THE CARIBBEAN REGION--ANTIGUA,BELIZE,DOMENICA,GRENADA,MONTSERRAT,ST KITTS/NEVIS/ANGUILLA,ST LUCIA & ST VINCENT. THREE TYPES OF ENTERPRISES WILL BE ELIGIBLE UNDER THE PROGRAM: 1)THOSE THAT EXPAND AND/OR STABILIZE THE MARKET FOR SMALL FARMER PRODUCTION;2)THOSE THAT REDUCE THE COST OF SMALL FARMER PRODUCTION;AND 3)THOSE WHICH INCREASE EMPLOYMENT FOR RURAL WORKERS. FOOD PROCESSING ENTERPRISES ARE EXPECTED TO ACCOUNT FOR THE MAJORITY OF

INVESTMENTS. OTHER POSSIBILITIES INCLUDE FERTILIZER MIXING ENTERPRISES & MANUFACTURING OF FARM IMPLEMENTS. @TO COMPLEMENT ITS AGRIBUSINESS FUND,THE CDB WILL FINANCE ADAPTIVE RESEARCH TO DEVELOP AGRIBUSINESS TECHNOLOGIES APPROPRIATE TO THE REGION'S RESOURCE BASE & MARKETS. RESEARCH SUB-GRANTS WILL INVOLVE PACKAGING TECHNOLOGY,CROP SYSTS,PROCESSING EQUIP,MULTI-PURPOSE PROCESSING FACILITIES & GROWER-PROCESSOR CONTRACTS. THE MAJOR INSTITUTIONS WITH WHICH CDB WILL CONTRACT FOR RESEARCH & TECH ASSIST INCLUDE THE CARIBBEAN RESEARCH INSTITUTE,CARIBBEAN AGR RESEARCH & DEVEL INSTITUTE,THE UNIV OF THE WEST INDIES,PRODUCE CHEMIST LABS (ONE IN EACH LDC),JAMAICA NATL SCIENTIFIC RESEARCH COUNCIL,REGIONAL PROFESSIONAL ASSOC'D,ASSOC'S OF INDUS & COMMERCE AND THE JAMAICA INDUS DEVEL CO. (TECH ASSIST WILL BE FINANCED THROUGH THE AGRIBUSINESS DEVEL FUND & THE GRANT WILL COVER ALL RESEARCH ACTIVITIES). IN ORDER TO BE FUNDED,THE RESULTING TECHNOLOGIES MUST HAVE DIRECT UTILITY IN THE AGRIBUSINESS DEVEL PROG & MUST BE OF USE TO MORE THAT 1 AGRIBUSINESS FACILITY. IN ADDITION, ALL BASIC RSRCH MUST ALREADY BE COMPLETED. RESRCH PROJS WILL NORMALLY BE FORMULATED BY THE CDB. ALSO,CDB MAY FINANCE PROPOSALS FROM RSRCH INSTITUTIONS,ENTREPRENEURS AND OTHER SOURCES.

COUNTRY/BUREAU OTHER WEST INDIES-EASTERN CARIBBEAN REG.
PROJECT NUMBER 538001400
PROJECT TITLE REGIONAL DEVELOPMENT TRAINING
PROJECT SUMMARY GRANT PROVIDED TO: 1)THE EAST CARIBBEAN COMMON MARKET(ECCM)SECRETARIAT TO IMPLEMENT A TRAINING PROGRAM FOR ALL LEVELS OF PUBLIC SERVICE PERSONNEL FROM MEMBER COUNTRIES(ANTIGUA,DOMINICA,GRENADA,MONTSERRAT,ST KITTS-NEVIS,ST LUCIA & ST VINCENT); AND 2)THE CARIBBEAN COMMUNITY(CARICOM)SECRETARIAT TO SUPPORT EXISTING AND NEW TRAINING PROGRAMS FOR PUBLIC & PRIVATE SECTOR PERSONNEL IN DEVELOPMENT-RELATED OCCUPATIONS FROM ITS MEMBER COUNTRIES(ECC COUNTRIES PLUS BELIZE,BARBADOS,GUYANA ,JAMAICA,AND TRINADAD & TOBAGO) @ECCM PROG WILL BE DIVIDED INTO SEPARATE PROGS FOR VARIOUS LEVELS & CLASSIFICATIONS OF PERSNL. TOP-LVL MANAGERS WILL BE SENT TO ECCM-AREA INSTITS TO ATTEND A SERIES OF SIX 3-DAY SEMINARS COVERING ORGANIZATIONAL BEHAVIOR & DESIGN,MGMT OF CHANGE,DEVEL PLANNING & ADMIN,COMMUNICATIONS,PERSNNL MGMT,AND SERVICING OF INTERNATL/INTER-REGIONAL ORGANIZATIONS. TRNG SPECIALISTS WILL DIRECT SEMINARS AND ALSO PROVIDE INSTRUCTION IN TRNG METHODOLOGY TO A CADRE OF PERSNNL(2 FROM EACH ECCM GOVT)WHO WILL CONSTITUTE A PERMANENT ECCM TRNG DIVISION. TRNG DIV WILL BE RESPONSIBLE FORDESIGNING & IMPLEMENTING THESE OTHER PROGS UNDER THE ECCM COMPONENT: 1)SEMINARS IN HUMAN RESOURCES DEVEL AND ORGNZATNL PLNNG & BUDGETING FOR MID-LVL MNGRS; 2)SEMINARS IN HUM RESORC DEVEL,ORG PLNNG & BUDGTNG,AND OFFICE MGMT FOR JR-LVL MNGRS; AND 3)WORKSHPS & ON-THE-JOB MGMT TRNG FOR ECCM SECRETARIATPERSNNL. CLERICAL PERSNNL WILL RECEIVE SKILLS TRNG AT INSTITS IN THEIR RESPECTIVE COUNTRIES. @MAJOR ELEMENT OF CARICOM COMPONENT IS THE PROVISION OF SHRT-TRM,IN-SRVC PARTIC TRNG GRANTS TO PRIMARILY GOVERNMENTAL OFFICIALS. SOME GRANTS WILL BE GIVEN TO PRIVATE-SECTOR PERSNNL WHOSE ORGS ARE INVOLVED IN PRIORITY DEVEL FIELDS. THIS TRNG WILL BE PROVIDED AT REGIONAL INSTITS SUCH AS THE UNIV OF THE WEST INDIES(UWI)WHENEVER POSSIBLE. A LIMITED NUMBER OF DIPLOMA & CERTIFICATE DEGREE TRNG GRANTS WILL BE GIVEN FOR STUDY IN PRIORITY AREAS(AGRONOMY,AGR ECON,MEDICAL TECHNOLOGY,ET AL)AT UWI & US UNIVS. REMAINDER OF SUPPORT TO CARICOM WILL BE USED FOR SEMINARS IN ADMIN & MGMT(FOR SMALL ENTREPRENEURS),EXPORT DEVEL(FOR PRIVATE-SECTOR BUSINESSMEN),AND ADMIN & MGMT(FOR PUB-SCTR MID/UPPR-LVL MGRS).

COUNTRY/BUREAU OTHER WEST INDIES-EASTERN CARIBBEAN REG.
PROJECT NUMBER 538001600
PROJECT TITLE CARIBBEAN INSTITUTIONAL DEVELOPMENT
PROJECT SUMMARY @GRANT IS PROVIDED TO THE CARIBBEAN DEVLPMNT BANK (CDB), A REGIONAL FINANCE INSTITUTION,TO ASSURE THE CONTINUATION OF ITS ROLE AS A MAJOR SOURCE OF TECH ASSISTANCE TO THE ENGLISH-SPEAKING NATIONS OF THE CARIBBEAN. A PERMANENT FUND WILL BE ESTABLISHED TO PROVIDE FINANCING TO INDIVIDUAL GOVTS FOR TECH ADVISORS,TRNG & STUDIES IN SUPPORT OF THEIR INSTITUTIONAL GROWTH AND/OR NATL DEVLPMNT PROGS. @THE CDB IS COMPOSED OF 18 REGIONAL & 2 NON-REGIONAL GOVTS (THE UNITED KINGDOM & CANADA). AT LEAST 70% OF ITS FUNDS WILL BE DIRECTED TOWARD THOSE COUNTRIES DESIGNATED AS LDC'S (ANTIGUA,BELIZE,DOMINICA,GRENADA,MONTSERRAT,ST KITTS-NEV'S,ANGUILLA,ST LUCIA,ST VINCENT,THE BRITISH VIRGIN ISLANDS,CAYMAN ISLANDS,& THE TURKS & CAICOS ISLANDS). THE REMAINDER WILL BE ALLOCATED TO MORE DEVELOPED MEMBERS SUCH AS THE BAHAMAS,BARBADOS,JAMAICA,TRINIDAD,TOBAGO,GUYANA & TO REGIONAL INSTITUTIONS. @THE CDB FUND WILL PROVIDE TECH ASSIST TO DEVLPMNT PROGS FOR WHICH THE BANK TYPICALLY PROVIDES LENDING--AGRI,LIVESTOCK,FISHERIES,MARKETING,MANUFACTURING,PLNNG,PUBLIC FINANCES,PUBLIC PROGRAMMING & BUDGETING,HOUSING,HLTH & EDUC. NON-PROJ RELATED ASSIST WILL BE PROVIDED IN SUCH SPECIALIZED AREAS AS SOILS RESEARCH,CROP PRODUCTION HANDLING OF PERISHABLES,MARKETING POLICY,LIVESTOCK & FOOD PROCESSING & SMALL-SCALE MANUFACTURING. ADVISORY SERVICES WILL INCLUDE BOTH EXPERTISE FOR SPECIFIC PROBLEM AREAS & PERSONNEL TO FILL KEY STAFF POSITIONS. @THE CDB WILL USE THE FUND TO SET UP SPECIAL COURSES OR REGIONAL SEMINARS AS WELL AS TO FINANCE JOB-RELATED ACADEMIC OR SEMINAR COURSES FOR SPECIFIC PERSONNEL. INSTITUTIONAL DEVLP ACTIVITIES WILL CONSIST OF ADVISORY TRNG PROGS IN PLNNG,STATISTICS & ACCOUNTING. @CDB WILL EXPAND ITS OWN TECH EXPERTISE IN FORESTRY MGMT &

EXPLORATION,AGRO-INDUSTRY & SYSTS MGMT. CDB WILL CONTRIBUTE 25% OF THE COSTS. @A TOTAL OF 17 STUDIES WILL BE FINANCED TO DEVELOP A "SHELF" OF PROJS READY FOR IMPLEMENTATION. THESE WILL INCLUDE PRE-INVESTMENT STUDIES,SURVEYS OF POTENTIAL RECIPIENTS TO DETERMINE PROJ DESIGN @EEDS,PROJ FEASIBILITY STUDIES,FINAL DESIGNS & POST-PROJ EVALUATIONS. @OTHER DONORS,THE UNITED KINGDOM & CANADA WILL PROVIDE MATCHING GRANTS.

COUNTRY/BUREAU OTHER WEST INDIES-EASTERN CARIBBEAN REG.
PROJECT NUMBER 538002901
PROJECT TITLE CARIBBEAN EDUCATIONAL DEVELOPMENT
PROJECT SUMMARY GRANT AND TECHNICAL ASSISTANCE ARE PROVIDED TO THE UNIVERSITY OF THE WEST INDIES (UWI) TO IMPROVE PRIMARY EDUCATION IN THE CARIBBEAN. UWI,IN CONJUNCTION WITH THE MINISTRIES OF EDUCATION OF THE VARIOUS PARTICIPATING TERRITORIES,WILL REVISE AND IMPROVE SYLLABI,CURRICULUM UNITS,AND TEACHERS GUIDES IN THREE OF FOUR BASIC PRIMARY SCHOOL UNITS--LANGUAGE ARTS,MATHEMATICS,SOCIAL STUDIES,AND SCIENCES. LOW-COST TEACHER AND PUPIL INSTRUCTIONAL AND LEARNING MATERIALS WILL THEN BE DEVELOPED AND TESTED IN FIVE PILOT SCHOOLS IN EACH OF THE PARTICIPATING TERRITORIES OF ANTIGUA,BARBADOS,BRITISH VIRGIN ISLANDS,BELIZE,DOMINICA,GRENADA,MONTSERRAT,ST KITTS/NEVIS/ANGUILLA,ST LUCIA,AND ST VINCENT. HEADTEACHERS,PRINCIPALS,AND SUPERVISORY STAFF WILL BE TRND IN THE USE OF NEW MATERIALS IN REGIONAL,TERRITORIAL,AND LOCAL WORKSHOPS. (80 TERRITORIAL,48 ADMINISTRATIVE,AND 480 LOCAL WORKSHOPS ARE PLANNED.) THE USAID GRANT FUNDS WILL SUPPORT A CORE UWI PROJECT STAFF CONSISTING OF ONE PROJECT COORDINATOR AND FIVE FULL-TIME EDUCATION CONSULTANTS. IN ADDITION,52 MONTHS OF SHORT-TERM ASSISTANCE ARE PLANNED IN SPECIALIZED AREAS OF ADMINISTRATION,CURRICULUM DEVELOPMENT AND IN THE PRODUCTION OF PRIMARY CURRICULUM MATERIALS.

COUNTRY/BUREAU OTHER WEST INDIES-EASTERN CARIBBEAN REG.
PROJECT NUMBER 538002902
PROJECT TITLE CARIBBEAN EDUCATIONAL DEVELOPMENT
PROJECT SUMMARY GRANT AND TECHNICAL ASSISTANCE ARE PROVIDED TO THE CARIBBEAN EXAMINATIONS COUNCIL (CXC),A REGIONAL INSTITUTION DEDICATED TO SECONDARY SCHOOL CURRICULUM-RELATED ACTIVITIES,TO IMPROVE THE QUALITY OF SECONDARY EDUCATION IN THE ENGLISH-SPEAKING CARIBBEAN. CXC WILL REVISE AND MODERNIZE SECONDARY SCHOOL SYLLABI FOR THE REGION. THE SUBJECTS COVERED BY THE NEW SYLLABI WILL INCLUDE SPANISH,AGRICULTURE SCIENCE,ENGLISH,MATHEMATICS,CARIBBEAN HISTORY,GEOGRAPHY,SOCIAL STUDIES,INTEGRATED SCIENCE,OFFICE PROCEDURES,TECHNICAL DRAWING,AND HOME ECONOMICS. FINAL,SECONDARY CERTIFYING EXAMINATIONS WILL ALSO BE REVISED--PROVIDING MORE RELEVANT EXAMINATIONS IN MORE SUBJECTS TO A LARGER PROPORTION OF THE STUDENT POPULATION. AID FUNDS WILL SUPPORT AN EXTENSIVE SERIES OF WORKSHOPS TO FAMILIARIZE SECONDARY TEACHERS AND ADMINISTRATORS WITH THE NEW MATERIALS. (THE TOTAL NUMBER OF TRAINING WORKSHOPS WILL INCLUDE 10 SUBJECT DEVELOPMENT WORKSHOPS,17 SUBJECT REVIEW WORKSHOPS,2 SCHOOL-BASED ASSESSMENT,40 TERRITORIAL,40 EVALUATION TESTING,AND 40 SUBREGIONAL WORKSHOPS.) CXC WILL SUBCONTRACT WITH THE UNIVERSITY OF THE WEST INDIES,THE UNIVERSITY OF GUYANA,AND PERHAPS OTHER INSTITUTIONS TO CARRY OUT MANY OF THESE TEACHER TRAINING ACTIVITIES. PARTICIPATING TERRITORIES WILL INCLUDE ANTIGUA,BARBADOS,BRITISH VIRGIN ISLANDS,BELIZE,DOMINICA,GRENADA,MONTSERRAT,ST KITTS/NEVIS/ANGUILLA, ST LUCIA,ST VINCENT,TURKS,CAICOS,TRINIDAD,AND TOBAGO. USAID WILL ALSO FINANCE MATERIALS PRODUCTION,EQUIPMENT,AND TRAINING TO EXPAND THE CXC DATA PROCESSING FACILITY.

COUNTRY/BUREAU OTHER WEST INDIES-EASTERN CARIBBEAN REG.
PROJECT NUMBER 538002903
PROJECT TITLE CARIBBEAN EDUCATIONAL DEVELOPMENT
PROJECT SUMMARY GRANT IS PROVIDED TO THE CARIBBEAN DEVELOPMENT BANK (CDB) TO FINANCE AND MANAGE THE IMPROVEMENT OF PRIMARY SCHOOL FACILTIES IN THE EASTERN CARIBBEAN REGION. THROUGH A SPECIAL FUND TO BE ESTABLISHED BY THE CDB,MATCHING GRANTS WILL BE PROVIDED TO EACH PARTICIPATING COUNTRY TO IMPLEMENT PLANS FOR IMPROVED PRIMARY SCHOOL MAINTENANCE. SPECIFICATIONS FOR SCHOOL FACILITIES,MAINTENANCE MANUALS,AND A SELF-HELP SYLLABUS ON TECHNIQUES FOR COMMUNITY PARTICIPATION IN SCHOOL CONSTRUCTION AND MAINTENANCE WILL BE PREPARED AND DISTRIBUTED IN ALL THE TERRITORIES. CDB WILL ALSO FINANCE SELECTED ACTIVITIES INVOLVING NEW CONSTRUCTION,EXTENSION,AND REHABILITATION OF PRIMARY SCHOOL FACILITIES. IN ADDITION,COUNTRY-LEVEL WORKSHOPS (PART OF THE PRIMARY CURRICULUM SUBPROJECT 538002901) WILL INCLUDE COMPONENTS ON CONCEPTS AND PRACTICES OF EFFECTIVE SCHOOL MAINTENANCE,AND SELF-HELP TECHNIQUES FOR MINISTRY AND PRIMARY SCHOOL PERSONNEL. PARTICIPATING COUNTRIES WILL INCLUDE ANTIGUA,DOMINICA,GRENADA,MONTSERRAT,ST KITTS/NEVIS,ST LUCIA,AND BELIZE.

Appendix II

Proposed Activity of U.S. National Park Service in Belize

Fiscal Year 1981

Country: BELIZE
Subject Area: Environmental Interpretation Planning
Project Title: Interpretive Plan-Half Moon Caye Natural Monument
Objectives:
-Prepare detailed interpretive plan.
-Provide in-service training.
Activities:
-Field work at monument (2 weeks)
-Write up in Belize City (1 week) which should include exhibit plans, draft of text for displays and publications.
Financing:
Total Cost: Undetermined. Govt. of Belize and Belize Audubon to provide camping equipment, local transportation and food at Monument
NPS Cost: Planner salary (3 weeks)
NPS Responsibility: Interpretive Planner
Authority: Endangered Species Act
Other Organizations Involved: Government of Belize, Belize Audubon Society, CATIE
Approximate Dates and Duration: Fall 1981 (3 weeks)
NPS Personnel Involved or Requested: Interpretive Planning with marine park experience.
Comments: Coordinated with CATIE. Team to include participants from Forestry Department, Fisheries Administration, Tourism Board, Audubon Society. Management plan to be prepared by Belize in collaboration with CATIE in March 1981.

Appendix III

List of Mammals

Belizean List of Mammals

Taxon	Common name
MARSUPIALIA — Marsupials	
Didelphidae — Opossums	
Didelphis marsupialis caucae Allen	Opossum
Didelphis virginiana yucatanensis Allen	Opossum
Metachirops opossum pallidus (J. A. Allen)	Four-eyed opossum
Marmosa alstoni nicaraguae Thomas	Alston's opossum
Marmosa robinsoni ruatanica Goldman	South American mouse-opossum
Marmosa mexicana mayensis Osgood	Mexican mouse-opossum
Caluromys derbianus fervidus (Thomas)	Wooly opossum
INSECTIVORA — Insectivores	
Soricidae — Shrews	
Cryptotis parva tropicalis (Merriam)	Guatemalan least shrew
Crytotis nigrescens mayensis (Merriam)	Yucatan small-eared shrew
CHIROPTERA — Bats	
Emballonuridae — Sac-winged Bats	
Rhynchonycteris naso (Wied-Neuwied)	Brazilian long-nosed bat
Saccopteryx bilineata (Temminck)	Greater white-lined bat
Peropteryx macrotis macrotis (Wagner)	Lesser doglike bat
Centronycteris maximiliani centralis Thomas	Thomas' bat
Balantiopteryx Thomas	Thomas' sac-winged bat
Mormoopidae — Leaf-chinned Bats	
Pteronotus parnellii mesoamericanus J. D. Smith	Parnell's mustache bat
Pteronotus davyi Gray	Davy's naked-backed bat
Phyllostomidae — American Leaf-nosed Bats	
Tonatia minuta Goodwin	Pygmy round-eared bat
Tonatia sylvicola sylvicola (D'Orbigny)	D'Orbigny's round-eared bat
Trachops cirrhosus coffini Goldman	Fringe-lipped bat
Glossophaga soricina leachii (Gray)	Pallas' long-tongued bat
Carollia brevicauda (Schinz)	Short-tailed bat
Carollia perspicillata (Linnaeus)	Seba's short-tailed bat
Sturnira lilium parvidens Goldman	Yellow-shouldered bat
Uroderma bilobatum molaris (W. B. Davis)	Tent-making bat
Vampyressa pusilla thyone Thomas	Yellow-eared bat
Artibeus jamaicensis yucatanicus J. A. Allen	Jamaican fruit-eating bat
Artibeus lituratus palmarum J. A. Allen and Chapman	Big fruit-eating bat
Artibeus phaeotis phaeotis (Miller)	Gervais' fruit-eating bat
Artibeus watsoni Thomas	Watson's fruit-eating bat
Desmodontidae — Vampire Bats	
Desmodus rotundus murinus Wagner	Vampire bat
Thyropteridae — Disk-winged Bats	
Thyroptera tricolor albigula G. M. Allen	Spix's disk-winged bat
Vespertilionidae — Vespertilionid Bats	
Myotis keaysi pilosatibialis LaVal	Myotis
Eptesicus furinalis gaumeri (J. A. Allen)	Tropical brown bat
Rhogeessa tumida H. Allen	Little yellow bat
Molossidae — Free-tailed Bats	
Tadarida laticaudata yucatanica (Miller)	Yucatan free-tailed bat
Molossus ater Geoffroy	Red mastiff bat
Molossus sinaloae J. A. Allen	Allen's mastiff bat
Molossus molossus aztecus Saussure	Little mastiff bat

PRIMATES — Monkeys	
Cebidae — Howlers and Spider Monkeys	Black howler monkey
Alouatta pigra Lawrence	Geoffroy's spider monkey
Ateles geoffroyi Hasselt a d Kuhl	
EDENTATA — Anteaters and Armadillos	
Myrmecophagidae — Anteaters	Giant anteater
Myrmecophaga tridactyla centralis Lyon	Tamandua
Tamandua tetradactyla mexicana (Saussure)	Two-toed anteater
Cyclopes didactylus mexicanus Hollister	
Dasypodidae — Armadillos	Nine-banded armadillo
Dasypus novemcinctus mexicanus Peters	
LAGOMORPHA — Rabbits	
Leporidae — Rabbits	Eastern cottontail
Sylvilagus floridanus (Bachman)	
(observed by Dora Weyer, AUIE)	Forest rabbit
Sylvilagus brasiliensis (Linnaeus)	
(observed by Dora Weyer, AUIE)	
RODENTIA — Rodents	
Sciuridae — Squirrels	Yucatan squirrel
Sciurus yucatanensis yucatanensis J. A. Allen	Variegated squirrel
Sciurus variegatoides Ogilby	Deppe's squirrel
Sciurus deppei vivax Nelson	Southern flying squirrel
Glaucomys volans (Li us)	Belize)
Geomyidae — Pocket Gophers	
Orthogeomys hispidus cayensis (Burr)	Hispid pocket gopher
Orthogeomys hispidus yucatanensis (Nelson and Goldman)	Hispid pocket gopher
Heteromyidae — Heteromyids	
Heteromys desmarestianus Gray	Desmarest's spiny pocket mouse
Cricetidae — New World Rats and Mice	
Oryzomys palustris pinetola A. Murie	Coues' rice rat
Oryzomys melanotis Thomas	Black-eared rice rat
Oryzomys alfaroi alfaroi (J. A. Allen)	Alfaro's rice rat
Oryzomys fulvescens mayensis Goldman	Pygmy rice rat
(collected by John C. Brier in 1973)	
Tylomys nudicaudus nudicaudus (Peters)	Peters' climbing rat
Ototylomys phyllotis phyllotis Merriam	Big-eared climbing rat
Nyctomys sumichrasti decolorus (True)	Sumichrast's vesper rat
Otonyctomys hatti Anthony	Yucatan vesper rat
Reithrodontomys gracilis gracilis J. A. Allen and Chapman	Slender harvest mouse
Sigmodon hispidus furvus Bangs	Hispid cotton rat
Sigmodon hispidus saturatus V. Bailey	Hispid cotton rat
Muridae — Old World Rats and Mice	
Rattus rattus (Linnaeus)	Black rat
Rattus norvegicus (Berkenhout)	Norway rat
(observed by Dora Weyer, AUIE)	
Mus musculus Linnaeus	House mouse
Erethizontidae — New World Porcupines	
Coendou mexicanus yucatanicae Thomas	Mexican porcupine
Dasyproctidae — Agoutis and Pacas	
Agouti paca nelsoni Goldman	Paca
Dasyprocta punctata richmondi Goldman	Agouti
Dasyprocta punctata yucatanica Goldman	Agouti

CARNIVORA — Carnivores	
Canidae — Foxes	
Urocyon cinereoargenteus fraterculus Elliot	Gray fox
Procyonidae — Raccoons and Allies	
Bassariscus sumichrasti campechensis (Nelson and Goldman)	Cacomistle
Bassariscus sumichrasti variabilis (Peters)	Cacomistle
Procyon lotor shufeldti Nelson and Goldman	Raccoon
Nasua nasua narica (Linnaeus)	Coati
Nasua nasua yucatanica J. A. Allen	Coati
Potos flavus chiriquensis J. A. Allen	Kinkajou
Mustelidae — Mustelids	
Mustela frenata perda (Merriam)	Long-tailed weasel
Eira barbara senex (Thomas)	Tayra
Galictis allamandi canaster Nelson (observed by Dora Weyer, AUIE)	Grison
Spilogale putorius yucatanensis Burt	Southern spotted skunk
Conepatus semistriatus yucatanicus Goldman	Striped hog-nosed skunk
Lontra longicaudis annectens (Major)	Southern river otter
Felidae — Cats	
Felis onca goldmani Mearns	Jaguar
Felis concolor mayensis Nelson and Goldman	Mountain lion
Felis pardalis pardalis Linnaeus	Ocelot
Felis wiedii yucatanica Nelson and Goldman	Margay
Felis yagouaroundi fossata Mearns	Jaguarundi
SIRENIA — Manatees	
Trichechidae — Manatees	
Trichechus manatus manatus Linnaeus	Manatee
PERISSODACTYLA — Perissodactyls	
Tapiridae — Tapirs	
Tapirus bairdii (Gill)	Baird's tapir
ARTIODACTYLA — Artiodactyls	
Tayassuidae — Peccaries	
Dicotyles tajacu nelsoni (Goldman)	Collared peccary
Dicotyles tajacu yucatanensis (Merriam)	Collared peccary
Tayassu pecari rinconi Merriam	White-lipped peccary
Cervidae — Cervid	
Odocoileus virginianus truei (Merriam)	White-tailed deer
Mazama americana cerasina Hollister	Red brocket
Mazama americana temama (Kerr)	Red brocket

Source: Kirkpatrick and Cartwright. 1975.

Appendix IV

Bibliography

1. General and Land Use
2. Physical Resources
3. Biological Resources
4. Health and Urban Environment

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1. General and Land Use

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