# ENVIRONMENTAL STATISTICS FOR BELIZE 2000

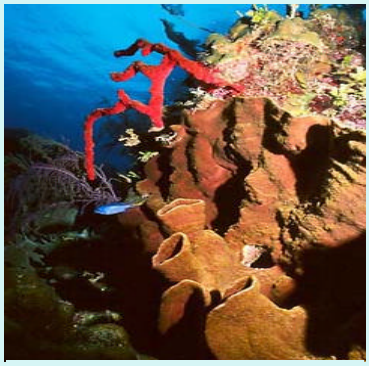
Belize's 1,000 Ft Water Fall

Belize's National Animal - The Tapir

Belize's Jaguar

Belize's Great Blue Hole

Belize's Corals



Belize's Corals

**CSO, July 2000**

**Central Statistical Office**
**Ministry of Finance, Belmopan, Belize.**

**Price: $35.00 Per Copy**

# PREFACE

This is the second CSO compendium publication of environmental statistics for Belize. In April 1999, our first release was published and was well received by the public in general. This new edition is intended to provide enough explanatory information to enable the readers to understand the data presented, and to serve as a statistical book for the general public interested in the topic **Environment**. The data have been compiled from existing sources and some produced by the Central Statistical Office. In addition, the completion of this publication depended crucially on the assistance and cooperation from other government departments, as well as the private sector, and a significant amount of work in research and evaluation. The data cover the main environmental concerns in Belize – Land Use, Agriculture, Forestry, Fishing, Mining, Energy, Water, Waste, Transport, Tourism, Health and a few issues on Climate Change and Environmental Indicators of Sustainable Development.

Environmental statistics is important to provide a sound basis for the many decision making, to monitor progress and to support public awareness with respect to the environment. It also aims, therefore, to provide synthetic presentation of data from various subject areas and sources. In addition, it is now globally accepted that the state of the environment is of fundamental importance to human survival. At the same time, the environment is subject to changes as a result of the way that human activities and natural events impact on it. Therefore, environmental statistics provide such information and enhances the policy making process that ensure that the present needs are met without compromising the ability of future generations to meet their own needs.

I, therefore, would like to express our gratitude to the Inter-American Development Bank, with Statistics Sweden as Consultants, for the supporting work. Special thanks, to those departments and agencies which provided us with information and constructive comments. The following members of the Central Statistical Office who worked arduously on the collection, compilation, and analysis of this environmental publication are also being specially thanked: Mr. Edgar Ek (Statistician II) and Mr. Rafael Lima (Statistical Officer) of the Environmental Statistical Unit (ESU).

The CSO welcomes feedback from users in order to improve this publication in any way. Please send any comments to the Chief Statistician at the address below.

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# COUNTRY INTRODUCTION

Belize is located in the northeast of Central America with a land area of approximately 22,966 square kilometers. Just off the Belizean coast lies the largest Barrier Reef in the Western Hemisphere and the second largest in the world. Belize shares border with Mexico on the north and part of the northwest and Guatemala on the south and rest of the west.

Belize's climate is subtropical and is tempered with trade winds. The dry seasons extends from February to May, followed by the rainy seasons which peaks in July. The coolest months in Belize are November, December and January.

Belize has a diverse ethnic population composed of Creoles, East Indians, Garifuna, , Mennonites, Mestizos, Ketchi Maya, Mopan Maya and Yucatec Maya. The 1991 Housing and Population Census showed that Mestizos and Creoles comprised 43.7 % and 29.8 % of the population respectively. The mid- year population estimates for 1998 showed that the country had a population of approximately 238,500 inhabitants including immigrants from Central America, especially from El Salvador and Guatemala. According to the population estimates, Belize's annual population growth is about 2.6 percent per annum. Despite of its growth rate, its current population is considered small for a Central American Nation of its size, with a low population density of 10 persons per $km^2$ .

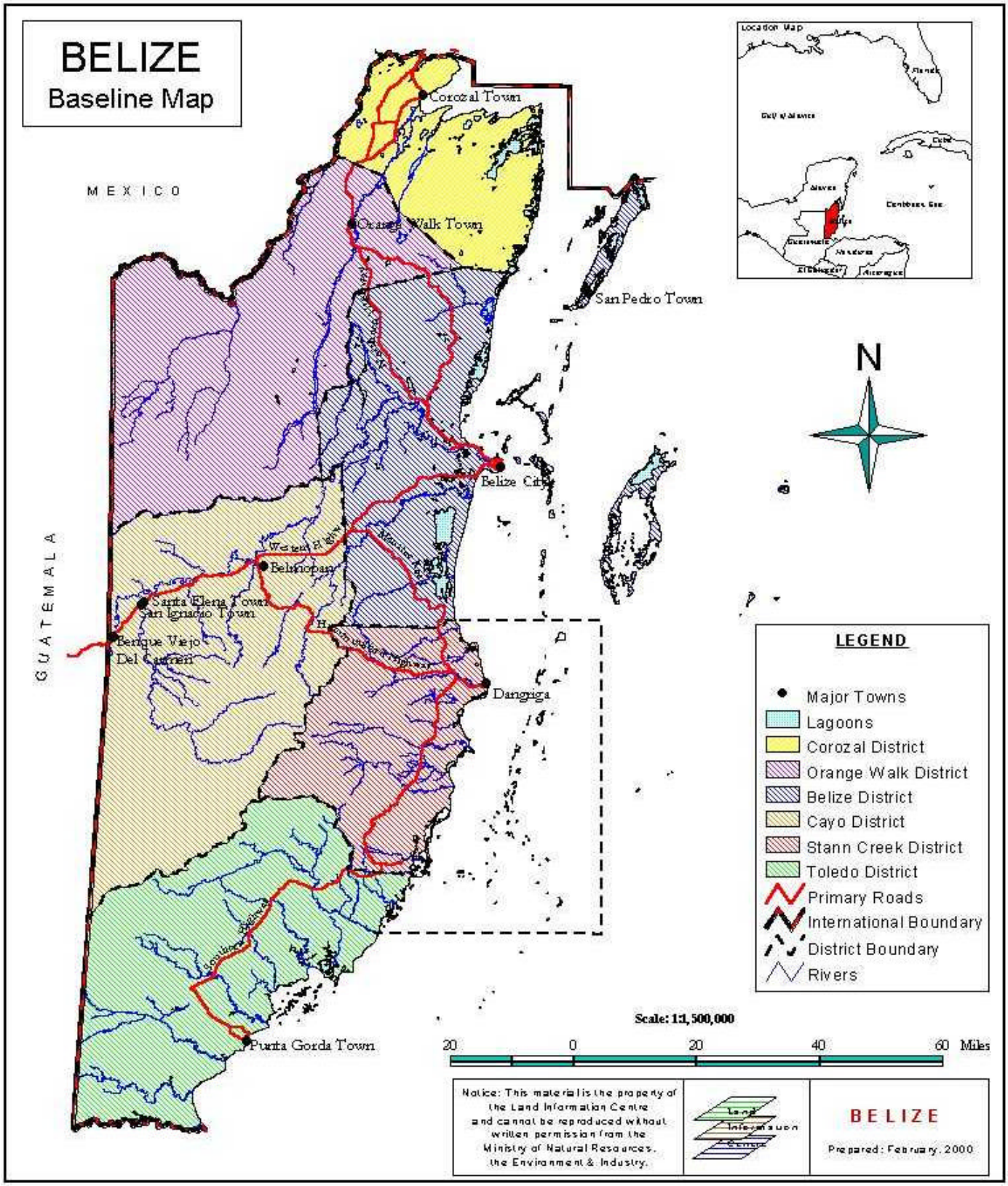
Belize is divided into six districts namely: Corozal (Czl), Orange Walk (O/W), Belize (Bz), Cayo (Cyo), Stann Creek (S/C) and Toledo (Tol). The nation has nine major urban population centers. English is the official language of the country. Spanish is the second language most often used in Belize. However, Creole (dialect) which is derived from the English language is another common means of communication throughout the country. In addition, there are ethnic groups who speak their own native language.

Belize is a small country with a Total Fertility Rate (TFR) of approximately 3.2 children per women in 1998, with the modal age group of childbearing at ages 20 to 24. In 1998, the overall Infant Mortality Rate (IMR) for the country was estimated at 21.5 deaths per 1,000 live births.

The Belizean economy grew in real terms by 6.4 % in 1999, significantly higher than the 1.6 % growth rate experienced in 1998. Like in many other developing countries there has been a move from the traditional agricultural production to the service sector. In 1999, the service activities accounted for 56.8 % of the total GDP, driven by heightened activity in the trade, tourism and transport and communications sub-sectors. The primary activities and the secondary activities contributed to 23.2 % and 23.3 % respectively. Growth in the primary sector resulted mainly from significant increases in agriculture and marine output, while the secondary sector was greatly influenced by an increase in manufacturing and construction output. The GDP per capita of Belize is estimated at about US $2,415.

The Belizean economy has been and still remains heavily dependent on external trade. In 1999, the total value of domestic exports grew by 7 % reflecting increases in both volume and earning in the traditional and non-traditional exports. Marine products, citrus concentrate and bananas had strong growth in earning, while sugar, molasses, sawn wood and garments showed a decline.

The Consumer Price Index Survey (CPI) conducted by the Central Statistical Office (CSO) revealed that the inflation rates went down in 1999 to a record of minus 1.2 %. The Labor Force Survey (LFS) conducted by the Central Statistical Office in April of 1999 indicated that unemployment rate stood at 12.8 % compared to 14.3 % a year earlier.

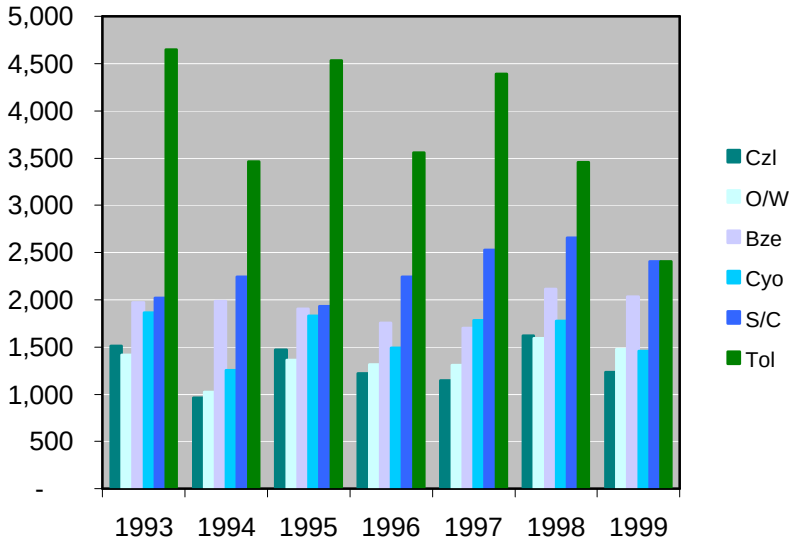



*Source: LIC, MNREI*

# CLIMATE

Northern Belize has a subtropical climate with an average annual rainfall of 1,500 mm. On the southern part of the country the climate changes from subtropical to tropical, with an average annual rainfall of 3,500 mm. The climate is characterized by a marked wet and dry season separated by a cool transition period. The rainy season extends from May/June to November and peaks in July. Approximately 60 % of the annual rainfall occurs during this period, which is produced by tropical systems, including the tropical cyclones. The cool transition period extends from November to February, with approximately 12 cold fronts occurring during this period. This transition period is followed by the dry season which extends from January/February to May. This is produced as a result of anticyclones in the Atlantic that generates a persistent stable southeasterly airflow across the country.

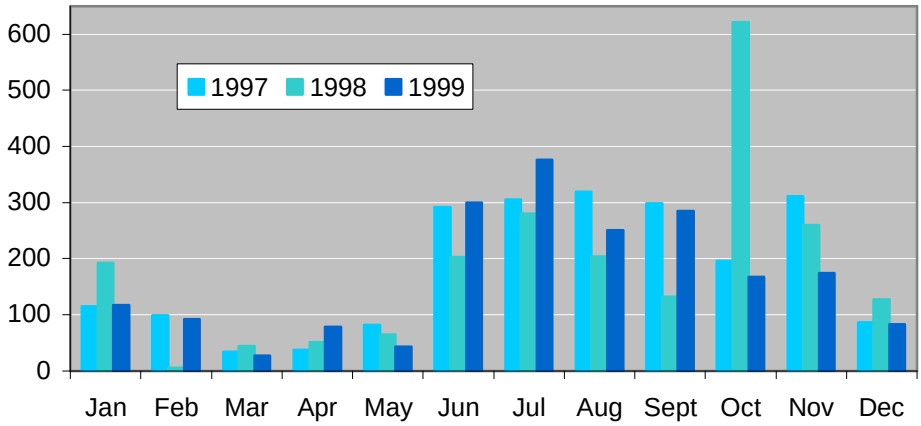
**Chart 3.1**
**Annual Rainfall (mm) by District, 1993 - 1999**




*Source: Meteorology Department*

The average annual rainfall for the country has been showing a decreasing trend from 2,239 mm in 1993 to 1,995 mm in 1999, except for 1998 when there was an increase in the average annual rainfall. The sudden increase in rainfall in 1998, refer to chart 3.2, especially for the month of October was due to the effects of hurricane Mitch that took place that same month.

**Chart 3.2**
**Belize's Annual Rainfall (mm) by Month, 1997- 1999**




*Source: Meteorology Department*

Data on the above charts refer to the stations in Consejo and Tower Hill in the north, PGIA and Central Farm in Belize Central, and Melinda and Punta Gorda in the south.

At the PGIA station, evaporation fluctuated from 4.4 mm to 5.4 mm for the years 1980 - 1999.

# CLIMATE

The mean air temperature ranges from 20°C to 31°C. Summers are some 8 degrees warmer than the winter average. The diurnal temperatures range in the interior is greater than that along the coast, where it is moderated by sea breeze. The mountainous regions are also cooler , with a fall in temperature of 10°C per kilometer above sea level. The temperature ranges in the country has been somewhat consistent throughout the years. Humidity is around 80 % throughout the year, but somewhat lower during the dry season.

**Table 4.1**
**Mean Annual Air Temperature (°C) at Phillip Goldson International Airport, 1970 - 1999**

| Year | Mean Annual Temperature | |
|---|---|---|
| | Max | Min |
| 1970-1997 | 30.2 | 22.9 |
| 1998 | 30.7 | 23.8 |
| 1999 | 30.7 | 23.7 |

*Source: Meteorology Department*

**Table 4.2**
**Monthly Air Temperature (°C) at Phillip Goldson International Airport, 1998 - 1999**

| Period | 1998 | | 1999 | |
|---|---|---|---|---|
| | Min | Max | Min | Max |
| March-April | 23.2 | 30.3 | 24.2 | 31.6 |
| May-September | 25.5 | 32.2 | 25.1 | 32.0 |
| October-February | 22.3 | 29.2 | 22.3 | 29.2 |
| **Mean Annual** | **23.8** | **30.7** | **23.7** | **30.7** |

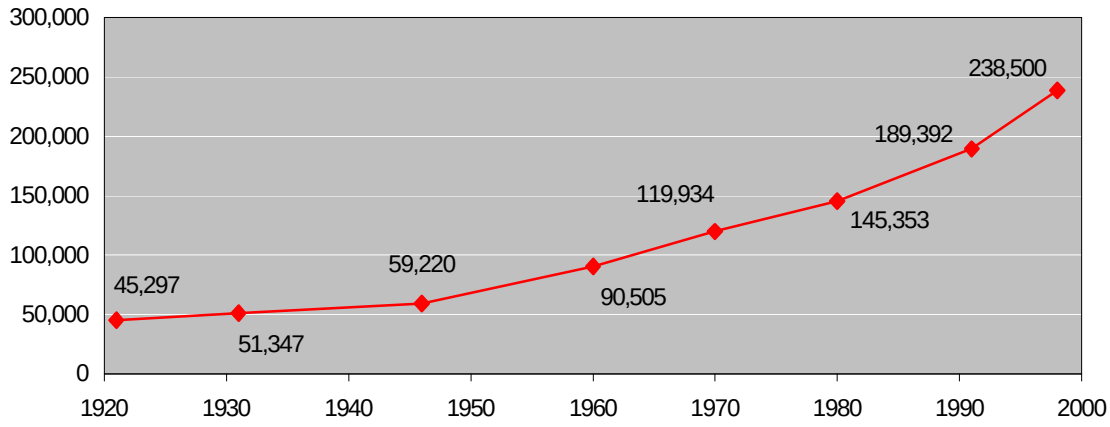
*Source: Meteorology Department*

## POPULATION

The interrelation between population growth and the environmental quality is very complex. Population growth rates can exert pressures on the environment which can affect long-term sustainability of natural resources and can also affect the quality of life. The unsustainable use of natural resources occurs if the population growth rates are faster than the rates at which the natural environment can renew itself. In addition, rapid population growth rates leads to an increase in a number of poor people which in turn lead to the degradation of the environment. Thus, environmental degradation have negative implications on the social and economic sectors of a country. In order to prevent such negative impacts proper measures, actions, planning and regulations should be put in place.

Population growth is not normally conceived as a problem in Belize. The country has one of the lowest population densities in the region, 10 inhabitants per square kilometer, and an average annual growth rate of approximately 2.6 % in 1998. However, Pulver and Nolan (1994), note this growth is largely concentrated in rural areas and when combined with the high fertility rates, 3.2 live births per woman in 1998, suggests that the country does indeed have a problem. However, the problem is not that serious when compared to the population growth problems that other developing countries are facing. This is so since more than 79 % of the country's area is still under some type of forest cover and approximately some 45.9 % of the area is under some type of protected status.

### Chart 5.1
### Population at Census Dates and Estimates for 1998




*Source: CSO*

The population of Belize has been and continues to be young showing not much change over the years. In 1991, approximately 64 % of the population (121,189 inhabitants) were at or under 25 years of age, more than 6 % were between 50 and 65, and more than 4 % were 65 and over. The 1998 mid-year estimates showed that Belize had a population of 238,500 inhabitants. In a 31 year period, the population of the country doubled from 90,505 in 1960 to 189,392 in 1991, as indicated by table 5.1.

The population growth rate was approximately 2.1 % per annum during the intercensal period of 1970-1980 and it increased to approximately 2.6 % per annum during the intercensal period 1980-1991.

In 1991, there were 37,943 houses mostly made out of wood and having sheet metal roofing. This shows the stress exerted to the natural resources for housing construction.

## POPULATION

### Table 6.1
### Population at Census Dates and Estimates by District and Subdivisions, 1946 - 1998

| District and Subdivisions | 1946 | 1960 | 1970 | 1980 | 1991 | 1998[(1)] |
|---|---|---|---|---|---|---|
| **Country Total** | **59,220** | **90,505** | **119,934** | **145,353** | **189,392** | **238,500** |
| Urban | 33,073 | 48,768 | 65,025 | 76,277 | 90,005 | 120,110 |
| Rural | 26,174 | 41,737 | 54,909 | 69,076 | 99,387 | 118,390 |
| **Corozal District** | **6,773** | **9,730** | **15,551** | **22,902** | **28,464** | **32,510** |
| Corozal Town | 2,190 | 3,171 | 4,724 | 6,899 | 7,062 | 8,085 |
| Rural | 4,583 | 6,559 | 10,827 | 16,003 | 21,402 | 24,425 |
| **Orange Walk District** | **5,520** | **10,306** | **17,041** | **22,870** | **30,681** | **39,570** |
| Orange Walk Town | 1,395 | 2,157 | 5,698 | 8,439 | 11,014 | 15,505 |
| Rural | 4,125 | 8,149 | 11,343 | 14,431 | 19,667 | 24,065 |
| **Belize District** | **26,781** | **40,084** | **49,355** | **50,801** | **57,030** | **70,355** |
| Belize City | 21,886 | 32,867 | 39,050 | 39,771 | 44,087 | 55,810 |
| San Pedro | | | | 1,125 | 1,849 | 3,435 |
| Rural | 4,895 | 7,217 | 10,305 | 9,905 | 11,094 | 11,110 |
| **Cayo District** | **7,370** | **11,764** | **15,975** | **22,837** | **37,693** | **49,440** |
| San Ignacio/Santa Elena | 1,548 | 1,890 | 4,336 | 5,616 | 8,962 | 11,570 |
| Benque Viejo | 1,264 | 1,607 | 1,921 | 2,435 | 3,580 | 6,200 |
| Belmopan | | | 274 | 2,935 | 3,558 | 7,105 |
| Rural | 4,558 | 8,267 | 9,444 | 11,851 | 21,593 | 24,565 |
| **Stann Creek District** | **6,373** | **10,906** | **13,023** | **14,181** | **18,085** | **23,965** |
| Dangriga Town | 3,414 | 5,287 | 6,939 | 6,661 | 6,435 | 7,390 |
| Rural | 2,959 | 5,619 | 6,084 | 7,520 | 11,650 | 16,575 |
| **Toledo District** | **6,403** | **7,715** | **8,989** | **11,762** | **17,439** | **22,660** |
| Punta Gorda Town | 1,376 | 1,789 | 2,083 | 2,396 | 3,458 | 5,010 |
| Rural | 5,027 | 5,926 | 6,906 | 9,366 | 13,981 | 17,650 |

*(1) represents 1998 mid -year population estimates*
*Source: CSO*

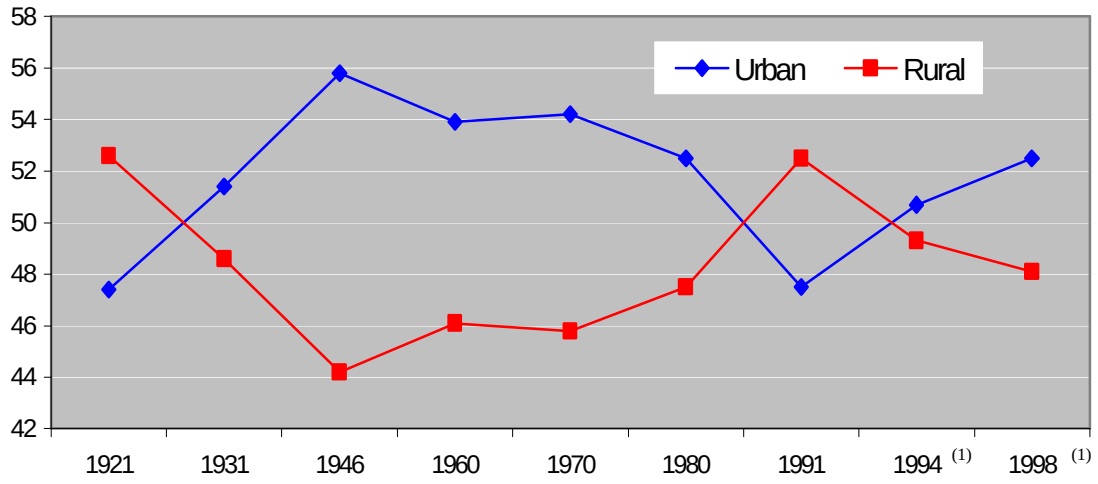
One way of examining the population growth and its impact on the environment is by looking at the urban-rural distribution. This indicator is linked to other demographic indicators, particularly urban population growth rate, to economic indicators and environmental indicators such as solid waste production and pollution. In 1921, Belize had a slightly larger rural population (47.4%) than urban. However, results from the Censuses that followed, 1931-1980, showed that there was a slight change towards urbanization. The greatest changed was observed in 1946 when there was a 55.8 % urban distribution. The trend changed, however, in the 1991 Census when rural distribution reached more than 52 %. More recent data from the surveys conducted by the Central Statistical Office indicate yet another reversal of this trend showing a trend towards urbanization again ( table 6.1 and chart 7.1).

While urban areas increased as a whole by 18 % from 1980 to 1991 rural areas increased by almost 43 % during the same period with Cayo Rural experiencing the highest increase (82.2 %). Another import point to mention is that Dangriga Town showed a negative population growth for that same period. A possible explanation is that people are migrating to urban areas, especially Belize City, in search of better job opportunities.

Belize City is the most developed urban area with the highest percentage of population, 23.4 %. This is not surprising since Belize City is the center for commercial and industrial activity. Due to this there is a great migration of rural people migrating to the city in search for better job opportunities and better living standards.

# POPULATION

## Chart 7.1
## Percentage of Urban and Rural Population Distribution at Census Dates, 1921 - 1998




*(1) represents mid -year population estimates for 1994 and 1998*
*Source: CSO*

## Table 7.2
## Population Density by District, 1970 - 1998

| District | Area in sq. Km. | Density per square Kilometer | | | |
|---|---|---|---|---|---|
| | | 1970 | 1980 | 1991 | 1998 |
| Corozal | 1,860 | 8.36 | 12.32 | 16.05 | 17.48 |
| Orange Walk | 4,636 | 3.68 | 4.93 | 6.91 | 8.54 |
| Belize | 4,307 | 11.46 | 11.79 | 13.24 | 16.33 |
| Cayo | 5,196 | 3.07 | 4.40 | 7.38 | 9.52 |
| Stann Creek | 2,554 | 5.10 | 5.55 | 7.19 | 9.38 |
| Toledo | 4,413 | 2.04 | 2.67 | 4.16 | 5.13 |
| **Total** | **22,966** | **5.22** | **6.33** | **8.45** | **10.39** |

*Source: CSO*

Population density measures the concentration of the human population in reference to space. Higher or growing population densities can threaten the sustainability of natural resources especially those that are ecologically fragile. Higher population densities means more solid waste production, higher levels of water contamination, air pollution thus human health is also affected. Thus, there is more local demand for employment, housing, services and for environmental infrastructure for sanitation and waste management.

The population density of the country in 1998 was approximately 10 inhabitants per square kilometer doubling the population density registered in 1970 (refer to table 7.2). The districts with the highest population densities have been and continues to be Corozal and Belize Districts with a density of approximately 17 and 16 inhabitants per $Km^2$ respectively. Toledo District has always been and continues to be the district with the lowest population density.

## HOUSEHOLDS AND THE ENVIRONMENT

The Labour Force Survey (LFS) is designed to collect information on the size and composition of the labour force. The Central Statistical Office (CSO) has carried out at least one round of Labour Force Survey since April 1993. Annually data collection has taken place at the national level over a four week period which deals mostly with the population 14 years of age and over since this age group is deemed to be the Working Age Population (WAP). It is the only sample survey directed to approximately 4,000 households selected at random in all districts of Belize.

In addition, CSO has occasionally expanded the LFS questionnaire to include modules used to collect data in other areas of interest, such as, *infant mortality*, *tourism*, *literacy* and in the previous survey a section on the *Environment* was included. The *results from questions on the Environment in April 1999 LFS*, are reported here.

In addition to the data reported in the tables and charts, it was found that 4% of the household use private generators, most often sharing with another household. In the rural areas 7 % of the household used private generators.

### Table 8.1
### Method of Household Waste Disposal by District and Urban/Rural Percentages, 1999

| Type | Czl | O/W | Bze | Cyo | S/C | Tol | Urban | Rural | Total |
|---|---|---|---|---|---|---|---|---|---|
| Municipal collection | 30 | 41 | 80 | 47 | 35 | 2 | 87 | 11 | 49 |
| Public Dump | 13 | 7 | 3 | 7 | 16 | 32 | 7 | 14 | 10 |
| Dump in own yard | 1 | 1 | 4 | 2 | 5 | 8 | 2 | 4 | 3 |
| Burn it | 55 | 43 | 9 | 39 | 28 | 50 | 3 | 60 | 32 |
| Bury it | 1 | 3 | 2 | 3 | 10 | 6 | 0 | 7 | 4 |
| Throw in Stream/Sea | 0 | 0 | 0 | 0 | 1 | 1 | 0 | 0 | 0 |
| Other | 0 | 4 | 0 | 1 | 4 | 0 | 0 | 3 | 1 |
| Not stated | 0 | 1 | 2 | 2 | 1 | 1 | 1 | 1 | 1 |
| Total | 100 | 100 | 100 | 101 | 100 | 100 | 100 | 100 | 100 |
| **H/H total** | **7,470** | **7,590** | **17,565** | **9,605** | **6,605** | **4,985** | **27,220** | **26,600** | **53,820** |

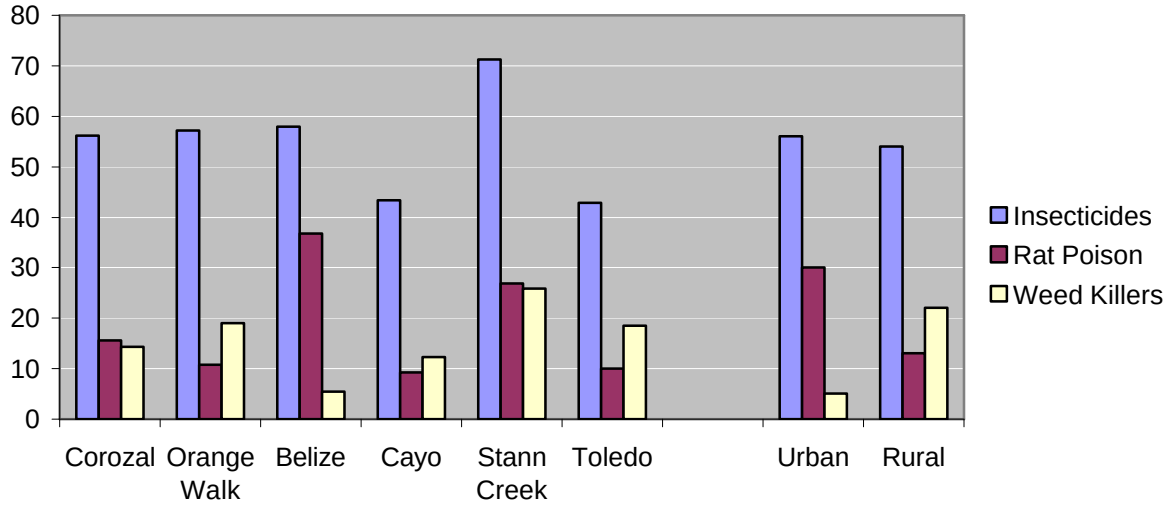
*Source: CSO*

The Labour Force Survey shows that 49 % of the total households in Belize dispose of their waste through the municipal collection system and 32 % dispose of their garbage by burning it. 87 % of the urban households dispose their garbage through the municipal collection process. More recently the waste collection system for the municipalities has been privatized. In Belize City, for example, 80 % of the household are disposing their garbage through the municipal collection system, while in Punta Gorda Town only 2 % of the households are presently disposing their garbage through the collection system. In the rural areas the case is different, 60 % of the household dispose there waste by burning it since they don't have the facilities that are provided in the urban areas.

The LFS data on the next page shows that out of the total households in Belize about 55 % use some type of insecticide. Insecticide is frequently used in Stann Creek District with 71 % of the households using it. Rat poison is used more frequently in urban areas. In fact the highest users are in Belize and Stann Creek Districts with 37 % and 27 % respectively. About 13 % of the rural household uses rat poison. On the other hand, weed killers are mostly used in the rural areas with 22 % of the households using them, while only 5 % of the urban households use weed killers.

## HOUSEHOLDS AND THE ENVIRONMENT

### Chart 9.1
### Households Using Toxic Substances by District and Urban/Rural, Percentages, 1999




*Source: CSO*

### Table 9.2
### Environmental Concerns in Households by District and Urban/Rural, 1999

| Environmental Concern | Czl | O/W | Bze | Cyo | S/C | Tol | Urban | Rural | Total |
|---|---|---|---|---|---|---|---|---|---|
| Deforestation | 710 | 2,660 | 1,885 | 2,265 | 1,150 | 970 | 4,450 | 5,190 | 9,640 |
| Destruction of Mangroves | 300 | 75 | 1,945 | 500 | 820 | 300 | 2,330 | 1,605 | 3,935 |
| Soil Erosion | 185 | 105 | 925 | 820 | 980 | 715 | 1,420 | 2,310 | 3,730 |
| Overfishing | 185 | 170 | 1,465 | 420 | 365 | 300 | 1,615 | 1,285 | 2,900 |
| Water Contamination | 1,585 | 2,365 | 3,615 | 4,155 | 2,790 | 1,820 | 6,740 | 9,595 | 16,335 |
| Air Pollution | 2,485 | 1,670 | 3,830 | 2,140 | 1,670 | 510 | 5,295 | 7,010 | 12,305 |
| Careless Waste Disposal | 3,270 | 4,095 | 8,960 | 4,470 | 2,630 | 1,700 | 14,020 | 11,110 | 25,130 |
| Careless use of Pesticides | 1,195 | 1,745 | 1,580 | 865 | 1,005 | 510 | 2,470 | 4,430 | 6,900 |
| Effects of Mass Tourism | 30 | 105 | 385 | 105 | 155 | 75 | 570 | 285 | 855 |
| Squatting | 255 | 665 | 1,295 | 405 | 315 | 135 | 2,020 | 1,050 | 3,070 |
| Drainage | 680 | 2,090 | 6,740 | 1,535 | 1,790 | 420 | 9,435 | 3,820 | 13,255 |
| Burning/Smoke | 60 | 185 | 40 | 105 | 0 | 0 | 165 | 225 | 390 |
| Other | 565 | 30 | 370 | 280 | 35 | 15 | 895 | 395 | 1,290 |
| Not Stated | 2,040 | 1,455 | 3,350 | 2,115 | 1,445 | 1,520 | 5,700 | 6,230 | 11,930 |
| **Total number of H/H[(1)]** | **7,470** | **7,590** | **17,565** | **9,605** | **6,605** | **4,985** | **27,220** | **26,600** | **53,820** |

*(1) - Totals do not equal the sum of items in each column because more than one item may be specified.*
*Source: CSO*

Based on the survey responses of April 1999, 78 % of the Belizean population aged 14 years and over were concerned about at least one environmental problem.

The survey also indicated that, by a substantial margin, the greatest environmental concern was careless waste disposal (47 %) followed by water contamination (30 %) and burning/smoke was the least environmental concern for Belizeans.

# LAND USE AND AGRICULTURE

Land use is one of the fundamental issues when considering the environment. The environment has undergone tremendous changes as a direct result of land use change over the past years. The increasing human demand for land, especially for agricultural purposes is creating pressures on our forests. Clearing of forests for agriculture use, the use of prime agricultural land for road and human settlements, and the degradation of soils through certain agricultural practices are all examples of forest degradation to fit human needs. The loss of forest land in particular may have negative effects on biodiversity, since habitats for some species could be critically reduced.

Agriculture is the human activity which perhaps interacts most widely with the natural environment, through land use, dependence on ground and surface water supply and impacts on the ecosystems. Agriculture is the most extensive form of land use in Belize. The economic and social importance of agriculture, coupled with the sector's dependence and impact on the environment, highlights the need to recognize the linkages between each of these elements in shaping the agricultural processes in Belize. The impact of agricultural activities on the environment has attracted the attention of the general public, politicians and decision makers. Agricultural systems have special importance in the Belizean economy and its social life also.

The clearance of native vegetation, especially for agricultural purposes has been, and continues to be the major factor leading to a decline in biodiversity. The transformed landscape is recognized to be, in most cases, more susceptible than natural ecosystems to various kinds of land degradation including: erosion by water and wind, soil salinization, soil acidification and soil structure decline.

Where land degradation processes are accelerated by agricultural land use, the probability of a deterioration in the quality of water resources is usually increased as soil and soil nutrient may contaminate water body system.

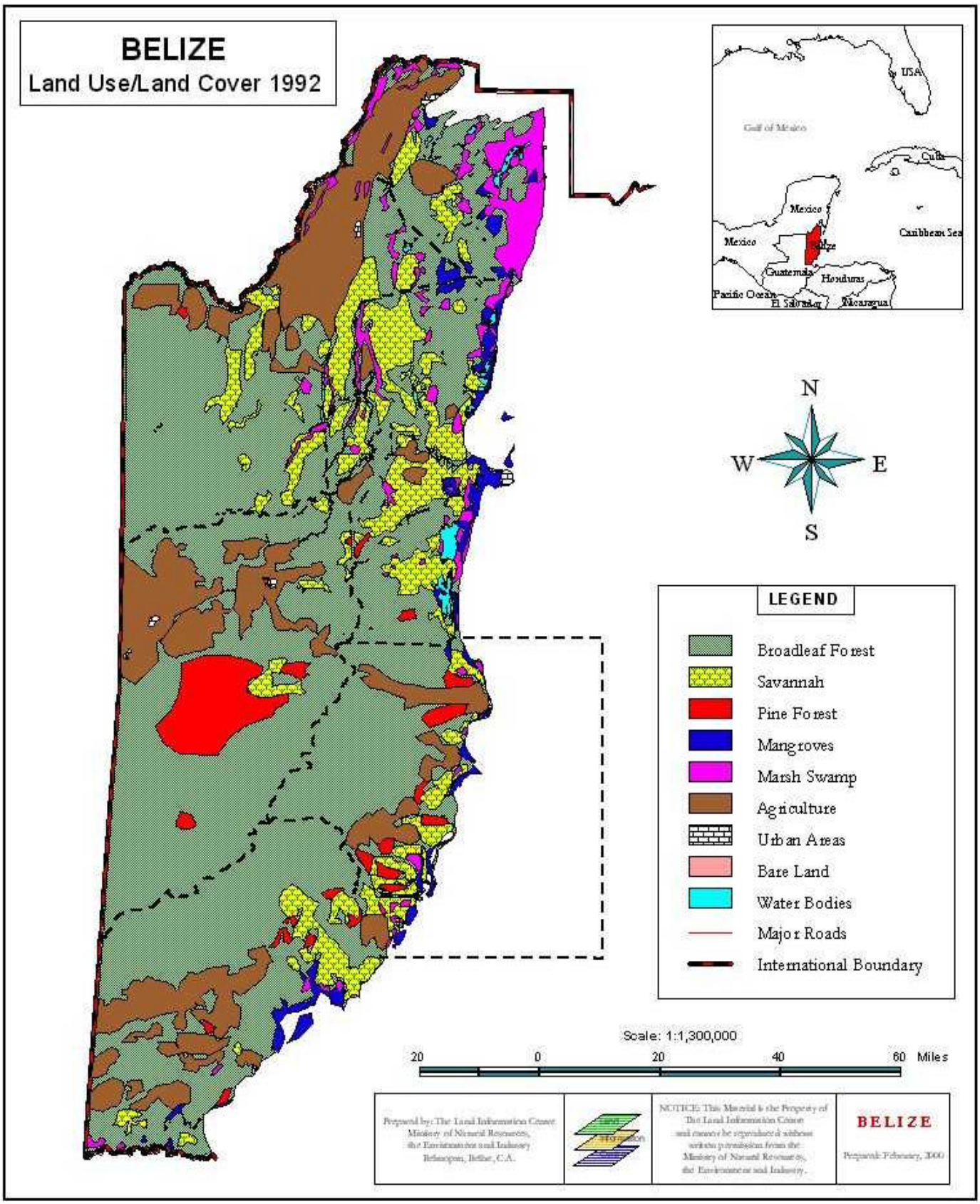
Agricultural activities generates many desirable outputs including agricultural commodities, export income, employment and tourism. Not all outputs, however, have been so positive. Agricultural wastes may flow into the wider environment and interact with the natural ecosystems. These wastes include –off or seepage of fertilizers and manure, greenhouse gas emission and a range of manufactured chemicals which may stay in the soil, enter waterways or remain in the agricultural products. Hence, waste outputs with the use of manufactured fertilizers and chemicals for agriculture have a potential threat to the natural environment, domestic stocks and human health.

## Table 10.1
## Summary of Land Use of Belize, 1989/92

| Type of Land Use | Area (acres) | % of Land Cover |
|---|---|---|
| Urban Areas | 20,646 | 0.4 |
| Agricultural Land | 535,778 | 10.0 |
| Range Land | 474,917 | 8.8 |
| Forest and Other Wooded Areas | 4,250,366 | 79.0 |
| Unproductive land | 98,707 | 1.8 |
| **Total** | **5,380,414** | **100.0** |

*Source: The Land Use of Belize 1989/92,LIC, MNREI*

Belize has been and continues to be a country of great natural resources especially forest products. Some 79 % of the country's area is still under some type of forest cover. Agricultural land makes up some 10 % of the country's land mass.




*Source: LIC, MNREI*

# LAND USE AND AGRICULTURE

## Table 12.1
## Potential Agricultural Land by District Including Protected Areas and Forest Reserves, 1989/92

| District | Area (acres) | | | | |
|---|---|---|---|---|---|
| | Grade 1(1) | Grade 2(2) | Grade 3(3) | Grades 4&5(4) | Total Area |
| Corozal | 0 | 184,253 | 63,841 | 211,455 | 459,549 |
| Orange Walk | 1,584 | 300,948 | 384,165 | 458,976 | 1,145,673 |
| Belize | 42,888 | 65,114 | 165,380 | 791,006 | 1,064,388 |
| Cayo | 102,712 | 64,711 | 197,716 | 918,783 | 1,283,922 |
| Stann Creek | 31,552 | 46,068 | 47,608 | 505,852 | 631,080 |
| Toledo | 65,731 | 29,565 | 248,847 | 746,487 | 1,090,630 |
| **Total** | **244,475** | **690,659** | **1,107,557** | **3,632,559** | **5,675,242** |

*(1) - high income potential*
*(2) - good chance of financial success*
*(3) - success subject to skilled management*
*(4) - includes marginal land (4) and steep slopes (5)*
*Source: Mission findings based on King et al, 1993*

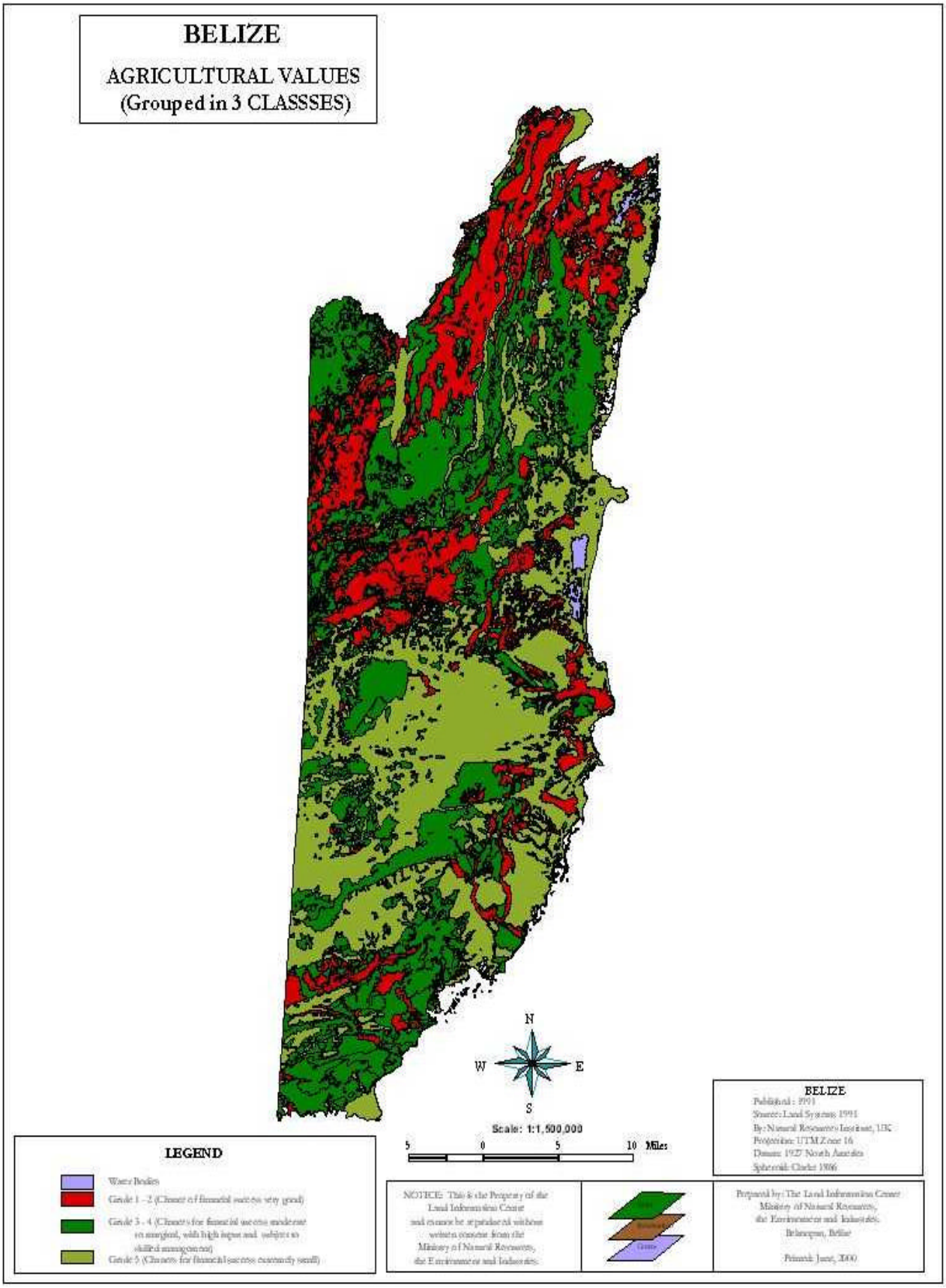
## Table 12.2
## Areas Under Main Crops ('000 acres), 1980 - 1999

| Crops | Area | | | | | |
|---|---|---|---|---|---|---|
| | 1980 | 1985 | 1990 | 1995 | 1998 | 1999 |
| Sugar Cane | 61 | 58 | 59 | 65 | 60 | 57 |
| Oranges | - | 10 | 31 | 48 | 56 | 63 |
| Grapefruit | - | 3 | 9 | 8 | 9 | 11 |
| Corn | 26 | 32 | 24 | 26 | 35 | 36 |
| Rice | 8 | 6 | 5 | 11 | 13 | 11 |
| RK beans | 6 | 5 | 10 | 8 | 11 | 11 |
| Bananas | 2 | 2 | 6 | 5 | 4 | 5 |
| **Total** | **103** | **116** | **144** | **171** | **187** | **194** |
| Other crops | - | - | 14 | 15 | 18 | 24 |
| **Grand Total** | **103** | **116** | **158** | **186** | **205** | **218** |

*Source: Ministry of Agriculture, Fisheries and Cooperatives*

The total land area of Belize is approximately 5.7 million acres or 22,966 $km^2$. Out of which some 17 % of the total land area is suitable for sustained agricultural production without skilled management (grade 1 and grade 2). About 34 % of the high potential agricultural land ( Grade 1 and Grade 2) is under some type of cultivation while the rest of the high potential land is held undeveloped land as public or private.

The agriculture sector is and will continue to be a very important factor in the economy of Belize. This sector consists mainly of three export crops; sugarcane, citrus, and bananas. Milpa farming is an agricultural system in which forest land is cleared and burned, cropped for one or more seasons and then left in fallow for a period of time. Milpa farming is found throughout Belize and is the traditional system used to produce food for domestic consumption and to supplement income generating activities, such as commercial products like sugarcane, citrus, banana and vegetables. The average yearly increase in area of main crops is approximately 6.1 % as reported by the district agricultural officers. The largest increase in area under cultivation was for the citrus industry with a 13.8 % increase in 1999.




*Source: LIC, MNREI*

## LAND USE AND AGRICULTURE

### Table 14.1
### Production of Main Agricultural Crops, 1980 - 1999

| Agricultural Crop | 1980 | 1985 | 1990 | 1995 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Sugar Cane ('000 L tons) | 1,014 | 962 | 1,072 | 1,025 | 1,160 | 1,163 |
| Oranges ('000 90 lb box[(1)]) | 1,109 | 1,043 | 1,696 | 3,133 | 3,880 | 4,455 |
| Grapefruit ('000 80 lb box[(1)]) | 408 | 476 | 1,103 | 1,214 | 1,236 | 1,328 |
| Corn ('000 lbs) | 41,500 | 43,280 | 41,162 | 62,180 | 82,908 | 87,387 |
| Rice ('000 lbs) | 19,000 | 12,334 | 10,172 | 21,227 | 20,838 | 26,204 |
| RK beans ('000 lbs) | 3,073 | 2,343 | 5,660 | 6,925 | 6,905 | 8,538 |
| Bananas ('000 40 lbs box) | 803 | 555 | 1,486 | 2,453 | 2,856 | 3,097 |

*(1) denotes crop year*

*Source: Ministry of Agriculture, Fisheries and Cooperatives*

In 1999, contribution of agriculture to the GDP was approximately 15.2 %. Even though, agriculture is of significance to the economy, provides agricultural commodities, export income and employment, care is needed to avoid this sector in becoming major threat to our natural resources, wildlife and human society. Agriculture is a sector that employs a large percentage of the labour force in the country.

Although there was an increase of 3.7 % in the area under main crops for 1999, production was much higher than that of 1998. The major increases in production for the year 1999 were in rice (25.7 % increase), RK beans (23.6 % increase) and orange (14.8 % increase) production. Increased food production is usually related to increased land use, resource use, solid waste production, fertilizer and pesticide use which can affect the environmental quality.

### Table 14.2
### Livestock Slaughtered, 1980 - 1999

| Livestock | 1980 | 1985 | 1990 | 1995 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Poultry (mn) | 1.3 | 2.0 | 3.9 | 4.4 | 4.5 | 5.6 |
| Cattle[(1)] | 6,600 | 7,600 | 7,900 | 8,200 | 8,200 | 8,300 |
| Pigs[(1)] | 6,500 | 6,400 | 11,600 | 12,100 | 14,000 | 15,000 |

*(1) figures for cattle and pigs slaughtered are rounded off to the nearest 100*

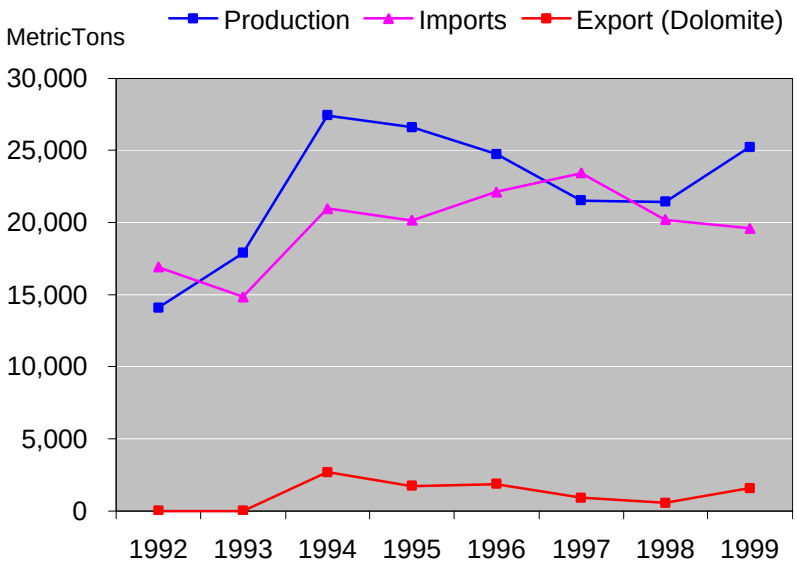
*Source: Ministry of Agriculture, Fisheries and Cooperatives*

There is no reliable data on the number of poultry, cattle or pigs. However, the Ministry of Agriculture, Fisheries and Cooperatives have data for the livestock slaughtered. In a ten year period, the poultry slaughtered increased four times the amount of 1980, cattle and pigs slaughtered increased by 25 % and 130 % respectively from 1980 to 1999.

The rearing of animals as an agricultural activity removes nutrients from the soil through feeding, which are replaced almost simultaneously in the form of manure. In addition to solid waste deposited by farm animals gases such as methane, carbon dioxide, ammonia, etc. are also emitted. The most important of them is methane which contributes to climate change (refer to section on climate change for additional information).

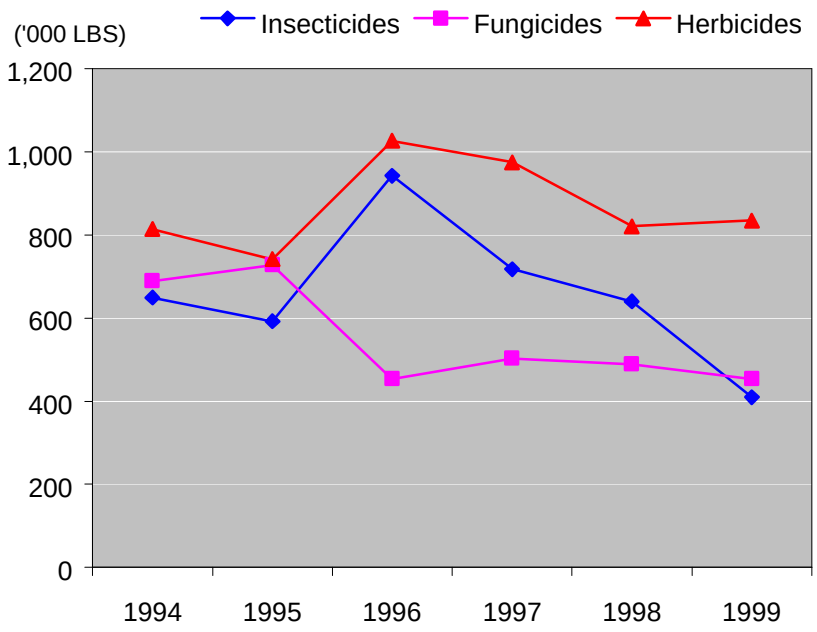
# LAND USE AND AGRICULTURE

**Chart 15.1**
**Fertilizer Production, Imports and Exports, 1992 - 1999**




*Source: CSO*

**Chart 15.2**
**Imports of Selected Agricultural Chemicals, 1994 - 1999**




*Source: CSO*

A variety of fertilizers and pesticides are employed by farmers to increase production by facilitating rapid, healthy growth of their crops and livestock and eliminating competing species of plants and animals. Soil and rainfall are vital elements determining the level of agricultural production. However, careful management of soil resources is also important in optimizing production. Sufficient and balanced use of fertilizers, lime, and use of legumes and pasture rotation, help to replace soil nutrients lost during the production process. Fertilizer use in Belize is extensive since most of the fertilizer produced and imported is used for agriculture activities with the inclusion of the aquaculture industry. The main threat of fertilizers is that it can lead to eutrophication which is a condition where an enrichment in mineral and organic matter in a water body reduces its oxygen content and light absorption to a point where it cannot sustain life.

The range of agricultural chemicals includes pesticides to kill or control insects (insecticides), mould (fungicides) and weeds (herbicides). The quantity, strength and type of chemical applied depends not only on the breed or variety of crop, but also on factors such as climate, season, geography, etc..

# LAND USE AND AGRICULTURE

**Table 16.1**
**National Pesticides Certification Program, 1997 - 1999**

| District | 1997 | 1998 | 1999 |
|---|---|---|---|
| Corozal | 32 | 77 | 297 |
| Orange Walk | 95 | 78 | 173 |
| Belize | 122 | 33 | 32 |
| Cayo | 58 | 91 | 199 |
| Stann Creek | 544 | 94 | 161 |
| Toledo | 477 | 196 | 109 |
| **Total** | **1,328** | **569** | **971** |

*Source: Pesticides Control Board*

The National Pesticide Certification Program for the use of Restricted Use Pesticide was introduced in 1996. In the year of introduction, 5,128 farmers were trained in the classification of, and the safe handling and rational use of pesticides throughout the districts of Cayo, Orange Walk and Corozal. Of these 3,081 were certified. Most of those who were trained and not certified, are still able to use pesticides in the appropriate manner, the only requirement that they needed to get certified was the final certification examination.

**Table 16.2**
**Licenses for Agriculture and Domestic Pesticide Distributors, 1995 - 1999**

| Year | Agricultural | Domestic |
|---|---|---|
| 1995 | 57 | 633 |
| 1996 | 35 | 431 |
| 1997 | 34 | 326 |
| 1998 | 38 | 391 |
| 1999 | 38 | 407 |

*Source: Pesticides Control Board*

All aspects of the importation, manufacture, distribution, sale, use and disposal of pesticides in Belize, are regulated by the Pesticides Control Board (PCB). In 1999, there was a slight increase in the number of licenses for domestic pesticide distributors. The number of licenses to agriculture and domestic pesticide distributors has been showing a slight increase for 1998 - 1999 after a sharp decrease in 1996 and 1997.

The pesticides with restricted use in Belize are only to be purchased and used by certified applicators.

## LAND USE AND AGRICULTURE

### Table 17.1
### Restricted Use Pesticides in Belize, 1999

| | | |
|---|---|---|
| Aldrin 5 g | Forator FC 15 GR | Nudrin 90 SP |
| Asuntol 50 % liquid | Furadan 10 GR | Penncap M |
| Asuntol %0 % Dust | Gramaxone Super 20 SL | Phostoxin |
| Azodrin 60 SL | Gramuron X | Preglone 20 SL |
| Basudin 60 EW | Lannate L | Quickphos |
| Counter 10 G | Lannate 90 SP | Reglone 20 SL |
| Counter FC 15 GR | Larvin 37.5 SC | Rugby 10 G |
| Diazinon 60 EC | Lebaycid 50 EC | Semevin 35 AF |
| Disafos 15 G | Metasystox R 25 EC | Super Pro-Quat |
| Disyston 10 GR | Metasystox R 50 SL | Tamaron 40 SL |
| Ethion 48 EC | Mocap 15 G | Tamaron 60 SL |
| Folidol 2 DP | Monocrotophos 60 G/L Technical (Procron) | Temik 15 G |
| Folidol M 45 SC | Nemacur 15 EC | Vydate L |
| Folidol 48 EC | Nemacur 40 EC | Woolman Concentrate 72 % |

*Source: Pesticides Control Board*

### Table 17.2
### Greenhouse Gases Emitted in the Land Use and Forestry Sector, 1994

| GHG | Emissions by weight (Gg) | Global Warming Potential | Emissions by Global Warming Potential (Gg) |
|---|---|---|---|
| $CO_2$ (net)[1] | -4174.3 | 1 | -4174.3 |
| $CO_2$ (gross)[2] | 1992 | 1 | 1992 |
| $CH_4$ | 6.5 | 24.5 | 159.2 |
| $N_2O$ | 0.04 | 320 | 12.8 |
| $NO_x$ | 1.6 | | N/A |
| CO | 56.6 | | N/A |
| NMVOC | | | N/A |
| $SO_2$ | | | N/A |
| **Total** | **2056.4** | | **2164.4** |
| **% Gross** | **69** | | **67** |

*N.B. 1 represents emissions*
*2 represents emissions less absorption*
*1 Gg = 1,000 tons.*
*Source: Belize Climate Change Project Report, 2000*

The 1994 inventory of GHGs emitted in the forestry and land use sector revealed that Belize was actually a net sink for Carbon Dioxide ($CO_2$). A gross volume of 6,165.9 Gg of $CO_2$ was removed from the atmosphere due to the existence of 696,650 acres of forest and vegetation cover. 69 % of the total volume of $CO_2$ emitted in this sector was produced and released as a result of human induced activities, change of forest areas to other uses (usually agricultural or residential expansion. The other most significant GHGs emitted were CO (56.6 Gg) and methane (6.5 Gg).

## MINING

Several economically important minerals are known to exist in Belize, but only dolomite and limestone has been found in commercial quantities. These are in economical quantities that Belize Minerals Limited exports to the Windward Islands. Gold is known to occur but in small scale and large scale prospecting has been inconclusive. Small scale prospecting and mining is proposed under the Geo-tourism project. In addition, the foreign oil companies have been exploring for petroleum in Belize.

It is clear that in Belize most of the present mining/quarrying is for construction materials. Due to the rapid development of houses and infrastructure in the entire country, the demand for these materials increases every year. The information provided on table 18.1 reflects production for only certain companies that report their activities. Dolomite occurs in commercial quantities near Punta Gorda and elsewhere in Toledo District.

### Table 18.1
### Mining by Major Categories, 1993 - 1999

| Year | Total Volume (cu. yds.) | | | | | Dolomite |
|---|---|---|---|---|---|---|
| | Sand/Gravel | Limestone agg. | Stone | Clay/Fill | Limesand/silt | (metric tons) |
| 1993 | 62,306 | 159,450 | 1,619 | - | - | 3,543 |
| 1994 | 55,307 | 151,172 | 264 | - | - | 6,815 |
| 1995 | 66,857 | 182,462 | 291 | - | - | 4,956 |
| 1996 | 83,269 | 164,175 | 1,429 | 74,902 | - | 6,740 |
| 1997 | 90,610 | 214,333 | 1,019 | 106,217 | - | 3,507 |
| 1998 | 254,266 | 189,258 | 894 | 122,312 | 113,656 | 3,198 |
| 1999 | 100,821 | 213,514 | 2,613 | 74,645 | 282,512 | 5,740 |

*Source: Geology and Petroleum Department , MNREI*

### Table 18.2
### Mining Operation Permits, 1991 - 1999

| Year | Small Scale Quarry Permits | Large Scale Mining Licenses |
|---|---|---|
| 1991 | 60 | 21 |
| 1992 | 44 | 19 |
| 1993 | 43 | 22 |
| 1994 | 36 | 28 |
| 1995 | 49 | 49 |
| 1996 | 48 | 40 |
| 1997 | 55 | 49 |
| 1998 | 56 | 52 |
| 1999 | 64 | 49 |

*Source: Geology and Petroleum Department, MNREI*

After a sharp increase in 1995, the mining operation permits have shown slight increases for the past years, except for a slight decrease registered in 1996. The greatest number of mining operation permits was registered in 1999.

### Table 18.3
### Offshore Dredging, 1995 - 1999

| Year | Mining Licenses | Quarry Permits | Total Volume (cu. yds) |
|---|---|---|---|
| 1995 | 5 | 15 | 197,367 |
| 1996 | 2 | 5 | 348,900 |
| 1997 | 2 | 14 | 80,250 |
| 1998 | 7 | 13 | 111,546 |
| 1999 | 8 | 19 | 282,512 |

*Source: Geology and Petroleum Department, MNREI*

Offshore dredging includes all types of material being extracted. Dredging is often a source of conflict to the conservation of natural resources in coastal areas. In 1996, the total volume of extracted material during offshore dredging increased by 1.7 times the volume of 1995. A sharp decrease in the volume of material extracted was registered in 1997 then in 1998 the situation changed when there was an increase. In 1999, there was another increase, an increase of approximately 2.5 times the amount of 1998.

# FOREST

The term *forest* encompass an enormous range of habitats, ranging from elfin clouds forests a few meters tall to a 50 meter high stands of wood and from single species coniferous plantations to tropical moist forest of extraordinary complexity. The forest has *Economic*, *Environmental* and *Social* roles. Some of the economic uses of forests includes the provision of raw material for the forest industries, timber production, pharmaceutical products, provision of energy and food. The environmental function of forest includes conserving the soil, controlling floods, and flow of water, rehabilitation of land and genetic conservation. The social roles of forests includes employment creation, provision of areas that can generate income, e.g. tourism and forest contribution to human and animal health.

Forests are renewable and when managed in a way that is compatible with environmental conservation, can produce goods and services to assist in development.

There is increasing human population pressure on the forest. Conversion of forest land to agriculture land, unsustainable logging, urban and industrial expansion and increasing demand for fuel wood are the physical causes of deforestation in many parts of the world. Damage and loss of forests causes soil erosion, reduces biological diversity and wildlife habitats and other products available for human development. It also reduces the number of trees that can retain carbon dioxide, a greenhouse gas, thus contributing to the so called Greenhouse Effect. There has also been losses in genetic variation due to overexploitation, pollution introduction of exotics and artificial breeding and climate change. In addition, there is a need to conserve biodiversity for ethical and ecological reasons and to restore the ecological balance and to provide for human needs.

The contribution of the natural environment to the economic development of a country is very difficult to measure in monetary terms but its depletion can have serious impacts on the economy.

The land area of Belize is roughly 22,966 square kilometers of which 79 % or 18,143 square kilometers is forest cover. It consist of extensive forest and associated woodland resources characterized primarily by tall diverse broadleaf forest and secondarily by pine forest, pine savannah, low scrubby woodland areas and abundant mangroves.

During the formative years of settlement in Belize, the forestry sector was the single largest contributor to Gross Domestic Product (GDP) and merchandise exports. Structural changes in the economy (in terms of GDP contribution), has caused this sector to be replaced by agriculture and more recently, by the service sector. The forest sector is still considered a major earner of foreign exchange for Belize. In 1999, timber exports accounted for 1.3 % of Belize's exports earning, amounting to $4.2 million Belize dollars. Among the various species of timber, mahogany has been the largest exports item.

In real economic term, Belize had been experiencing decline in the forest production. In 1999, the forest sector's contribution to GDP was approximately 1.6 % and is likely to continue at this level. Studies indicate that the area of forest considered suitable for sustainable forestry production, totals 4.4 % of the land area. An additional 9.6 % of land could be considered as timber production area if one includes forested national and forested private lands. This brings it to a total of 14 % (Alder 1993).

Presently about 45.9 % of land area is set aside in protected areas for the preservation and protection of highly important natural and cultural feature. Better management will require more information on the state of the forest.

# FOREST

## Table 20.1
## Forest Land in Belize by Category, 1981

| Forest Land Category | Area (acres) | Area (sq. ml.) | % of Land Area |
|---|---|---|---|
| Closed Forest (Broadleaved) | 3,904,198 | 6,105 | 68.9 |
| Open Forest (Woodland and Pine) | 243,457 | 381 | 4.3 |
| Mangrove and Swamp | 594,568 | 930 | 10.5 |
| Open and Grassland | 522,469 | 817 | 9.2 |
| **Total** | **5,264,692** | **8,232** | **92.9** |

*Source: Country Environmental Profile, April 1984*

The study conducted in 1981 indicates that 92.9% of the total land area in Belize was under forest cover of which 68.9 % of the forest cover was broadleaved forest. During this period no well established classification of forest land existed in Belize.

## Table 20.2
## Forest Classes, Areas and Percentages for Belize Mainland, 1994

| Forest Class | Area (acres) | Area (sq. ml.) | % of Land Area |
|---|---|---|---|
| Broadleaf Forest | 3,503,704 | 5,478.8 | 65.1 |
| Open Broadleaf Forest | 29,705 | 46.5 | 0.6 |
| Pine Forest | 142,283 | 222.5 | 2.6 |
| Open Pine Forest | 18,041 | 28.2 | 0.3 |
| Thicket and Other Degenerated Broadleaf | 209,477 | 327.6 | 3.9 |
| Herbaceous and Scrub | 46,564 | 72.8 | 0.9 |
| Bamboo and Riparian Vegetation | 28,462 | 44.5 | 0.5 |
| Coastal Strand Vegetation | 6,131 | 9.6 | 0.1 |
| Mangrove, Medium and Tall | 19,308 | 30.2 | 0.4 |
| Mangrove, Dwarf | 57,925 | 90.6 | 1.1 |
| Saline Swamp Vegetation, with Palmetto & Mangrove | 85,152 | 133.2 | 1.6 |
| Marsh Swamp | 103,613 | 162.0 | 1.9 |
| **Total Forest Area** | **4,250,365** | **6,646.3** | **79.0** |

*Source: Deforestation in Belize 1989/92 - 1994/96, LIC, MNREI*

Unfortunately, we are not able to compare table 20.1 with table 20.2 since in 1994 there was a well established classification for forest land in Belize and categories on the 1981 study were reclassified on the 1994 study, thus not coinciding. On this study however, forest area accounted for 79 % of the total land area.

# FOREST

## Table 21.1
## Land Use and Land Cover of Central Belize, 1996

| Classification | Area (acres) | Study Area (%) |
|---|---|---|
| **Developed Land** | **67,773** | **7.4** |
| Farmland | 57,895 | 6.3 |
| Residential/Commercial | 3,136 | 0.3 |
| Barren | 6,741 | 0.7 |
| **Forest and Savannah** | **594,203** | **65.0** |
| Broadleaf Forest | 486,411 | 53.2 |
| Pine Forest | 11,691 | 1.3 |
| Riparian/Bamboo | 4,915 | 0.5 |
| Natural thicket/secondary regrowth | 32,262 | 3.5 |
| Low secondary regrowth, herbaceous and scrub/shrub | 12,830 | 1.4 |
| Savannah and other grasslands | 46,093 | 5.0 |
| **Wetland and Coastal Land** | **40,550** | **4.4** |
| Mangroves, tall to medium height | 8,170 | 0.9 |
| Mangroves, dwarf | 11,175 | 1.2 |
| Mash/swamp | 2,637 | 0.3 |
| Coastal broadleaf/strand vegetation | 17,007 | 1.9 |
| Coastal savannah | 1,562 | 0.2 |
| **Other** | **212,222** | **23.2** |
| Water | 168,056 | 18.4 |
| Clouds and shadows | 44,165 | 4.8 |
| **Total** | **914,747** | **100.0** |

*Source: Remote Sensing Analysis of Land Cover/Land Use, Central Belize 1998*

According to the land use and land cover study of Central Belize in 1996, 65 % of the land area was under forest and savannah cover. Developed land accounted for 7.4 % of the land area. It is important to note that this was only a case study of Central Belize and the results should not be generalized for the whole country. The study area is located in the eastern half of Central Belize and includes portions of the Belize, Cayo and Stann Creek Districts. It extends from the Northern and Southern Lagoons on the coast, inland to Belmopan, and southeast to Dangriga. The study also includes several forest reserves like Manatee, Sibun, Grants Works (A), part of Mountain Pine Ridge, and other protected areas like Blue Hole, Five Blues Lake, a portion of Chiquibul National Park, Monkey Bay Private Reserve among others.

## Table 21.2
## Estimated Rates of Forest Clearance, 1989/90 - 1990/91

| Tenure Type | Approximate Land Area (acres) | Approximate Rate of Clearance (% per year) | Approximate Area Cleared (acres) |
|---|---|---|---|
| Private | 1,912,900 | 3.8 | 145,000 |
| Lease National Land | 600,400 | 5.9 | 75,000 |
| National Land | 1,335,800 | 0.5 | 25,000 |
| Forest Reserves | 1,427,240 | 0.2 | 4,400 |
| National Wildlife Reserves | 213,360 | - | - |
| Private Reserves | 185,200 | - | - |
| **Total** | **5,674,900** | | **249,400** |

*Source: 1991, Review of Development Concessions and Leases 1989/90/91: BCES*

Table 21.2 indicates that private lands followed by forest reserves and national lands respectively are the major tenure types in Belize. However, the highest rate of clearance is found on leased national lands with a rate of 5.9 % per year. Private lands had an approximate rate of clearance of 3.8 % per year.

Deforestation leads to environmental degradation. It is a major cause of soil erosion, destruction of wildlife habitats and biological diversity among other devastating effects.

# FOREST

The estimated rate of forest cover loss for the years 1980 to 1987 was 22,239 acres per year (World Resource Institute 1987, cited in Ledec 1992) and for the years 1981 to 1990 it was 12,355 acres per year (FAO, 1994). The accuracy of the rates is unknown. The estimated rate for 1989/92 to 1994 was 61,727 acres per year of which 16,510 acres was lost from protected areas and managed areas.

## Table 22.1
## Rates of Forest Cover Loss in Mainland Belize, 1989/92 to 1994

| Period | Approximate Location in Belize | Loss (acres) | Annual Loss Rate (acres/year) |
|---|---|---|---|
| 1989 - 94 | South | 60,527 | 12,105 |
| 1990 - 94 | Central | 66,302 | 16,575 |
| 1992 - 94 | North | 66,097 | 33,047 |
| **Total** | | **192,926** | **61,727** |

*Source: Deforestation in Belize, 1989/92– 1994/96, LIC, MNREI*

## Table 22.2
## Forest Cover Loss Between 1989/92 -1994 and 1998 in National and Private Reserves, Parks and Sanctuaries

| Protected Areas | Area (acres)* | Loss (acres) | Area (acres) 1998** |
|---|---|---|---|
| Forest Reserves | 1,033,965 | 13,936 | 1,007,214 |
| National Parks*** | 373,929 | 1,297 | 376,921 |
| Private Reserves | 92,613 | 588 | 274,237 |
| Nature Reserves*** | 111,286 | 492 | 111,781 |
| Wildlife Sanctuaries*** | 128,277 | 180 | 339,253 |
| Archeological Reserves*** | .. | 17 | 25,580 |
| **Total** | **1,740,070** | **16,510** | **2,134,986** |

* - *1989/92 Land use inventory (LIC 1994), MNREI*
** - *LIC for June 1998, MNREI*
*** - *Included in "National Lands"*
*Source: Deforestation in Belize 1989/92 - 1994/96, LIC, MNREI*

The districts that had the most extensive forest cover losses were Cayo, Toledo and Orange Walk. Broadleaf forests with approximately 153,000 acres was the most common forest type cover that was loss during the period 1989/92 to 1994.

Another type of forest cover loss is by forest fires. In the MPRFR approximately 13,000 acres of forest was under wild fire in 1998 and 1999. The Forest Department, however, is presently developing a national fire protection program as dictated under the Forest Laws of Belize.

## Table 22.3
## Log Volumes Produced (in cu ft) by License Type and Forest Office, 1999

| Forest Office | FL | LT | PP | SA | Total |
|---|---|---|---|---|---|
| Belize | 69,199 | - | 84,460 | 3,803 | **157,462** |
| Belmopan | 71,172 | - | 3,173 | - | **74,345** |
| Douglas de Silva | 304 | 347,765 | 70,470 | - | **418,539** |
| Melinda | 152,901 | - | 82,893 | - | **235,793** |
| Orange Walk | 19,729 | - | - | 4,137 | **23,865** |
| San Ignacio | 13,571 | - | 168,913 | 15,102 | **197,586** |
| Savannah | 174,174 | 470 | 40,640 | - | **215,283** |
| Toledo | 119,485 | 148,467 | 61,260 | 10,093 | **339,305** |
| Not Stated | 20,127 | - | - | - | **20,127** |
| **Total** | **640,660** | **496,702** | **511,810** | **33,134** | **1,682,306** |
| **1998** | **758,390** | **628,598** | **548,187** | **143,742** | **2,078,917** |

*Source: Forest Department, MNREI*

# FOREST

## Table 23.1
## Number of Current Forest License Issued by Forest Office and License Type, 1999

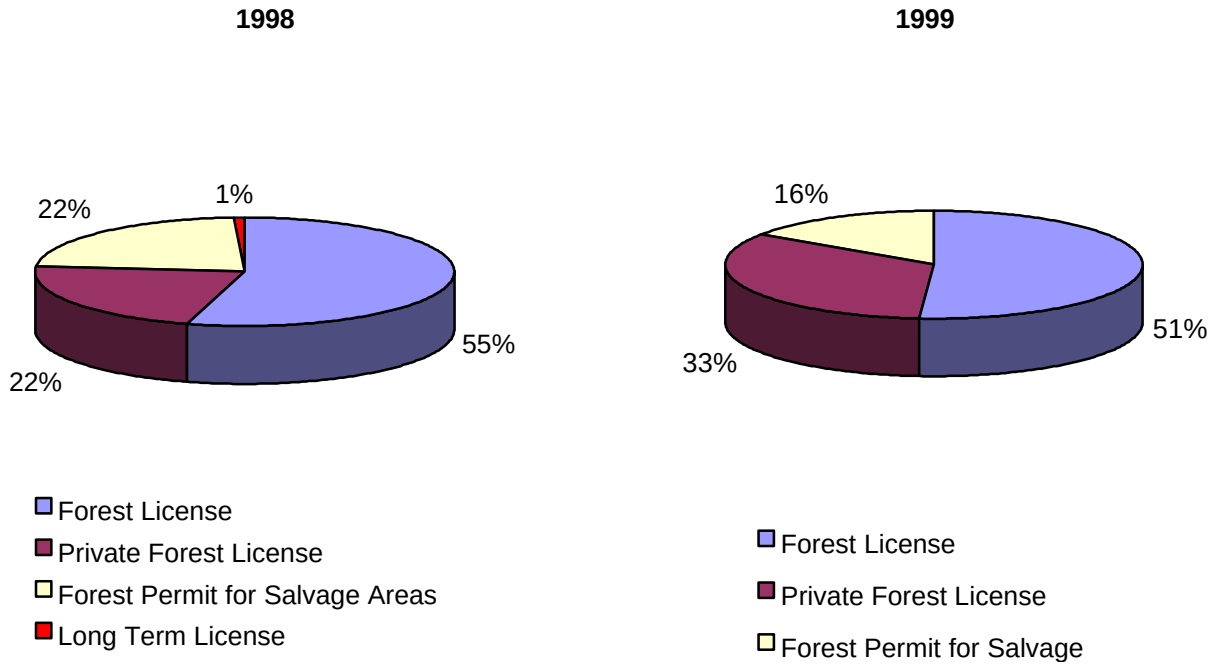
| Forest Office | FL | PP | SA | Total |
|---|---|---|---|---|
| Belize | 10 | 8 | 2 | **20** |
| Belmopan | 5 | 4 | - | **9** |
| Douglas de Silva | - | - | - | **-** |
| Melinda | 9 | 3 | 1 | **13** |
| Orange Walk | 10 | 8 | 4 | **22** |
| San Ignacio | 4 | 4 | 7 | **15** |
| Savannah | 6 | 1 | - | **7** |
| Toledo | 5 | 4 | 1 | **10** |
| **Total** | **49** | **32** | **15** | **96** |
| **1998** | **56** | **23** | **23** | **102** |

*FL - Forest License*
*LT - Long Term License*
*PP - Private Forest License*
*SA - Forest Permit for Salvage Areas*

*Source: Forest Department, MNREI*

Log volumes produced in 1999 decreased by 20 % from the previous year. Major decreases were registered in FL, LT and SA license types. The decrease in log volume produced can be attributed to the fact that there was a 6 % decrease in forest license issued. When compared 1999 to 1998 FL and SA licensed types decreased by 23.4 % while the PP license type showed an increase of 39.1 %.

## Chart 23.2
## Percent of Forest Licenses Issued by Licenses Type, 1998 - 1999




*Source: Forest Department, MNREI*

*Source: Forest Department, MNREI*

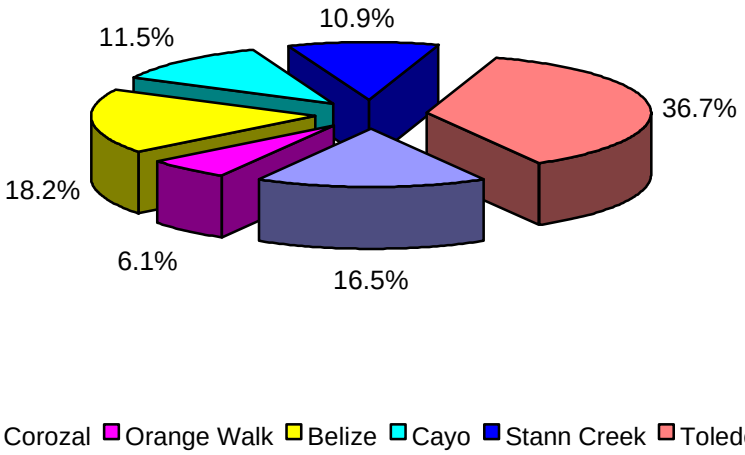
# FOREST

**Table 24.1**
**Area (acres) Under Each Forest License Issued by District, April 1997**

| Forest Office | FL | LT | PP | SA | Total |
|---|---|---|---|---|---|
| Corozal | 121,508 | 10,068 | 94,446 | - | 226,022 |
| Orange Walk | 64,855 | - | 1,891 | 17,155 | 83,901 |
| Belize | 195,761 | - | 52,092 | 1,278 | 249,131 |
| Cayo | 71,871 | 83,463 | - | 2,139 | 157,473 |
| Stann Creek | 144,881 | - | 4,003 | - | 148,884 |
| Toledo | 297,357 | 201,829 | 2,387 | - | 501,573 |
| **Total** | **896,233** | **295,360** | **154,819** | **20,572** | **1,366,984** |

*Source: Review of the Timber Licenses of Belize, (Andrew Mitchell, April 1997)*

**Chart 24.2**
**Area of Timber Licenses in Percentage by District, 1997**




*Source: Review of the Timber Licenses of Belize, (Andrew Mitchell, April 1997)*

As on March 1997, there were 74 valid licenses, issued to 68 different licensees. The figures indicated that the highest number of licenses were issued in the Cayo District, representing 33 % of all total licenses issued. Whilst the greatest area under the licenses was in Toledo District, representing 36.7 % of the total area under timber production. However, the largest license issued was in the Toledo District with a size of 159,018 acres, and over 80 % bigger than the second largest license issued in the Stann Creek District.

In addition, during this study it was clear that the emphasis of timber production moved from private land to national land. This indicating that the demand of the elite species of timber in the national lands licenses has increased.

# FOREST

## Table 25.1
## Timber Production (in cu ft) by Major Species, 1997 - 1999

| Species | 1997 | 1998 | 1999 |
|---|---|---|---|
| Banak | 3,978 | 10,013 | 13,705 |
| Barba Jolote | 14,176 | 17,559 | 12,498 |
| Billy Webb | 5,754 | 14,331 | 13,287 |
| Bitterwood | 9,185 | 21,930 | 13,108 |
| Black Cabbage Bark | 38,970 | 43,640 | 15,238 |
| Bullet Tree | 29,469 | 27,637 | 22,669 |
| Cedar | 29,932 | 34,879 | 20,137 |
| Cotton | 38,529 | 38,815 | 23,687 |
| Mahogany | 274,564 | 226,641 | 140,320 |
| Male Bullhoof | 25,403 | 36,605 | 21,555 |
| Mylady | 60,471 | 54,275 | 25,701 |
| Nargusta | 80,190 | 53,418 | 32,552 |
| Pine | 950,385 | 869,621 | 833,044 |
| Quan wood | 26,079 | 42,333 | 44,038 |
| Santa Maria | 294,442 | 237,736 | 160,162 |
| Sapodilla | 27,900 | 19,641 | 8,453 |
| Tambran | 19,719 | 19,470 | 14,335 |
| Yemeri | 174,329 | 173,529 | 191,626 |
| **Subtotal** | **2,103,471** | **1,942,073** | **1,606,114** |
| Other timber | 86,628 | 141,640 | 70,410 |
| **Grand Total** | **2,190,099** | **2,083,714** | **1,676,524** |

*Source: Forest Department, MNREI*

For the period 1997 - 1999, timber production has been showing a decreasing trend. This is a 20 % decrease in 1999 from the 1998 production. It is very important to mention at this point in time that illegal logging is not accounted for. It is assumed that illegal logging is done by Belizean nationals and people from our neighboring countries of Mexico and Guatemala. Production in 1999 showed a decrease in all the major species, with some showing a decrease of up to 47 %, except for Yemeri production which registered slight increase of 10 %.

In addition to timber production, there are other forest products which are of interest for the country of Belize. For example, *Chicle* which is a base for chewing gum, can be harvested throughout the entire life of the sapodilla tree, and dose not harm the rain forest. *Latex*, useful for the making of hand made rubber bags can be extracted from the rubber plant without damaging the forest as well. There are many other non-timber products that the forest can produce and are of economic interest for the country.

# FOREST

If we are to produce timber in the future then we have to manage and produce it in a sustainable manner. In this way we can assure that future generations will enjoy forest products as we do today. Rio Bravo Management and Conservation Area (a private reserve) and Chiquibul Forest Reserves are very good examples of managed forest reserves in Belize, that is production is done in a sustainable way, under a harvesting plan. How does a managed forest work? First of all, an area of the forest is selected as the production area which is then divided into different sections. Logging takes place in a first section and logging rotates from year to year and from section to section until the first section is reached again (normally a minimum period of 40 years). When this happens the first section is ready for logging again since it goes through a regeneration process during those years when that section was inactive from logging. It is important to note that logging in each section is done through a selective process whereby healthy trees are left as parent or seedling trees.

**Table 26.1**
**Sustainable Timber Production (in cu ft) by Major Species, 1998 - 1999**

| Species | 1998 | 1999 |
|---|---|---|
| Banak | 1,199 | 1,047 |
| Barba Jolote | 9,031 | 482 |
| Bastard Mahogany | 71 | - |
| Bitterwood | 2,056 | - |
| Black Cabbage Bark | 2,516 | 781 |
| Carbon | 3,942 | 1,492 |
| Cedar | 902 | - |
| Cedrillo | 2,611 | - |
| Granadillo | 674 | - |
| Hobillo | 847 | 665 |
| Ironwood | 3,367 | 3,153 |
| John Crow Beed | 348 | - |
| Mahogany | 6,294 | 3,361 |
| Male Bullhoof | 4,827 | 946 |
| Monkey Apple | 7,198 | 10,340 |
| Mylady | 1,146 | 165 |
| Nargusta | 13,013 | 3,369 |
| Other species | 4,486 | 2,564 |
| Pine | 256,830 | 347,765 |
| Red sillion | 768 | 1,989 |
| Salmwood | 142 | - |
| Santa Maria | 7,582 | 1,677 |
| Sapodilla | 10,765 | 1,313 |
| Sillion | 2,689 | 599 |
| White Breadnut | 9,598 | 8,858 |
| Yemeri | 8,399 | - |
| **Total** | **363,296** | **392,564** |

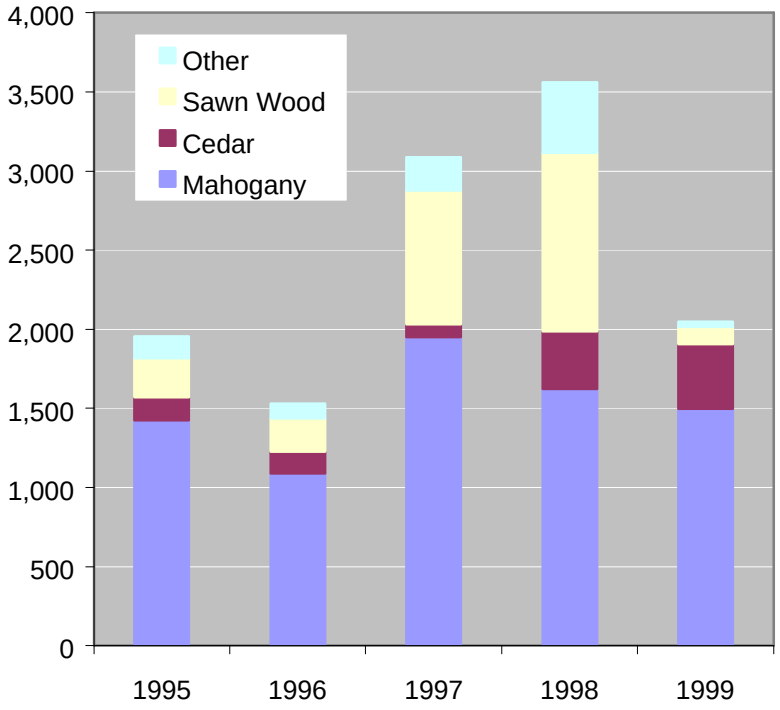
*Source: Forest Department, MNREI*

# FOREST

Most of the timber production is for export purposes. Timber exports seemed to have been increasing since 1995 to 1999 after a decline in 1996. However, the trend was not the same in 1999 when a sharp decline of almost 40 % in timber exports was registered. Mahogany, sawn wood and cedar are the major timber type exports. The decline in exports was due mainly to a very sharp decline in sawn wood exports, even though slight decline in other timber types were also registered.

Timber production is a major product of forests, even though not all forest products are being accounted for. Forestry contribution to GDP should not be based only on timber production but also other valuable products as well, such as, other non-timber products like animal products and others.

**Chart 27.1**
**Timber Export ('000 Bd ft) by Type, 1995 - 1999**




*Source: CSO*

**Table 27.2**
**Royalties Collected (Bz $)on the Log Production by Forest Office and License Type, 1999**

| Forest Office | FL | LT | PP | SA | Total |
|---|---|---|---|---|---|
| Belize | 29,125 | - | 34,520 | 1,924 | **65,569** |
| Belmopan | 26,461 | - | 886 | - | **27,346** |
| Douglas de Silva | 103 | 115,184 | 12,555 | - | **127,842** |
| Melinda | 53,567 | - | 18,618 | - | **72,184** |
| Orange Walk | 8,706 | - | - | 1,322 | **10,028** |
| San Ignacio | 16,401 | - | 27,922 | 5,669 | **49,992** |
| Savannah | 79,040 | 18,773 | 5,468 | 800 | **104,081** |
| Toledo | 77,602 | 34,305 | 10,463 | 12,516 | **134,885** |
| Not Stated | 6,753 | - | - | - | **6,753** |
| Total | **297,758** | **168,262** | **110,431** | **22,231** | **598,682** |
| **1998** | **398,950** | **218,943** | **145,724** | **48,351** | **811,968** |

*Source: Forest Department, MNREI*

# FOREST

## Table 28.1
## Exports of Wood Manufactures Excluding Furniture, 1998 - 1999

| SITC | Unit | 1999 Quantity | 1999 Value (Bz $) | 1998 Quantity | 1998 Value (Bz $) |
|---|---|---|---|---|---|
| 634.3110 | cu.ft. | 3,500 | 160,034.00 | 1,845 | 50,032.00 |
| 634.9110 | lb | 22,660 | 21,350.00 | 22,370 | 16,266.00 |
| 634.9120 | lb | 6,636,870 | 538,789.00 | 2,204,000 | 171,488.00 |
| 634.9190 | lb | 2,270,480 | 212,494.00 | 448,800 | 318,362.00 |
| Others | lb | 54,565 | 204,226.00 | 15,199 | 51,648 |

*634.1110 - Plywood*
*634.9110 - Split Poles, Piles*
*634.9120 - Other Coniferous Wood*
*634.9190 - Other Hoop wood: Split Poles, Piles, Pillets and Stakes of Wood*
*Other - Includes Other Articles of Wood, Cases, Boxes, Doors and their Frames, Table and Kitchenware of Wood, Other Builders' Joinery and Carpentry of Wood and Wall Plaques etc.*

*Source: CSO*

## Table 28.2
## Number of Sawmills in Operation and Number of Logging Permits by District, 1999

| District | No. of Sawmills Operating | No. of Logging Permits[1] |
|---|---|---|
| Corozal | 2 | 1 |
| Orange Walk | 15 | 2 |
| Belize | 2 | 1 |
| Cayo | 9 | 5 |
| Stann Creek | 7 | 1 |
| Toledo | 10 | 2 |
| **Total** | **45** | **12** |

*(1) refers to logging permits in forest and private reserves*
*Source: Mr. Oscar Rosado (Consultant for MNREI)*

As indicated in Table 28.2, it is obvious that the majority of sawmills are in the Orange Walk and Toledo Districts representing 33.3 % and 22.2 % respectively. In addition, Corozal and the Belize Districts are two districts with less activities in the timber production.

Deforestation at a rate faster than the rate at which the natural environment can replenish itself is a crucial contributing factor in the reduction of our timber production. It is of interest to note, what percentage of these logging industries and sawmills are promoting the replanting of timber and if there are any incentives for private land owners to replant timber trees for our future generations.

# FOREST

## Flora and Fauna

The essential goods and services on our planet depend on the variety and variability of genes, species, population and ecosystems. Biological resources feed and clothe us, and provide housing, medicines and spiritual nourishment. Those resources are found in natural ecosystems of forests, savannahs, pasture and rangelands, rivers, lakes, and seas. They are also in farm fields gardens, genes banks, botanical gardens and zoos.

The loss of the world's biological diversity continues, mainly from habitat destruction, overharvesting, pollution and the inappropriate introduction of foreign plants and animals. This decline is largely caused by humans and represents a serious threat to our development.

Belize displays as much habitat diversity as any Mesoamerican country, ranging from coral reef, mangroves, and coastal lagoons to savannah, rainforest and pine forest. The endemic species in Belize are of special concern, since their conservation is wholly dependent on the national measure. Fifty-eight such species have been listed, most of them are flora in the pine ridge and the savannah area.

The creation of protected areas is perhaps the most important way to take care of biodiversity. Belize has a long and honorable tradition in this respect, with large areas set aside for such purposes, for example up to June 2000 about 45.9 % of the national area was under some type of protection. A very wide range of other measures have been taken to conserve such important elements of nature, such as pesticides control programs, management of water resources, solid waste management, the coastal zone, forest areas, fisheries and other resources and various NGO activities. Many further measures have been proposed, as recommended in the Belize Biodiversity Strategy of 1998, and the accompanying Action Plan.

Belize is a country high in biodiversity. Even though, not enough information exist at present to quantify the value of biodiversity in Belize, but it is clear that it is high. Due to intense population pressure, the surrounding countries are more likely to exhibit fragmentation of critical habitats, degraded ecosystems and higher levels of threatened and endangered species. Also, it is important to mention that Belize is a signatory of the Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES).

**Table 29.1**
**Medicinal Plants in Belize That are Considered Threatened Internationally and Their IUCN Category, 1998**

| Family | Scientific Names | IUCN Category |
|---|---|---|
| Piperaceae | Piper zacatense (C.D.C.) | Rare |
| Fabaceae | Bauhinia erythrocalyz (Wunderlin) | Rare |
| Rubiaceae | Psychotria limonesis (Krause) | Rare |
| Dioscoreaceae | Dioscorea bartlettl | Rare |
| Bromeliaceae | Tillandria streptophylla | Vulnerable |
| Acanthaceae | Justicia bartletti (Standley) | Indeterminate |

*Source: Belize National Biodiversity Action Plan, NBC, MNREI, 1998*

# FOREST

## Flora and Fauna

### Table 30.1
### Export of Plant and Vegetable Material, 1998 - 1999.

| Description | Unit | 1998 | | 1999 | |
|---|---|---|---|---|---|
| | | Quantity | Value (Bz$) | Quantity | Value (Bz$) |
| Coral and Similar Material | lb | 23,593 | 9,849 | 32 | 62 |
| Other Plants and Parts of Plants | lb | 2,403 | 8,441 | 52 | 722 |
| Other Live Plants | no | 12,550 | 22,179 | 15,592 | 17,131 |
| Orchids | lb | 1,255 | 8,012 | 590 | 2,196 |
| Ginger Lilies | lb | - | - | 175 | 946 |
| Heliconias | lb | - | - | 7,825 | 55,891 |
| Bamboos | lb | - | - | 100 | 444 |
| Aloa Vera extract | lb | 45 | 1,900 | - | - |
| Other Fresh Cuts Flowers & Buds | lb | 230 | 2,800 | - | - |
| Foilage, Branches etc. Ornamental | lb | - | - | 218 | 206 |
| Other Vegetable Saps & Extracts | lb | 924 | 4,674 | 758 | 3,133 |
| Tree Shrub/Bushes Crafted etc. | lb | - | - | 300 | 1,200 |
| Seaweeds and other Algea | lb | 438 | 3,535 | - | - |
| **Total** | | | **61,390** | | **81,931** |

*Source: CSO*

### Table 30.2
### Estimated Number of Endangered Species in Belize, 1998

| TAXA | Number of Native Species | Number of endangered Species | Endangered Species as % of Total |
|---|---|---|---|
| **Vertebarates** | | | |
| Mammals | 163 | 52 | 31.9 |
| Birds | 571 | 81 | 14.2 |
| Reptiles | 121 | - | - |
| Amphibians | 42 | - | - |
| Inland Fish | 117 | 2 | 1.7 |
| **Invertebrates** | | | |
| Mollusks | 157 | - | - |
| Crustaceans | 1 | - | - |
| Insects | 10 | - | - |
| Odonate | 176 | - | - |
| Butterflies | 288 | - | - |
| Other | 2 | - | - |
| **Plants** | | | |
| Angiosperms | 3,409 | 57 | 1.7 |
| Gymnosperms | 3 | - | - |

*Source: Belize National Biodiversity Action Plan, NBC, MNREI, 1998*

# FOREST

## Protected Areas

**What is a protected area?**
A *protected area* is an area set aside for the preservation and protection of highly important natural and cultural features, for the regulation of the scientific, educational and recreational use.

**Types of Protected Areas**

- *National Park:* is an area reserved for the protection and preservation of natural and scenic values of national significance for the benefit and enjoyment of the general public.
- *Nature Reserve:* is an area reserve for the protection of biological communities or species and natural processes in an undisturbed state for scientific study, monitoring, education and the maintenance of genetic resources.
- *Natural Monument:* is an area reserved for the protection and preservation of nationally significant natural features and unique characteristics for education, research and public appreciation.
- *Wildlife Sanctuary:* is an area reserved as a nature conservation reserve for the protection of nationally significant species, wildlife habitats and physical features.
- *Forest Reserve:* is reserved for the protection of forests for management of timber extraction and for the conservation of soil, watershed, and wildlife resources.
- *Marine Reserve:* is an area reserved for the protection, research, recreation, education, controlled extraction in relation to marine and freshwater species and their habitats.
- *Archaeological Reserve:* is an area reserved for the protection and research of their cultural and historical values.
- *Private Reserve:* is a privately owned area reserve to promote conservation of the natural heritage of Belize and to promote wise use of its natural resources.

### Table 31.1
### Declared Protected Areas of Belize (June 2000)

| Site Name | Year Established | Area in Acres | % of Total land Area |
|---|---|---|---|
| **Forest Reserves** | | **1,015,776** | **17.9** |
| Chiquibul | 1995 | 147,810 | 2.6 |
| Columbia | 1997 | 148,357 | 2.6 |
| Commerce Bight | 1977 | 10,910 | 0.2 |
| Deep River | 1990 | 77,557 | 1.4 |
| Freshwater Creek | 1997 | 35,841 | 0.6 |
| Grants Work | 1989 | 7,590 | 0.1 |
| Machaca | 1998 | 3,119 | 0.1 |
| Manatee | 1959 | 103,834 | 1.8 |

## FOREST

(Cont.)

| Site Name | Year Established | Area in Acres | % of Total land Area |
|---|---|---|---|
| **Forest Reserves** | | | |
| Mango Creek | 1989 | 34,891 | 0.6 |
| Maya Mountain | 1979 | 41,732 | 0.7 |
| Monkey Caye | 1996 | 1,654 | 0.0 |
| Mountain Pine Ridge | 1977 | 127,203 | 2.2 |
| Sibun | 1977 | 106,192 | 1.9 |
| Silk Grass | 1997 | 2,166 | 0.0 |
| Sittee River | 1977 | 93,920 | 1.7 |
| Swasey Bladen | 1989 | 15,000 | 0.3 |
| Terra Nova | 1993 | 6,000 | 0.1 |
| Vaca | 1991 | 52,000 | 0.9 |
| **National Parks** | | **395,294** | **7.0** |
| Aguas Turbias | 1994 | 8,950 | 0.2 |
| Bacalar Chico | 1996 | 12,641 | 0.2 |
| Blue Hole | 1986 | 575 | 0.0 |
| Chiquibul | 1995 | 285,937 | 5.0 |
| Five Blues Lake | 1994 | 4,250 | 0.1 |
| Guanacaste | 1994 | 52 | 0.0 |
| Laughing Bird Caye | 1996 | 10,119 | 0.2 |
| Monkey bay | 1994 | 2,250 | 0.0 |
| Paynes Creek | 1994 | 29,420 | 0.5 |
| Rio Blanco | 1994 | 100 | 0.0 |
| Sarstoon/Temash | 1994 | 41,000 | 0.7 |
| **Nature Reserve** | | **109,711** | **1.9** |
| Bladen | 1990 | 97,000 | 1.7 |
| Burbon Creek | 1992 | 5,970 | 0.1 |
| Tapir Mountain | 1994 | 6,741 | 0.1 |
| **WildLife Sanctuaries** | | **370,846** | **6.5** |
| Agua Caliente Luha | 1998 | 9,492 | 0.2 |
| Cockscomb basin | 1990 | 122,360 | 2.2 |
| Community Baboon Sanctuary | .. | 12,980 | 0.23 |
| Corozal Bay | 1998 | 180,500 | 3.2 |
| Crooked Tree | 1984 | 36,479 | 0.6 |
| Gales Point | 1998 | 9,035 | 0.2 |

## FOREST

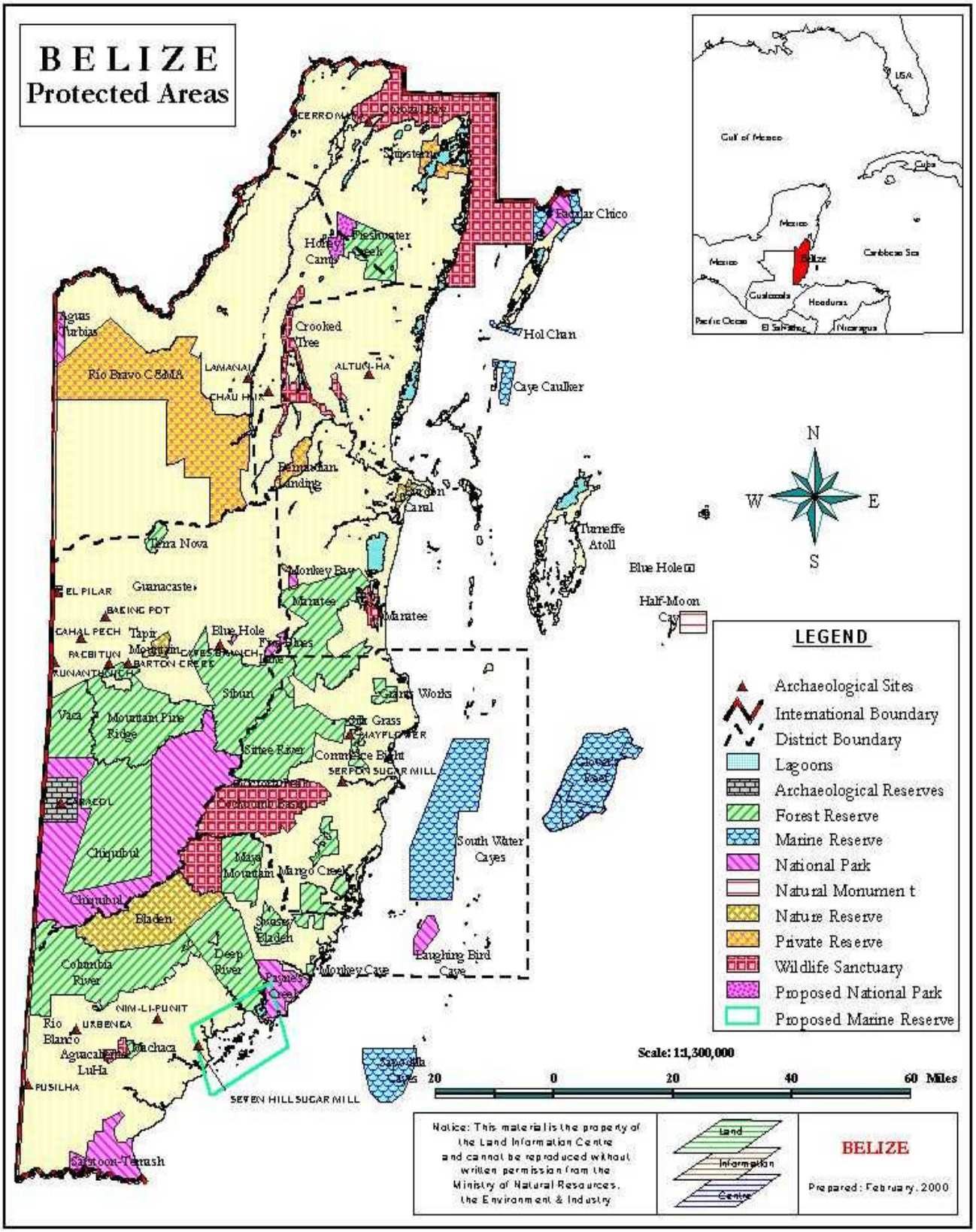
(Cont.)

| Site Name | Year Established | Area in Acres | % of Total land Area |
|---|---|---|---|
| **National Monuments** | | **15,570** | **0.3** |
| Blue Hole | 1996 | 1,023 | 0.0 |
| Half Moon Caye | 1982 | 9,700 | 0.2 |
| Victoria Peak | 1998 | 4,847 | 0.1 |
| **Archaeological Reserves** | | **28,567** | **0.5** |
| Cahal Pech | 1995 | 22 | 0.0 |
| Caracol | 1995 | 25,556 | 0.5 |
| El Pilar | 1998 | 1,771 | 0.0 |
| Altun Ha | 1994 | 44 | 0.0 |
| Cerro Maya | 1976 | 43 | 0.0 |
| Lamanai | 1985 | 958 | 0.0 |
| Nim Li Punit | 1995 | 121 | 0.0 |
| Xunantunich | 1995 | 52 | 0.0 |
| **Private Reserves** | | **279,447** | **4.9** |
| Monkey Bay Wildlife Sanctuary | | 1,474 | 0.0 |
| Rio Bravo Management & Conservation Area | | 259,133 | 4.6 |
| Shipstern Nature Reserve | | 18,840 | 0.3 |
| **Marine Reserves** | | **392,051** | **6.9** |
| Bacalar Chico | 1996 | 15,529 | 0.3 |
| Caye Caulker | 1998 | 9,670 | 0.2 |
| Gladden Split/Silk Caye | 2000 | 25,600 | 0.5 |
| Glover's Reef | 1993 | 81,200 | 1.4 |
| Hol Chan | 1987 | 2,578 | 0.0 |
| Port Honduras | 2000 | 101,100 | 1.8 |
| Sapodilla Cayes | 1996 | 38,500 | 0.7 |
| Southwater Cayes | 1996 | 117,874 | 2.1 |
| **Grand Total** | | **2,607,262** | **45.9** |

*Source: Forest Department and LIC, MNREI*

*N.B. Area given on the above table refers to the S.I. Acreages (Statutory Instruments) which provides the legal mandate and description of the protected areas of Belize. Under the Statutory Instrument Private Reserves do not have legal status except for Rio Bravo Management and Conservation Area which has acquired legal status.*

*As indicated in table 31.1 private reserves have no declared status, however such important initiatives should be highly recommended. During the first few months of the year 2000 two new areas gained some type of protective status.*




*Source: LIC, MNREI*

## FISHERIES

The oceans, including enclosed and semi-enclosed seas are an essential part of global life-support systems. They cover much of the earth's surface, influence climate, weather and the state of the atmosphere and provide food and other resources for our growing population. However, our marine waters and coastal areas are under increasing environmental stress from pollution, overfishing and degradation of coastlines and coral reefs and many more human induced problems.

In addition, most of our marine pollution comes from sources on land like pollution from towns and cities, industry, construction, agriculture, forestry and tourism. A few of the contaminants that pose threat to the marine environment are sewerage, chemicals, sediments, litter and plastic, metals and oil. Some of these materials take years for their breakdown and some may even accumulate in living creatures and may affect in some way or the other their lifecycles.

The Belize Barrier Reef is the second largest in the world and is considered a World Heritage Site. Belize's coastal and marine zone contains a wide diversity of ecosystems that are rich in plant and marine resources. The coastal area is a complex system comprising the 220 Km barrier reef, three atolls, seagrass beds, dense mangrove forest, and numerous coral islands.

Belize has eight marine protected areas with the major objectives of protection, research, visitation, and education.

The reef complex is of global importance in term of its biodiversity. A number of species of commercial value depend on the seagrass beds, and the coastal waters provide a habitat for endangered species, such as manatees, crocodiles, marine turtles, and many species of birds. The mangrove environment provides areas for fish spawning and feeding, and it is the principal source of nutrients for coastal marine life. Furthermore, the mangroves, the reef, and seagrass play an important role in stabilizing and protecting the coastline against erosion and also act as a physical buffer for the inland areas against storms. The wetlands also act as a natural sink for terrestrial run-off and pollutants. In addition, population pressure, deforestation, waste disposal and development for the construction of tourist facilities in the coastal areas have had adverse impact on marine life and the environment.

In Belize the two sectors that depend most on the coastal zone are fishing and tourism. In 1999, the fishing industry contributed some 5.6 % to the GDP and is expected to grow with the expansion of the aquaculture industry. Furthermore, the value of fisheries export accounted for 55.6 million Belize dollars in 1999 representing more than 17 % of the total domestic exports. The tourism industry is considered one of the largest primary sources of foreign exchange and is estimated to contribute about 15 % of GDP. This reflects the importance of a healthy marine environment, thus sustainable use of this resource is recommended.

### Table 35.1
### Exports of Marine Products ('000 lbs), 1994 - 1999

| Marine Product | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Fish | 84 | 151 | 400 | 314 | 110 | 65 |
| Lobster | 574 | 779 | 583 | 641 | 549 | 606 |
| Sea Shrimp | 42 | 56 | 49 | 35 | 59 | 34 |
| Conchs | 328 | 363 | 304 | 539 | 479 | 365 |
| Other | 1 | 10 | 5 | 10 | 9 | 10 |
| **Subtotal** | **1,029** | **1,359** | **1,341** | **1,539** | **1,207** | **1,079** |
| Farmed Shrimp | 1,074 | 1,280 | 1,136 | 1,654 | 3,076 | 4,603 |
| **Total** | **2,103** | **2,639** | **2,477** | **3,193** | **4,283** | **5,682** |

*Source: CSO*

## FISHERIES

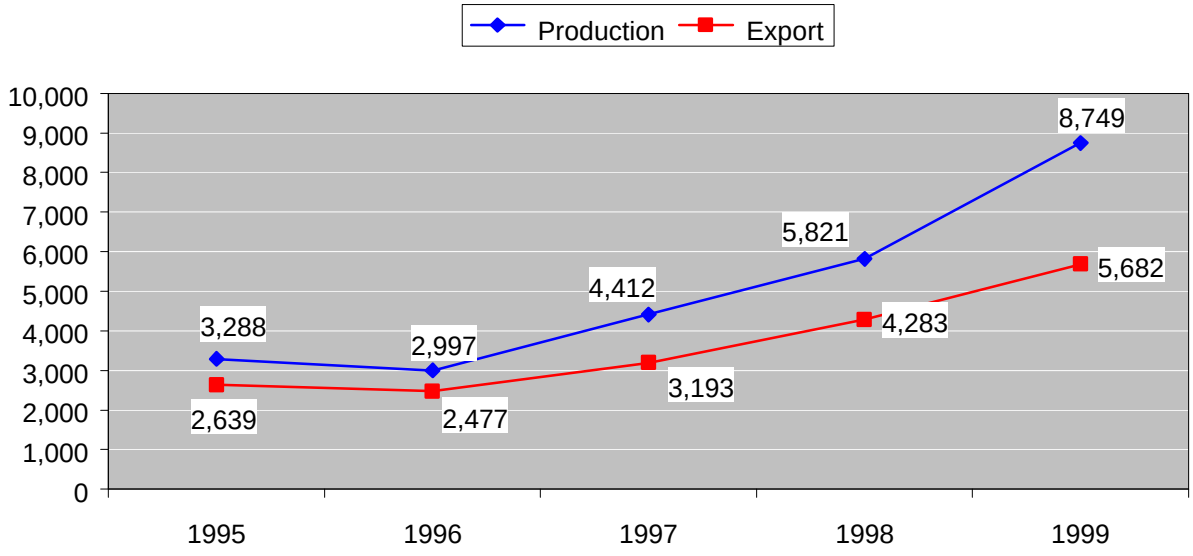
The fisheries production trend as shown in chart 36.1 clearly indicates a growth in total landings from around 3.3 million lbs in 1995 to 8.7 million lbs in 1999. In volume terms total fish catches are dominated by 4 main species ( shrimp, lobster, conch and fin fish) which typically make up over 95 % of total landings. Most of the fishing efforts are focused at the capture of the spiny lobster and the queen conchs which represent the largest fisheries within the industry. Finfish are also caught on a commercial basis, but in many cases are part of the by-catch of the lobster fishery.

The increase in the fishery industry was caused by a significant rise of almost 78 % in the production of farmed shrimp over the period 1999 and 1998. Exports, on the other hand, had about 50 % growth for the same period. In addition, lobster production increased by 8.5 % while export had a growth of 11 %. Exports of other marine products (fin fish, sea shrimp and conchs ) decreased by 71.6 % for the period 1999.

One of the serious concern is the trawled shrimp fishery. The best year for marine shrimp was in 1988 with a production of 300,000 lbs. However production has decreased over the years to an average of 76,000 lbs in 1999. The trawled shrimp fishery have negative impacts such as: slightly economically feasible production, limited trawling grounds, benthic habitat destruction, and non-marketable fish mortalities which makes a long term justification for the existence of such industry very difficult to come by.

Accurate records on the fishery stocks and production of fisheries are not available, but it has been established that fisheries stocks has been severely overexploited due to illegal fishing and the use of unsustainable fishing practices. An important part of the fishery industry is not accounted for and that is of the freshwater species catches. Freshwater fishery is generally known for subsistence purposes yet unsustainable practices can deplete the fresh water species stocks.

**Chart 36.1**
**Total Production and Exports of Marine Products ('000 lbs), 1995 - 1999**




*Source: CSO & Fisheries Department*

# FISHERIES

After the sudden increase in the total number of licenses in 1997 the total number decreased to 3,406 in 1999, showing a decrease of almost 53 % in 1998 and a 66 % decrease in 1999. The major decrease in the license types were registered on fishermen licenses and boat licenses.

Yet, about 75 % of all full time fishermen in Belize are members of one of the four Fishermen's Cooperatives, Northern, National, Placencia and Caribeña or the most recently formed Toledo Fishermen's Cooperative. These cooperatives purchase, process and export fisheries products on behalf of the fishermen.

**Table 37.1**
**Number of Licenses Issued by Type of Activity, 1993 - 1999**

| Type | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|
| Fishermen License | 2,302 | 1,604 | 3,014 | - | 8,804 | 3,735 | 2,586 |
| Boat License | 901 | 924 | 2,005 | - | 1,140 | 954 | 790 |
| Black Coral License | 44 | 37 | - | - | 30 | 25 | 23 |
| Research License | 15 | 15 | - | - | - | 23 | 7 |
| **Total** | **3,262** | **2,580** | **5,019** | **-** | **9,974** | **4,737** | **3,406** |

*Source: Fisheries Department*

In Belize, there is a small but very profitable aquarium fish industry in operation. Production in this industry is inconsistent since some collectors do this as a secondary source of income.

After a significant increase in the number of exported aquarium fish in 1997 there was a sharp decrease in 1998 and 1999. However, the value in 1999 was much higher than any other year as shown in table 37.2.

**Table 37.2**
**Export of Aquarium Fish, 1990 - 1999**

| Year | Quantity (number) | Value ('000 Bz$) |
|---|---|---|
| 1990 | 15,121 | 38 |
| 1991 | 17,363 | 77 |
| 1992 | 5,983 | 54 |
| 1993 | 6,864 | 58 |
| 1994 | 16,837 | 71 |
| 1995 | 21,267 | 76 |
| 1996 | 15,238 | 72 |
| 1997 | 26,242 | 94 |
| 1998 | 9,338 | 100 |
| 1999 | 8,920 | 119 |

*Source: CSO*

## AQUACULTURE

Farmed shrimp constitutes the dominant part of the aquaculture industry and is an important contributor to fisheries production in Belize. The industry also depends on good water quality.

Farm shrimp is the largest contributor to our total marine exports comprising of 81 % of all marine exports in 1999. The industry is one of the fastest growing industries in the country. For example, table 35.1 shows that farmed shrimp exports has been increasing reaching to a total of 4,603,000 lbs in 1999 from a total of 1,074,000 lbs in 1994. This increase in production are justified by the rapid growth in the production area which has more than doubled in the short period of 1997 to 1999.

About eighty percent of Belize's aquaculture operations are located in the south of the country (Stann Creek and Toledo Districts) and the remaining 20 % in the Belize District. The sharp fall in shrimp production in 1996 was due to infection by the Taura Syndrome Virus (TSV) which seriously damaged the industry. The farms recovered from the disease and production is now back to normal.

Between 1998 and 1999 the number of ponds increased by 23.3 % with an average daily water exchange rate of 4 %. An Environmental Impact Assessment, as required by the Environmental Protection Act, is mandatory for most farms.

### Table 38.1
### Structure of the Shrimp Mariculture Industry, 1998

| Farm Name | Total Land Area (acres) | Production Area (acres) | Av. Pond Size (acres) | Number of Ponds | Water exchange (%/day) |
|---|---|---|---|---|---|
| Nova | 4,700 | 860 | 22 | 39 | 3.8 |
| Paradise Farm | 2,163 | 430 | 20 | 21 | 5.0 |
| Nova Laguna | 1,296 | 48 | 4 | 12 | 2.5 |
| Nova Toledo | 3,645 | 410 | 25 | 26 | 3.8 |
| Belize Aqua-culture | 100 | 10 | - | 24 | - |
| Toledo Fish Farming | 506 | 152 | 8 | 20 | 8.0 |
| Aqua-Mar | 2,700 | 341 | 14 | 21 | 5.0 |
| **Total** | **15,110** | **2,251** | **93** | **163** | **4.0** |

*Source: CSO*

### Table 38.2
### Structure of the Shrimp Mariculture Industry, 1999

| Farm Name | Total Land Area (acres) | Production Area (acres) | Av. Pond Size (acres) | Number of Ponds | Water exchange (%/day) |
|---|---|---|---|---|---|
| Nova | 4,950 | 1,330 | 23 | 57 | 3.8 |
| Paradise Farm | 3,163 | 720 | 20 | 35 | 5.0 |
| Nova Laguna | 1,296 | 48 | 4 | 12 | 2.5 |
| Nova Toledo | 3,645 | 410 | 25 | 26 | 3.8 |
| Belize Aqua-culture | 100 | 17 | 1 | 26 | - |
| Toledo Fish Farming | 506 | 152 | 8 | 20 | 8.0 |
| Aqua-Mar | 5,700 | 421 | 17 | 25 | 5.0 |
| **Total** | **19,360** | **3,098** | **97** | **201** | **4.0** |

*Source: CSO*

## AQUACULTURE

Although of its rapid expansion in the industry, aquaculture activities will require close surveillance and additional regulations in order to ensure that they are neither the recipient of pesticides and fertilizers pollution nor the cause of coastal degradation.

Farms sources of water for production purposes include seawater, estuary water and lagoon water. In 1999, the total feed consumption by aquaculture farms is about 7,249.4 MT/Yr an increase from 5,620.5 MT/Yr in 1998. Fertilizer are applied to ponds to increase nutrient concentrations, the primary fertilizer nutrients are urea, sodium nitrate, ammonium nitrate triple superphosphate and diammonium phosphate. The total fertilizer application rate is 348 lbs/acre/wk for 1999 a growth of 15.2 % over the previous year. In addition, white lime is used for controlling algal production in ponds, as well as, part of a disease control program. The total of lime application is estimated 1,841,000 lbs/yr for 1999.

### Table 39.1
### Parameters Monitored by the Shrimp Mariculture Industry, 1998

| Farm | Seawater Source | Intake Volume (mil gals/day) | Effluent Treated/ Monitored | Inputs | | |
|---|---|---|---|---|---|---|
| | | | | Feed ('000 lbs/yr) | Fertilizer (lbs/acre/wk) | White Lime ('000 lbs/yr) |
| Nova | Sea | 36.0 | No/Yes | 5,700 | 22 | 950 |
| Paradise Farm | Sea | 10.7 | Yes/Yes | 1,152 | 132 | 6 |
| Nova Laguna | Lagoon | 0.1 | Yes/Yes | 600 | 60 | 28 |
| Nova Toledo | Sea | 16.3 | Yes/Yes | 1,600 | 60 | 246 |
| Belize Aquaculture | Sea | 0.2 | Yes/Yes | 455 | N/A | 1 |
| Toledo Fish Farming | Sea | 12.0 | No/No | 317 | 3 | 152 |
| Aqua-Mar | Estuary | 85.4 | Yes/Yes | 2,567 | 25 | - |

*Source: CSO*

### Table 39.2
### Parameters Monitored by the Shrimp Mariculture Industry, 1999

| Farm | Seawater Source | Intake Volume (mil gals/day) | Effluent Treated/ Monitored | Inputs | | |
|---|---|---|---|---|---|---|
| | | | | Feed ('000 lbs/yr) | Fertilizer (lbs/acre/wk) | White Lime ('000 lbs/yr) |
| Nova | Sea | 53.0 | No/Yes | 8,911 | 24 | 1,400 |
| Paradise Farm | Sea | 13.3 | Yes/Yes | 1,142 | 151 | 5 |
| Nova Laguna | Lagoon | 0.1 | Yes/Yes | 390 | 60 | 28 |
| Nova Toledo | Sea | 16.3 | Yes/Yes | 1,120 | 60 | 246 |
| Belize Aquaculture | Sea | 0.5 | Yes/Yes | 990 | N/A | 10 |
| Toledo Fish Farming | Sea | 12.0 | No/No | 527 | 3 | 152 |
| Aqua-Mar | Estuary | 105.6 | Yes/Yes | 2,902 | 50 | - |

*Source: CSO*

## COASTAL ZONE

### Table 40.1
### Status of Coastal and Marine Species of Primary Interest, 1998

| Taxa | Threatened with Protective Status | Threatened & Unprotected | Protected but Enforcement lacking | Protected Measures not Adequate |
|---|---|---|---|---|
| Hawksbill | + | | + | |
| Green Turtle | + | | + | |
| Loggerhead | + | | + | |
| American Crocodile | + | | + | + |
| Morelets Crocodile | + | | + | + |
| Nassau Grouper | | + | + | + |
| Queen Conch | + | | + | + |
| Common Snook | | + | | |
| Bonefish | + | | + | |
| Jewfish | | + | | |
| Tarpon | | + | | |
| Permit | | + | | |
| Manatee | + | | + | + |
| Hicatee | + | | + | + |
| Sharks | | + | | |
| Marine Aquarium Fish | | + | | |
| Brown Nuddy | + | | | + |
| Woodstork | + | | | + |
| Bay Breasted Warbler | + | | | + |
| Cape May Warbler | + | | | + |
| Brown Booby | + | | | + |
| Roseate Spoonbill | + | | | + |

*Source: Belize National Biodiversity Action Plan, NBC, MNREI, 1998*

### Table 40.2
### Summary of Biological Diversity in Coastal and Marine Areas, 1998

| Taxa | Coastal | | Marine | |
|---|---|---|---|---|
| | Genera | Species | Genera | Species |
| Fish | 37 | 173* | 229 | 472 |
| Invertebrates | 29 | 45 | 296** | 456 |
| Reptiles | 17 | 124 | 5 | 7 |
| Amphibians | 6 | 7 | - | - |
| Insects | 152 | 240*** | - | - |
| Birds | 128 | 177 | 34 | 47 |
| Mammals | 37 | 39 | 4 | 5 |
| Plants | 188 | 235 | 66 | 315 |
| **Totals** | **594** | **627** | **338** | **1,302** |

*Source: Belize National Biodiversity Action Plan, NBC, MNREI, 1998*

* *Includes freshwater species*

** *Some genera and species inferred from carefully analyzed geographic distribution data*

*** *Including counts from rivers forest, coastal creeks, beaches and cayes*

# ENERGY

Our atmosphere is under increasing pressure from greenhouse gases that threaten to change the climate and from chemicals that reduce the ozone layer. In addition, other pollutants, including those that cause acid rain, often travel long distances through the atmosphere to cause damage to land and water in other parts of the world.

*Energy* use is a major source of greenhouse gas emissions. The use of energy is essential for economic and social development and for improved quality of life. Much of the world's energy, however, is produced and consumed in ways that cannot be sustained if overall quantities increase substantially. The ways in which energy are produced, supplied and consumed are some of the major ways in which human activity affects the environment. The prime objective of sustainable development is to ensure that future generations can enjoy quality energy services similar to those we enjoy today.

As a developing country, Belize has already taken important steps to preserve the environment, a good example is the establishment of the Mollejon Hydro Power in May of 1995. The use of hydro electric power will reduce the $CO_2$ emissions in the atmosphere, since through this process no fossil fuels are consumed. The production of electrical energy is considered to contribute about 5 % of the GHG emissions in Belize. Also, with the hydro in place, it has lessened Belize's dependence on imported fuel, as well as, the reduction of the use of fossil fuel for electrical power production.

The demand for electric power supply in Belize has increased over the past years as a result of the increase in human population and the consequent urban and rural developments. The Belize Electricity Limited (BEL) is the supplier of electricity in Belize and has different sources of energy generation which are thermal (BEL), imported thermal (Mexico) and the hydroelectric power.

**Table 41.1**
**Total Electric Energy Supplied (MWh) to the Country of Belize, 1993/94 - 1999/00**

| Energy Source | 1993/94 | 1994/95 | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 |
|---|---|---|---|---|---|---|---|
| Net Diesel Generation | 133,948 | 139,844 | 97,929 | 88,108 | 96,917 | 103,381 | 60,134 |
| KW Purchased | 20,448 | 22,986 | 71,014 | 88,363 | 100,819 | 109,545 | 174,848 |
| • Hydro | - | - | 46,695 | 62,375 | 72,028 | 67,985 | 67,809 |
| • Mexico | 20,448 | 22,986 | 24,319 | 25,988 | 28,791 | 41,560 | 107,039 |
| **Total Sent Out** | **154,396** | **162,830** | **168,943** | **176,471** | **197,736** | **212,926** | **234,982** |

*Source: BEL Annual Report, 1999/2000*

Previous to the installation of the hydro power plant, most of the electric power used in Belize, was generated through the heating plants using diesel. Today, the Belize Electricity Limited obtains about 26 % of its electricity from fossil fuels (diesel), compared with 87 % in 1993. This reduction in the use of fossil fuels also reduces Belize's emissions of greenhouse gases into the atmosphere.

For the past years the country had been highly dependent on diesel generated power and on the power generated by the Mollejon after its introduction. The situation changes, however, in the 1999/2000 fiscal year. During this period more than 45 % of the power supplied in the country was bought from Mexico. The advantage of receiving electric power from Mexico is that through this process the greenhouse gases and other wastes produced and/or released will be accounted for in Mexico and not in Belize.

It is important to mention that some wastes from agro-industries is reused to produce energy. In 1999 the Belize Sugar Industry reused about 68 % of its waste produced to generate 18.3 million kWh of electricity for their own use.

## ENERGY

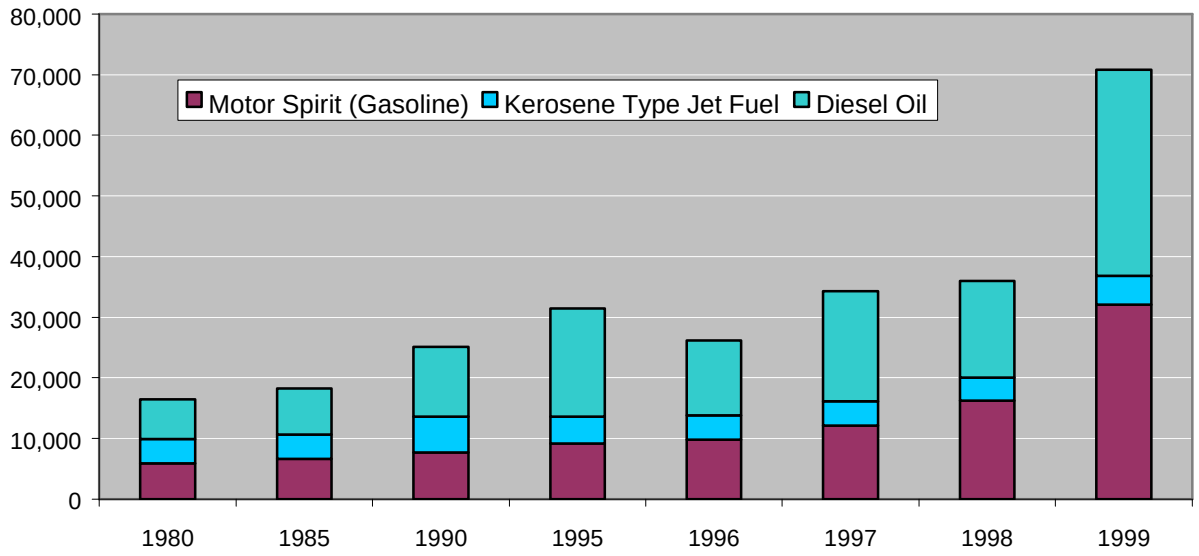
The rated capacity is the total load output (100 %) in kW as recommended by the engine manufacturers. However, the available capacity is the percentage of the rated capacity that an engine can achieve due to malfunctions of the engine from time to time. In 1999, the available country-wide diesel power generation capacity was much lower than the previous years, 64 % output . The year 1995 was the only year where the available capacity was almost equal the rated power generation capacity.

**Table 42.1**
**Country-Wide Diesel Generation Capacity, 1991- 1999**

| Year | Rated Capacity (kW Installed) | Available Capacity (kW) |
|---|---|---|
| 1991 | 39,737 | 34,900 |
| 1992 | 43,318 | 38,419 |
| 1993 | 46,128 | 40,419 |
| 1994 | 48,013 | 43,019 |
| 1995 | 48,743 | 47,369 |
| 1996 | 44,433 | 39,719 |
| 1997 | 42,263 | 37,919 |
| 1998 | 32,617 | 26,885 |
| 1999 | 30,390 | 19,050 |

*Source: BEL*

**Chart 42.2**
**Fuel Imports ('000 gals), 1980 - 1999**




*Source: CSO*

The major types of fuel imports to the country of Belize are diesel and gasoline. In 1999 the highest record in the imports of fuel was recorded with an sharp increase of 97 % over the 1998 total amount of fuel imports and 4.3 time higher than that registered in 1980. It is assumed that a high percentage of the increase in fuel imports was as a result of the functioning of Corozal Free Zone. Diesel imports have been on average some 30 % higher than gasoline imports, except in 1998 when gasoline imports were 2 % higher than diesel imports. Jet fuel on the other hand, has been somewhat steady for the same period.

# ENERGY

## Table 43.1
## Import of Petroleum Products, 1997 - 1999

| SITC[1] | | 1997 | | 1998 | | 1999 | |
|---|---|---|---|---|---|---|---|
| | Unit | Quantity | Value (Bz$) | Quantity | Value (Bz$) | Quantity | Value (Bz$) |
| 334.44 | gls | 569,419 | 898,205.00 | 566,436 | 674,613.00 | 446,512 | 376,783.00 |
| 334.52 | gls | 538,975 | 4,245,403.00 | 568,364 | 4,447,085.00 | 538,685 | 3,836,867.00 |
| 334.53 | lbs | 199,204 | 268,954.00 | 144,010 | 206,401.00 | 88,038 | 153,698.00 |
| 334.54 | lbs | 842,687 | 811,940.00 | 757,420 | 692,210.00 | 934,015 | 998,376.00 |

*(1) represents Standard International Trade Classification*
*334.44 - Other bunker "C" grade fuel oil*
*334.52 - Lubricating oils*
*334.53 - Lubricating grease*
*334.54 - Hydraulic brake fluid and other liquid for hydraulic transmission*

*Source: CSO*

## Table 43.2
## Quantity of Petroleum Products Used (gals) for Generating Electricity, 1995/96 - 1998/99

| Consumption Type | 1995/96 | 1996/97 | 1997/98 | 1998/99 |
|---|---|---|---|---|
| Fuel | 8,034,702 | 6,985,486 | 7,376,378 | 7,979,539 |
| Lube Oil | 75,639 | 59,698 | 61,427 | 70,083 |

*Source: BEL*

The Belize Electricity Limited (BEL) consumes approximately about 50 % of the total diesel imports, in addition, a large quantity of lubricating oil is also used in the generation of electricity. These mineral oils and petroleum products used in the thermal power generation are known to contain a significant number of hydrocarbon components.

BEL has an Environmental Mitigation Project in place which includes spills prevention implementation, as well as, a soil remediation and clean up campaign for specific power station sites in the country.

## Table 43.3
## Percent of Household by Type of Fuel Used for Cooking, 1980 and 1991

| Year | Wood | Gas | Electricity | Other[1] |
|---|---|---|---|---|
| 1980 | 31.3 | 60.5 | 1.1 | 7.1 |
| 1991 | 29.2 | 62.0 | 0.9 | 7.9 |

*(1) under this category fuel types such as biogas and kerosene operated stoves are included.*
*Source: Population Census 1980 and 1991, CSO*

According to table 43.3 approximately 60.5 % and 62.0 % of the households used butane gas for cooking as indicated by the Census results of 1980 and 1991 respectively.

# ENERGY

## Table 44.1
## Total Electricity Used ('000 kWh) by Category, 1995/96 - 1999/00

| Category | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 |
|---|---|---|---|---|---|
| Residential | 67,979 | 70,916 | 77,672 | 80,779 | 84,010 |
| Commercial | 40,791 | 42,552 | 46,609 | 49,806 | 59,962 |
| Industrial | 32,616 | 34,026 | 35,461 | 43,120 | 51,011 |
| Others | 11,545 | 12,044 | 12,525 | 13,026 | 13,547 |
| **Total** | **152,931** | **159,537** | **172,267** | **186,731** | **208,531** |

*Source: BEL Annual Report, 1999/2000*

Energy contribute substantially to the welfare and living standards of the Belizean society, and its supply underpins activity in all parts of the economy. The efficiency with which energy is produced, converted and used affects economic performance, domestic cost and international competitiveness. The production and use of energy can also deplete and degrade natural resources, produce waste heat and other pollutants and place undue stress on the natural environment.

In a nine year span (1990/91 - 1999/00), the total electricity consumption doubled with an average annual increase of approximately 6.1 % over the last five years.

About 42 % of the total electric power generated in 1999 was consumed by households. The industrial category, however, might have been the main consumer of electricity but not all industries are included here since there are some industries that generate their own power supply as mentioned at the beginning of this section.

## Table 44.2
## Number of Electricity Consumers by Category, 1995/96 - 1999/00

| Category | 1995/96 | 1996/97 | 1997/98 | 1998/99 | 1999/00 |
|---|---|---|---|---|---|
| Residential | 36,985 | 38,553 | 40,553 | 42,735 | 43,892 |
| Commercial | 4,876 | 5,140 | 5,594 | 6,075 | 7,835 |
| Industrial | 19 | 19 | 17 | 18 | 20 |
| Street Lights | 1 | 1 | 1 | 1 | 1 |
| **Total** | **41,851** | **43,713** | **46,165** | **48,829** | **51,748** |

*Source: BEL Annual Report, 1999/2000*

The total number of electricity consumers has almost doubled for the past years. This can be attributed mainly to population growth, that is urban and rural development for the same period. Residential consumers constitute 86 % of the total consumers.

Note that the industrial consumers only make up 1 % of the total consumers. Not only that, but as low as these may seem this sector consumes about 20.8 % of the energy produced. Note that street lights are government owned thus, is considered as one consumer only.

# WATER

Water is a vital component of the natural environment, as well as, an important resource for humans. Water also plays important economic and social roles. In fact, water is now a critical factor for development on a worldwide basis, as well as, for the healthy functioning of nature.

Belize is very rich in surface and ground water resources. Although Belize is a relatively low country with large areas along the coastal plain below sea level, rivers and streams meet most of its water needs. The country river system includes about 16 main catchments areas and rivers, most of which originate from the Maya Mountain Range, which forms the topographic and geological backbone of the country.

There is limited information on the country's water resources, whether surface or underground water. Surface water resources appears to be abundant except on the Vaca Plateau where streams disappear in the porous limestone. For many villages and settlements in the rural areas, rivers and streams are the major source of washing and even drinking.

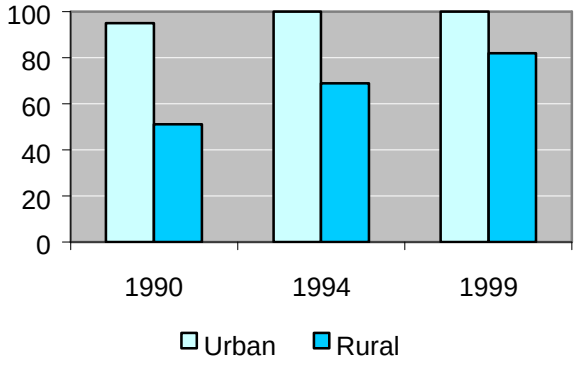
Water is mainly used for industrial purposes and for human consumption. Thus, in general, Belize has enough water resources to meet the population's present and future water needs. Access to safe water in Belize has improved significantly in recent years.

In urban areas the safe water coverage is between 90 % and 100 %, while in the rural areas the coverage is estimated at about 82 %. This improvement in the supply of safe water to a great percentage of the population has greatly reduced the incidence of water borne diseases.

Water quality in urban areas is good and is constantly monitored, but in rural areas (mainly in the southern part of the country and Cayo District) the water quality is not too satisfactory. The Water and Sewerage Authority (WASA) monitors all urban water systems. In the rural areas full water purification takes place only in the Rudimentary Water Systems that are connected to the WASA System. Some of the villages tend to do their own purification, but the results are not too satisfactory, since they do not meet the PAHO drinking water guidelines.

Although water pollution in Belize is not a serious problem yet, the risk of contamination increases with the intensification of domestic and industrial uses. The contamination of surface water originates mainly from sources such as agriculture run-off, domestic waste water and solid waste, industrial wastewater and solid waste, and trans-boundary pollution. Ground water contamination affects the quality of the drinking water. Domestic wastewater and infiltration of agricultural chemicals are the main source of ground water contamination.

**Chart and Table 45.1**
**Percent of Water Supply Coverage, 1990 - 1999**




| Water source | 1990 | 1994 | 1999 |
|---|---|---|---|
| Urban | 95 | 100 | 100 |
| Rural | 51 | 69 | 82 |

*Source: Belize Environmental Report, 1996 & PAHO*

*Source: Belize Environmental Report, 1996 & PAHO*

# WATER

Groundwater and surface water are a vital and well used resource in Belize, with uses ranging from domestic and industrial to hydro-electric power generation and irrigation.

The Water and Sewerage Authority (WASA), a quasi-government institution under the Ministry of Public Utility, Energy and Communication is responsible for the development and administration of all new water systems, including any upgrades of existing water systems.

Access to water in Belize has improved significantly in recent years. According to 1999 estimates by PAHO , approximately 85 % of Belize's population has access to potable water via a well with hand pump or a pipe system. In urban areas, the coverage is approximately 100 %, while in rural areas it is estimated to be about 82 %. It is important to note that in the rural areas safe water supply has increased from 69 % in 1994 to 82 % in 1999.

## Table 46.1
## Water Abstraction ('000 gals) by Area, 1994 - 1999

| City/Town | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Belize | 959,023 | 1,263,623 | 1,280,802 | 1,272,541 | 1,305,490 | 1,273,536 |
| Belmopan | 170,772 | 205,533 | 257,404 | 220,764 | 208,190 | 192,604 |
| Benque Viejo | 61,440 | 63,990 | 60,462 | 55,139 | 61,624 | 61,412 |
| Corozal | 107,254 | 124,304 | 125,611 | 139,973 | 140,879 | 146,100 |
| Dangriga | 80,525 | 112,017 | 114,162 | 125,416 | 140,459 | 148,924 |
| Orange Walk | 128,369 | 113,937 | 123,554 | 134,605 | 129,626 | 121,019 |
| Punta Gorda | 81,656 | 84,686 | 80,621 | 63,177 | 65,075 | 67,123 |
| San Ignacio | 237,123 | 287,542 | 182,262 | 172,311 | 197,912 | 212,899 |
| San Pedro | 23,600 | 27,148 | 28,697 | 44,993 | 52,435 | 60,839 |
| **TOTAL** | **1,849,762** | **2,282,780** | **2,253,575** | **2,228,919** | **2,301,690** | **2,284,456** |

*Source: WASA*

Annual water abstraction by the Water and Sewerage Authority from surface water and ground water represents about 85.4 % and 14.6 % respectively. Between 1994 and 1999 withdrawal of water increased by 23.4 % with an annual average increase of 4.3 % over the same period. In 1999, the Belize City distribution system alone accounted to about 55.7 % of the total water abstraction. Water abstraction from other industries such as the citrus, sugar, banana and others are not included. Rapid population growth can lead to water resource depletion which can have serious effects on the economic and social sectors of the country.

In order to cope with the rapid population growth and development demands, such as the present housing projects, WASA is presently looking at an expansion project of the Belize City water system. A major concern is that the proposed system for Belize City will definitely put additional pressure by the increase in the amounts of wastewater pumped into the sewer system. Thus, proper management of our water resources is needed in order to conserve this vital element for life.

# WATER

## Table 47.1
## Water Sources and Water Connections (number) by Area, 1990 - 1999

| City/Town | Source and Method of Purification | 1990 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| Belize | Surface Water - from Belize River | 10,992 | 12,808 | 13,612 | 14,000 |
| Belmopan | Surface Water - from Belize River | 1,369 | 3,100 | 3,583 | 3,785 |
| Benque Viejo | Surface Water - Infiltration Gallery | 990 | 1,547 | 1,579 | 1,617 |
| Corozal | Wells - Ground Water Aquifer | 1,396 | 2,536 | 2,680 | 2,764 |
| Dangriga | North Stann Creek River | 1,831 | 2,903 | 3,146 | 3,411 |
| Orange Walk | Wells - Ground Water Aquifer | 2,288 | 2,925 | 3,035 | 3,135 |
| Punta Gorda | Wells - Ground Water Aquifer | 764 | 1,450 | 1,596 | 1,696 |
| San Ignacio | Belize River - Infiltration Gallery | 2,077 | 3,138 | 3,378 | 3,782 |
| San Pedro | Desalination (Reverse Osmosis) | 298 | 700 | 1,019 | 1,227 |
| **TOTAL** | | **22,005** | **31,107** | **33,628** | **35,417** |

*Source: WASA*

The Belize Water and Sewerage Authority has different sources of water namely surface water from the Belize River and Stann Creek River, ground water aquifers and sea water.

In a ten year period (1990 - 1999), the number of water connections increased tremendously, by 60.9 %, with an annual average increase of about 5.4 % for the same period. In 1999, there was a 5.3 % increase in the number of water connections over the 1998 period with San Pedro Town showing the highest percentage increase, 20.4 % increase, for the same period. Belize City has the highest number of water connections having more than 39 % of the total water connections.

## Table 47.2
## Water Consumption by Area ('000 gals), 1990 - 1999

| City/Town | 1990 | 1997 | 1998 | 1999 |
|---|---|---|---|---|
| Belize | 341,167 | 555,497 | 581,351 | 598,456 |
| Belmopan | 45,011 | 85,627 | 96,392 | 107,832 |
| Benque Viejo | 13,330 | 29,615 | 35,277 | 36,119 |
| Corozal | 26,207 | 62,788 | 69,888 | 70,621 |
| Dangriga | 24,119 | 58,429 | 64,538 | 69,024 |
| Orange Walk | 38,269 | 83,795 | 94,605 | 95,182 |
| Punta Gorda | 12,949 | 30,667 | 42,835 | 49,142 |
| San Ignacio | 43,755 | 94,706 | 98,712 | 101,340 |
| San Pedro | 5,308 | 33,810 | 45,345 | 52,928 |
| **TOTAL** | **550,115** | **1,034,934** | **1,128,944** | **1,180,644** |
| Government | N/A | 132,599 | 130,563 | 135,873 |

*Source: WASA*

Water consumption during the last ten years has increased by almost 115 % from 550,115,000 gallons in 1980 to 1,180,644,000 gallons in 1999. The average annual increase in water consumption is 8.9 %. Out of the total amount of water consumed Belize City alone consumes 51 %. Interestingly enough, water consumed in 1999 represents only 52 % of the total water abstracted by WASA. According to the Water and Sewerage Authority the huge loss of water was due to technical problems, through leakage ( 12 - 13 %) and malfunctions of meters , authorized un-metered water connections and theft.

## WATER

The quality of waters in Belize is generally good when compared to other Central American countries, primarily due to Belize's sparse population. Water quality testing is done by both WASA and Public Health Bureau (PHB), since they have well equipped laboratories. There are nine urban water treatment systems which are monitored by WASA and PHB. The water is disinfected using chlorine with concentrations within the WHO standards. The Public Health Bureau has the responsibility for the monitoring of drinking water quality in both urban and rural areas. Through a project funded by PAHO in 1995, 40 chlorine pumps were procured for distribution to rudimentary water systems so that continuous treatment could be provided.

### Table 48.1
### Water Quality Parameters in Drinking Water Monitored By WASA, June 1998

| Distribution Systems | Alkalinity | Hardness | | | Sulphate | Total Coliform | Nitrate | Chloride |
|---|---|---|---|---|---|---|---|---|
| | | Total | Calcium | Mg | | | | |
| Belize | 141 | 507 | 423 | 84 | 463 | 1 | 1 | 34 |
| Belmopan | 165 | 208 | 175 | 33 | 24 | 0 | 0.9 | 22 |
| Benque Viejo | 309 | 358 | 346 | 12 | 33 | 0 | 1.8 | 24 |
| Corozal | 338 | 592 | 419 | 173 | 300 | 0 | 2.5 | 83 |
| Dangriga | 19 | 26 | 15 | 11 | 1 | 5 | 0.6 | 19 |
| Orange Walk | 290 | 546 | 462 | 84 | 325 | 3 | 0.9 | 78 |
| Punta Gorda | 224 | 242 | 224 | 18 | 1 | 5 | 1.2 | 17 |
| San Ignacio | 122 | 150 | 145 | 5 | 27 | 1 | 0.8 | 16 |
| San Pedro | 21 | 71 | 64 | 7 | 80 | 0 | 0.6 | 213 |

*Source: WASA*

As indicated by the Public Health Bureau the W.H. O. guidelines for drinking water is only a partial listing. The parameters listed on Table 48.2 represent the ones routinely tested by the water quality laboratory of the Public Health Bureau. If this values are exceeded there is a risk for possible negative effects, such as water borne diseases, diarrhea , salty taste etc.

The objective of the Water Quality Laboratory at PHB is to identify the potential risks of water-borne diseases in time so that the necessary preventive and remedial actions can be taken.

### Table 48.2
### W.H.O. Drinking Water Guidelines

| Parameters | Guideline Values | Possible effects |
|---|---|---|
| PH | 6.5 - 8.5 | Taste |
| Iron | 0.3 mg/l | Taste/colour |
| Hardness(1) | 300 mg/l | Taste |
| Nitrate | 50 mg/l | Blue baby condition |
| Sulphate | 500 mg/l | Taste/diarrhea |
| Flouride | 1.5 mg/l | Fluorosis |
| Chloride | 250 mg/l | Salty Taste |
| Alkalinity(1) | 400 mg/l | |
| Turbidity | 5 NTU | Aesthetic |
| Coliform | 0 cols/100 ml | Water Borne Diseases |

*(1) represents standards from The American Academy Of Science and not the W.H.O. standards*
*Source: Public Health Bureau, MOH*

# WATER

## Table 49.1
## Number of Hand Pumps by District, 1992 - 1999

| Distrcit | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|
| Corozal | 185 | 187 | 187 | 187 | 187 | 200 | 200 | 200 |
| Orange Walk | 138 | 142 | 150 | 150 | 150 | 150 | 150 | 150 |
| Belize | 93 | 88 | 87 | 89 | 87 | 87 | 87 | 87 |
| Cayo | 76 | 76 | 76 | 76 | 76 | 76 | 76 | 76 |
| Stann Creek | 65 | 65 | 36 | 36 | 36 | 3 | 3 | 3 |
| Toledo | 154 | 154 | 154 | 154 | 154 | 150 | 150 | 154 |
| **Total** | **711** | **712** | **690** | **692** | **690** | **666** | **666** | **670** |

*Source: Public Health Bureau, MOH*

There are approximately 670 functional hand pump wells in rural areas of Belize, with almost 30 % of the pumps found in the Corozal District and 23 % of them found in Toledo District. Most of these pumps are installed in small communities with population less than 250. The treatment of the well water is not provided regularly but periodic chlorination treatment is provided by the Water Supply and Sanitation Program (RWSSP) when contamination is reported. In order to facilitate the improvement and paving of the Hummingbird Highway a number of hand pumps in the Stann Creek District had to be removed.

## Table 49.2
## Number of Hand Pumps Tested by District, 1992 - 1999

| District | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|
| Corozal | 93 | 167 | 145 | 87 | 43 | - | - | - |
| Orange Walk | 20 | 46 | 99 | 78 | 39 | 1 | 1 | - |
| Belize | 69 | 84 | 76 | 66 | 26 | - | 5 | 27 |
| Cayo | 35 | 7 | 57 | 29 | 7 | - | - | - |
| Stann Creek | 13 | 15 | 29 | 10 | 3 | - | - | - |
| Toledo | 32 | 11 | 125 | 11 | 1 | 29 | 20 | 14 |
| **Total** | **262** | **330** | **531** | **281** | **119** | **30** | **26** | **41** |
| Number Tested Positive | 53 | 52 | 169 | 66 | 17 | 19 | 9 | 22 |

*Source: Public Health Bureau, MOH*

The Rural Water Supply and Sanitation Program (RWSSP) was abolished in December of 1995, however, a few of the hand pumps continued to be tested for faecal Coliform during the last years. In 1999, the RWSSP was reopened and now is supporting projects for development of the sector in rural areas. With the RWSSP in place, a total of 41 hand pumps were tested in 1999, an increase of 57.7 % in the number of hand pumps tested in 1998.

However, in 1999 testing of hand pumps for faecal coliform only took place in Belize and Toledo Districts. Out of the 41 hand pumps tested in 1999, 22 were contaminated (tested positive), that is about 54 % of them tested positive. This represents the second highest percentage of hand pump contamination during the last eight years. The highest percentage of contamination occurred in 1997 when 63 % of the hand pumps tested were positive.

# WATER

*Groundwater* from wells and springs is an essential resource in Belize. About 30 % of the urban population and 94 % of the rural population obtain their water needs from groundwater. Development of safe and reliable supplies of ground water is an important issue. Quality problems exist, but these are localized or temporary. The most important contamination sources for ground water are human and animal waste, and infiltration of agricultural chemicals. There are also problems with groundwater that is safe to drink but does not taste well.

*Surface water* resources in Belize are abundant but not a lot is known about the quality.

## Table 50.1
## Surface Water Quality Overview

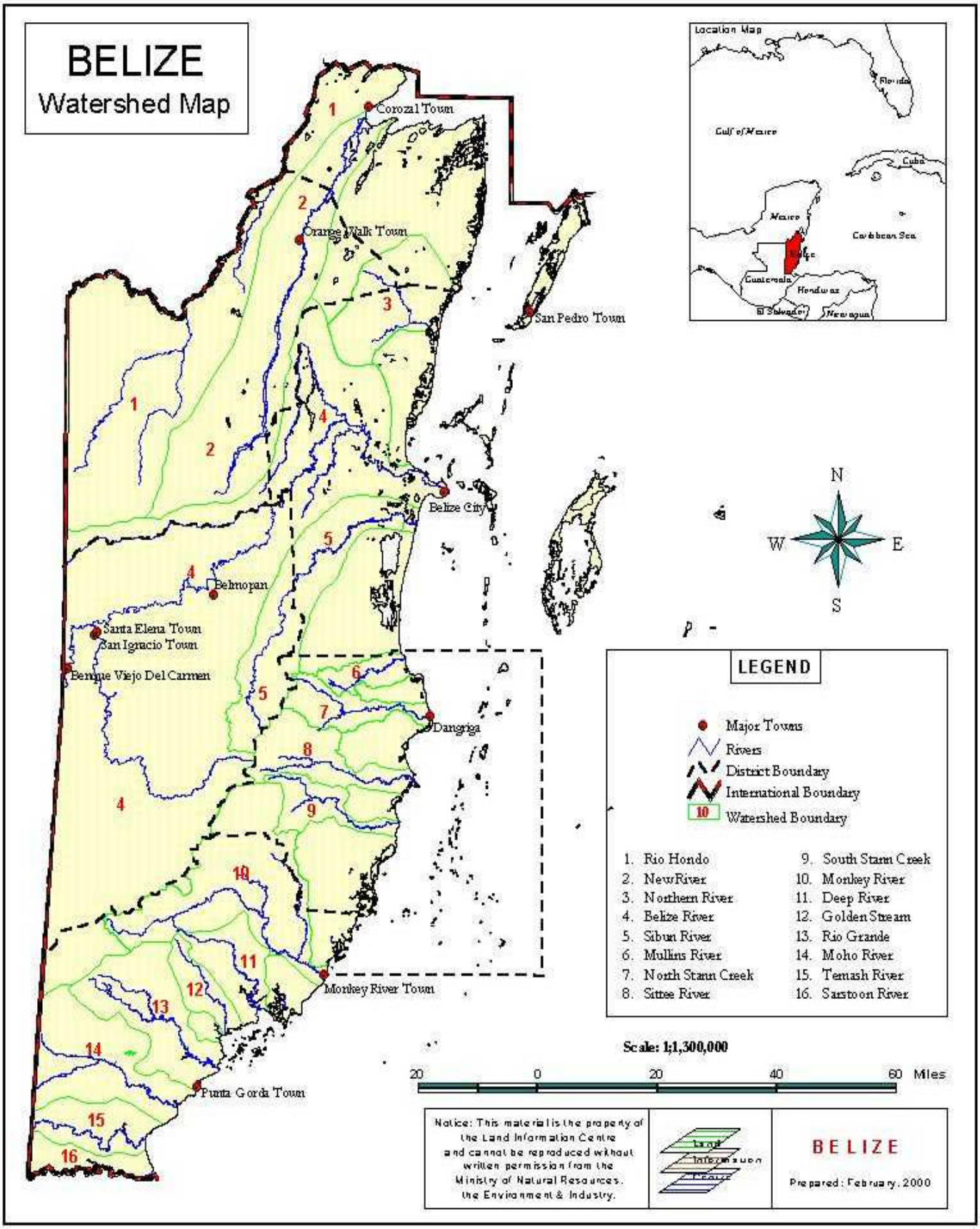
| Basin[(1)] | Water characteristics | Pollution situation |
|---|---|---|
| I | High hardness, sulphates, alkalinity | Domestic/Agricultural[(2)] |
| II | High dissolved oxygen, hardness, sulphates, alkalinity | Sugar refineries discharge phosphates, nitrates, caustics, organic debris<br>Some agrochemical<br>Domestic/Agricultural[(2)] |
| III | High hardness, sulphates, alkalinity<br>High BOD (oxygen demand), suspended particles<br>Also caustics, chlorine, oil | Dumping of organic matters<br>Milpas give high sediment load<br>Domestic/Agricultural[(2)]<br>Cross-border pollution (wastes) |
| IV | Moderate to high hardness<br>High sediment loads | Limited industrial and agrochemical pollution<br>Domestic/Agricultural[(2)] |
| V | Low hardness, alkalinity<br>High suspended solids, fertiliser, pesticide residues<br>Toxic low pH, high BOD | Citrus processing plant discharges cause low pH, high BOD<br>Domestic/Agricultural[(2)] |
| VI | High hardness, alkalinity | Organic pollution from banana industries<br>Milpas give high sediment load<br>Domestic/Agricultural[(2)] |

*Source: Water Resources Assessment for Belize, 1998*

*(1) represents*

- ***Basin I*** *- is the Rio Hondo basin.*
- ***Basin II*** *- is Northern Belize basin (Northern & New Rivers);*
- ***Basin III*** *- is the Belize River basin (Belize River)*
- ***Basin IV****- is the North-central coastal basin (Sibun & Mullins Rivers),*
- ***Basin V*** *- is the South-central coastal basin (Sittee River, North & South Stann Creek) and*
- ***Basin VI*** *- is the Southern Belize basin (Monkey, Deep, Moho, Temash, Sarstoon Rivers, Golden Stream and Rio Grande).*

*(2) represents domestic waste water and agricultural runoffs that can cause some biological contamination near and down river from populated places.*




*Source: LIC, MNREI*

# SANITATION

It is important to note that in Belize the lack of proper sanitation facilities has led to increasing contamination of our groundwater resources which as a result has increased human health problems such as gastroenteritis and hepatitis A. Adequate sanitation coverage in urban areas of Belize seems to be improving over the years. According to the 1999 PAHO report, 71 % of the urban areas have proper sanitation facilities an increase of 12 % in coverage from the World Bank estimates of 1995. However, the coverage in rural areas is showing a decline from 35 % in 1995 to 25 % coverage in 1999. This is so since the different classifications might have been used.

## Table 52.1
## Percentage of Sanitation Coverage, 1990 - 1999

| Sanitation | 1990[1] | 1995[1] | 1999[2] |
|---|---|---|---|
| Urban | 59 | 59 | 71 |
| Rural | 25 | 35 | 25 |

*(1) represents estimates from The World Bank*
*(2) represents estimates from PAHO.*
*Source: Belize Environmental Report , 1996 & PAHO*

## Table 52.2
## Sanitation Coverage by District, 1994

| District | Percent Urban | Percent Rural |
|---|---|---|
| Corozal | 53 | 21 |
| Orange Walk | 28 | 27 |
| Belize | 81 | 33 |
| Cayo | 43 | 14 |
| Stann Creek | 18 | 19 |
| Toledo | 33 | 24 |
| **Total** | **59** | **22** |

*Source: WASA and RWSSP Report, 1994*

According to the WASA and RWSSP Report of 1994 the percentage of proper sanitation coverage was 59 % urban and 22 % rural. Belize and Corozal Districts urban areas have the highest percentage of adequate sanitation coverage with 81 % and 53 % respectively. Belize District and Orange Walk District rural areas have the highest percentage adequate sanitation coverage with 33 % and 27 % coverage respectively.

## Table 52.3
## Sanitation Coverage by Type of Service, 1999

| Type of Service | Urban | Rural |
|---|---|---|
| Sewer System | 39.1 | - |
| Septic Tanks and Latrines | 31.8 | 25.3 |
| **Total** | **70.9** | **25.3** |

*Source: PAHO*

## Table 52.4
## Number of Household Connected to Sewer Systems, 1999

| City/Town | Number of Households | Coverage Percent |
|---|---|---|
| Belize City | 4,887 | 60 |
| Belmopan | 2,150 | 80 |
| San Pedro | 140 | 30 |
| **Total** | **7,177** | **57** |
| **1998** | **7,160** | |

*Source: PAHO*

There are three municipalities in the country that have sewer systems namely Belize City, Belmopan and San Pedro. The Belize City and San Pedro systems use facultative and maturation lagoons where the sewerage is pumped and treated. While Belmopan use basic primary treatment.

Presently the sewer system serves about 57 % of the household in this three municipalities. In addition, the number of household connected to the sewer system in Belize City and Belmopan has remain unchanged since 1998 while in the island of San Pedro their was a slight increase from 123 in 1998 to 140 in 1999.

# WASTE

The rapidly growing quantities of solid waste, pose threats to human health and the environment. Urban waste pollutes the air, land, and water over a wide area. In addition, the improper handling and disposal of solid waste and sewerage, affects the daily life of our population and especially the children who are highly vulnerable to the effects of the environment degradation.

Unsustainable consumption is increasing the amount and variety of waste produced, and quantities could increase tremendously over the years to come. The best way to cope with waste problems is through a waste prevention approach, mainly focused on changes of lifestyle and changes in production and consumption patterns.

Solid waste is generally taken to mean waste generated by the households, commercial, industrial and the construction sectors. The waste produced by these sectors comprise most of the waste that is disposed at the landfills, dumpsites and to incineration plants.

The responsibility for solid waste management, collection and disposal previously rested with the local government at the city and town levels. More recently the collection and disposal of municipal waste has been privatized. Funding for the services is taken from a combination of local revenues and Central Government subventions through the Ministry of Local Government.

Solid waste is a growing problem in Belize. Estimates of the amount of municipal solid waste generated by households, commercial and institutional sectors are based on the study conducted for the Belize Solid Waste Management Project. In this study it was derived that the average waste generation rate was 2.1 pounds per person per day. In 1997, it was estimated that the urban areas of the country generated about 40,000 tons of municipal solid waste per annum. Presently, in Belize, the landfills are not being required to keep records concerning the solid waste disposed there. Although, the exact amount of solid waste generated per year in the country is not known it is assumed that large amounts of waste is generated each year. Solid waste disposal is of major concern because if not well managed it can lead to environmental degradation, as a result human health can also be seriously affected.

Recycling is an alternative but the process may be expensive and no major recycling takes place in Belize, except for the export of scrap metal to our neighboring country of Mexico.

The Government of Belize is currently in the process of developing a comprehensive National Solid Waste Management Plan, which will include provisions for the collection, management and final disposal of solid waste. However, in the liquid waste sector, Belize is yet to adopt a comprehensive policy framework.

## Table 53.1
## Solid Waste Generated by Municipalities, 1997

| Municipality | Tons per Annum | lbs/capita/day | Tons per Day | Vehicles Used for Waste Collection |
|---|---|---|---|---|
| Corozal | 2,640 | 2.1 | 7.2 | 2 |
| Orange Walk | 6,125 | 2.5 | 16.8 | 3 |
| Belize City | 19,328 | 2.2 | 53.0 | 10 |
| San Ignacio | 4,078 | 2.2 | 11.2 | 4 |
| Benque | 1,465 | 1.5 | 4.0 | 2 |
| Belmopan | 1,548 | 1.4 | 4.2 | 3 |
| Dangriga | 1,159 | 1.0 | 3.2 | 2 |
| Punta Gorda | 1,166 | 1.5 | 3.2 | 2 |
| San Pedro | 640 | 1.2 | 1.8 | 3 |
| **Total** | **38,148** | **2.1** | **104.5** | **31** |

*Source: Belize Solid Waste Management Project and CSO*

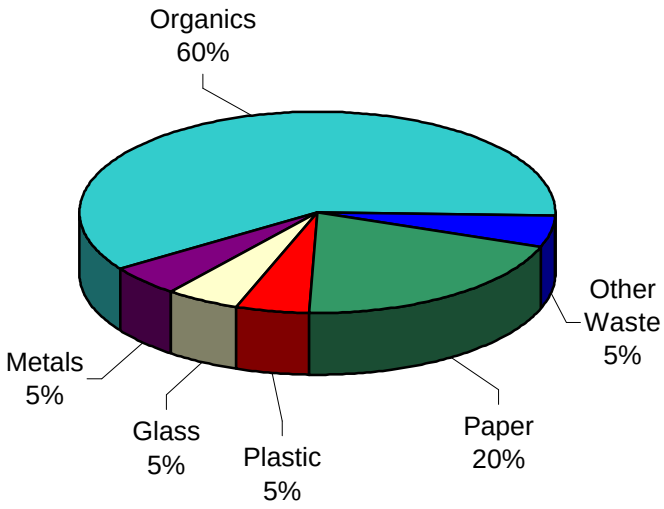
# WASTE

**Table 54.1**
**Annual Expenditure Estimates on Municipal Solid Waste, 1997**

| Municipality | Value (Bz$) | Value per capita (Bz$) |
|---|---|---|
| Corozal Town | 150,000 | 19.44 |
| Orange Walk Town | 300,000 | 19.95 |
| Belize City | 1,255,642 | 23.29 |
| San Ignacio Town | 250,000 | 21.98 |
| Benque Viejo Town | 88,000 | 14.68 |
| Belmopan City | 120,998 | 17.83 |
| Dangriga Town | 225,000 | 31.65 |
| Punta Gorda Town | 100,000 | 20.96 |
| San Pedro Town | 114,625 | 35.00 |
| **Total** | **2,604,265** | **22.46** |

*Source: Belize Solid Waste Management Report and CSO*

**Chart 54.2**
**Percent Composition of Municipal Waste, 1997**




*Source: Belize Solid Waste Management Project*

Based on the results from the study conducted by the Belize Solid Waste Management Project, it is estimated that in 1997, the expenditure on municipal solid waste was about 2.6 million Belize dollars per annum, with an average per capita expenditure of $22.50 Belize dollars. Approximately 48 % of the total expenditure amount on solid waste was spent on Belize City due to the fact that some 51 % of the solid waste is produced there. However, San Pedro Town has the highest per capita expenditure on solid waste with Bz $35.00 per capita.

Waste disposal has become a necessary function of modern society. Economic activity involves the production, consumption, and the ultimate disposal of materials consumed by individuals and industries. The composition of waste to be disposed provides useful input such as recycling and composting initiatives. Belize has no recycling plant, but there is an extensive, successful beverage glass container deposit system operating in the country; and as mentioned on the energy chapter Belize Sugar Industries is has taken a positive step towards the reuse of its waste. The sugar industry reuses its solid waste to produce energy and they produce enough energy to meet their needs. The Citrus Processing Facilities has been successful in a composting pilot project for their citrus peels. It appears as if composting into organic fertilizers is the most viable alternative for the disposal of citrus peels. This composting into organic fertilizer initiative will be expanded in the next few years to come. Initiative like those mentioned should be encouraged in the country in order to reuse waste generated by the several industries.

# WASTE

## Table 55.1
## GHG Emissions in the Waste Sector, 1994

| Type of Waste Generated | $CH_4$ Emissions (Gg) | $CO_2$ Equivalent (Gg) | % of Total $CO_2$ Equivalent Emissions |
|---|---|---|---|
| Solid | 1.1 | 27 | 0 |
| Domestic and Commercial Waste Water & Sludge | 258.5 | 6,334 | 21 |
| Industrial Waste Water & Sludge | High(1) | High(1) | Not Known |

*(1) methane is produced as a principal gas but the volume is unknown, it is expected to be high*
*Source: Belize Climate Change Project Report, 2000*

Where the environmental and economic costs of recycling are high, it may be better to recover energy from waste, by burning it or by using the methane rich gases which is generated as organic waste in landfill sites decompose. A wide range of waste types can be disposed of safely and sanitary landfills may remain the only option for some inert wastes and for wastes which are difficult to burn, recycle or reuse.

Waste is also a major contributor to the increase atmospheric concentrations of GHGs. The bulk of the emissions from this sector consists of methane from the decomposition of organic waste from the landfill sites. If not properly managed, sanitary landfills could have the potential of releasing pollutants to water bodies and soil.

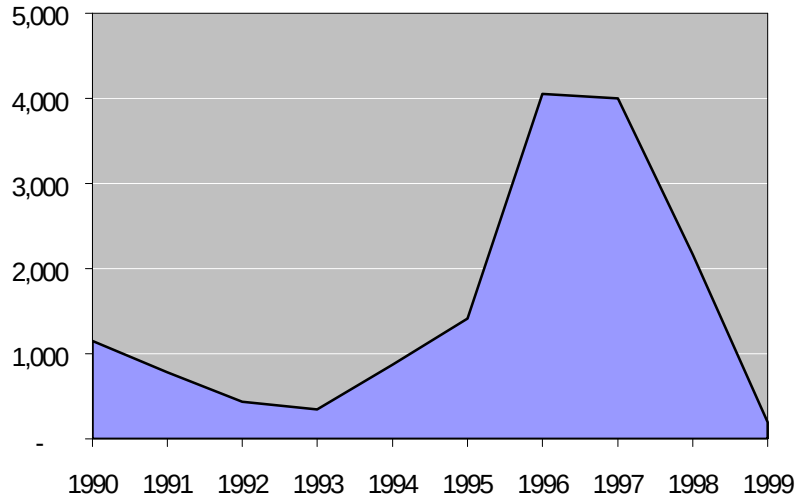
An alternative to waste going to landfill sites is the incineration of waste. Waste incineration has a number of advantages: it reduces the emissions of methane, a potent greenhouse gas, it reduces by up to 90 % the volume of waste which then has to be disposed of, and it converts waste into a material which is less biologically active and poses fewer threats to the environment. In Belize, there are six government incinerator plants (in hospitals) on which 692.1 metric tons of medical waste was incinerated for the year 1999 of which approximately 90 % of the medical waste was incinerated in Belize City Hospital.

GHG emissions for solid waste sector was quantified as a mere 1.1 Gg of methane. It was also estimated that domestic waste water from septic tanks accounted 25,858 tons of methane. The carbon dioxide equivalent emissions comprises of 633,398 tons, which is 21 % of the total carbon dioxide produced in the country.

The total combined GHG being emitted by the waste sector is estimated to be around 9.97 % of the total emissions by sector.

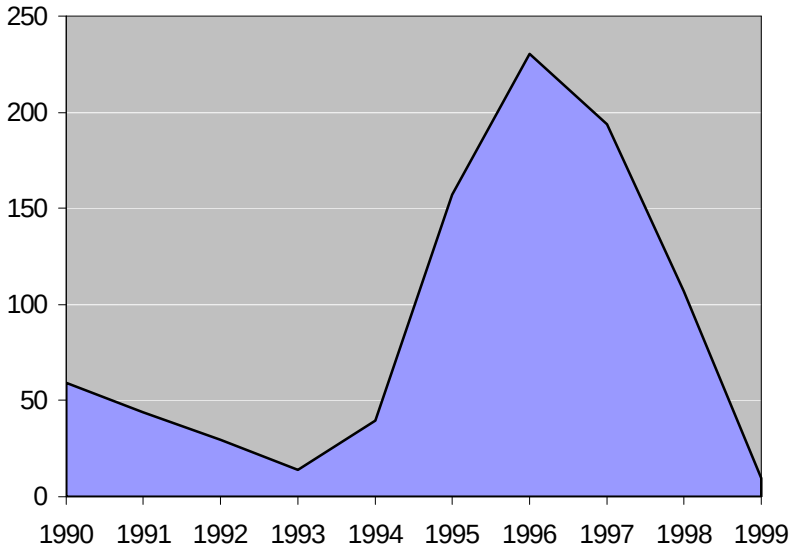
# RECYCLING

**Chart 56.1**
**Exports of Metal Scrap (tons), 1990 - 1999**




*Source: CSO*

**Chart 56.2**
**Value of Metal Scrap (Bze$) Exported, 1990 - 1999**




*Source: CSO*

After a sharp increase in the amount in export of metal scrap in 1996, hence the increase in export value too, the amount of metal scrap exported has been declining significantly after the 1996 period. For example, 1999 was the worst year for the export of metal scrap amounting only 9 % of the 1998 total export of metal scrap decreasing from 2,161 tons exported in 1998 to only 196 tons exported in 1999.

The export of waste, for example, metal scrap as in this case, is a very useful resource for Belize to get rid of the solid waste. In this way the waste stops being a nuisance to the environment and humans, and on the longer run it becomes a useful resource that can be utilized again.

It is very important to note that most (60 %) of the municipal waste generated in Belize is organic in nature, which means that if properly disposed of, it will effectively be taken care of by natural processes of decomposition.

Individuals can reduce waste not only directly, by recycling, reusing and composting where possible, but also through their actions as consumers, by buying long life, re-usable environmentally friendly products. A process that should be encouraged in Belize.

# TRANSPORT

The transport system plays a major role in the economic and social life of the Belizean people. Transport is of substantial importance in international trade, in business operations, household consumption expenditure, and in public expenditure. Yet, if not well monitored, transport will have a serious effect on the Belizean environment in the years to come. Motor vehicle transport dominates the movement of people in Belize. Transport systems affects air quality, through the emission of GHGs and other air pollutants; it uses considerable land and marine resources; energy resources. The construction of roads can have devastating impacts on wildlife habitats.

In 1994, the transport sector produced about 12 % of all GHGs of Belize. Road transport is the main source of nitrogen oxides, among other emissions is carbon dioxide. Both of these are the so-called Greenhouse Gases.

Road corridors intersect natural vegetation forms and wildlife habitats and fauna corridors. The construction of roads, with the associated land clearing, extraction and deposition of soils and road building materials, can lead to changes in vegetation, wildlife habitats and catchments, and the interruption of fauna corridors. Fragmentation of habitat can reduce fauna population while also causing them to be isolated, thus reducing their ability to adapt to environmental changes.

Shipping is also very important in the Belizean economic and social life. The pressures on the natural environment that result from shipping activities include: wastes production (scrapped vessels and craft), risks associated with transportation of hazardous materials, oil spills, destruction of marine life and marine debris.

Air transport also have negative effects on the natural environment. The wastes produced, such as scrapped aircrafts and dumped fuel, depletion of land resources used for infrastructure, modification of water tables and river courses in airport construction, are all negative effects of this transport system. However, not all is negative, air transport is the main means of transportation for tourists, which is a major foreign exchange earner for Belize.

The following chapter gives an insight of the transport systems in Belize.

**Table 57.1**
**Number of Motor Vehicle Licensed by Type, 1990 - 1999**

| Year | Public Service | Private Vehicles | Goods Vehicles | Total |
|---|---|---|---|---|
| 1990 | 2,004 | 9,898 | 5,161 | **17,063** |
| 1991 | 1,989 | 11,016 | 5,820 | **18,825** |
| 1992 | 2,089 | 15,189 | 3,406 | **20,684** |
| 1993 | 2,246 | 16,434 | 3,005 | **21,685** |
| 1994 | 2,302 | 13,942 | 2,306 | **18,550** |
| 1995 | 2,131 | 18,802 | 2,560 | **23,493** |
| 1996 | 2,200 | 19,752 | 2,633 | **24,585** |
| 1997 | 2,365 | 22,533 | 4,179 | **29,077** |
| 1998 | 2,412 | 22,560 | 3,314 | **28,286** |
| 1999 | 1,586 | 25,935 | 3,761 | **31,282** |

*Source: Department of Transport*

# TRANSPORT

There were 31,282 motor vehicles licensed in the country of Belize for the year 1999. This represents an increase of 10.6 % from the previous year, with Cayo and Belize District representing an increase of 28.9 % and 12.6 % respectively. It should be noted that these figures do not include Government (418) and Statutory (60) motor vehicles. Private motor vehicles accounted for about 83 % of the total motor vehicles licensed and recorded an increase of 15.0 % for the year 1999. Also, what was surprising to find out was that the number of Public Service Vehicles registered had decreased dramatically by 34.2% for the same period.

## Table 58.1
## Number of Newly Registered Motor Vehicles by District, 1999

| District | Public Service | Private Vehicles | Goods Vehicles | Total |
|---|---|---|---|---|
| Corozal | 17 | 476 | 76 | 569 |
| Orange Walk | 21 | 500 | 66 | 587 |
| Belize | 270 | 3,103 | 300 | 3,673 |
| Cayo | 89 | 1,031 | 156 | 1,276 |
| Stann Creek | 43 | 238 | 59 | 340 |
| Toledo | 9 | 107 | 36 | 152 |
| **Total** | **449** | **5,455** | **693** | **6,597** |

*Source: CSO*

In 1999, there were 6,597 newly registered motor vehicles. About 56 % of the total number of newly registered vehicles were registered in Belize District. The district with the lowest number of newly registered motor vehicles is Toledo District.

## Table 58.2
## Total Number of Motor Vehicles Imports by Year of Manufacture and Fuel Type, 1999

| Year | Fuel Type | | | | Total |
|---|---|---|---|---|---|
| | Gas | Diesel | Butane | Not Known | |
| Up to 1970 | 20 | 11 | 1 | - | **32** |
| 1971 - 1975 | 61 | 24 | - | - | **85** |
| 1976 - 1980 | 188 | 76 | - | 2 | **266** |
| 1981 - 1985 | 784 | 293 | 2 | 12 | **1,091** |
| 1986 - 1990 | 1,887 | 321 | 2 | 34 | **2,244** |
| 1991 - 1995 | 1,022 | 113 | - | 16 | **1,151** |
| 1996 - 2000 | 537 | 681 | - | 9 | **1,227** |
| Not Known | 4 | 104 | - | - | **108** |
| **Total** | **4,503** | **1,623** | **5** | **73** | **6,204** |

*Source: CSO*

Knowing the year of manufacture and the fuel type of motor vehicles is crucial when considering the effects of road transport on the Environment especially the emissions of green-house gases. Newer models are fuel efficient thus, tend to pollute less the environment.

## TRANSPORT

In Belize, the motor vehicle transportation dominates the movements of people and is a very significant carrier of freight. As said before, motor vehicle stocks increases every year. In 1999, 6,204 motor vehicles were imported to the country. Of this total only some 38 % of the motor vehicles imported were manufacture during the period 1991 to 2000. It is important to mention, that newer motor vehicle models use unleaded petrol which is not harmful to human health

The information provided on the previous and current table indicates that most of the vehicles imported uses petrol or diesel as its source of energy with 72.6 % and 26.2 % respectively.

In addition, of the total number of motor vehicles imported the majority were cars and pickup trucks which account for 5,488 vehicles or 88.4 % of the total imports.

The road sector accounts for 84 % of GHG emissions. Carbon dioxide is the principal gas emitted through motor vehicles tailpipe emissions.

### Table 59.1
### Total Number of Motor Vehicle Imports by Vehicle Type and Fuel Type, 1999

| Vehicle Type | Fuel Type | | | | Total |
|---|---|---|---|---|---|
| | Gas | Diesel | Butane | Not Known | |
| 8701 | 9 | 304 | - | 1 | **314** |
| 8702 | 135 | 245 | 1 | 6 | **387** |
| 8703 | 2,722 | 230 | - | 40 | **2,992** |
| 8704 | 1,637 | 832 | 4 | 23 | **2,496** |
| 8705 | - | 12 | - | 3 | **15** |
| **Total** | **4,503** | **1,623** | **5** | **73** | **6,204** |

***8701*** *: Tractors (other than those tractors of heading No. 87.09)*

***8702*** *: Motor vehicles for the transport of ten or more persons, including the driver.*

***8703*** *: Motor cars and other motor vehicles principally designed for the transport of persons (other than those of heading No. 87.02), including station wagons and racing cars.*

***8704*** *: Motor vehicles for the transport of goods.*

***8705*** *: Special purpose motor vehicles, other than those principally designed for the transport of persons, or goods (for example, breakdown lorries, crane lorries, fire fighting vehicles concrete-mixer, road sweeper, spraying, mobile workshop, mobile radiological units).*

*Source: CSO*

# TRANSPORT

## Table 60.1
## Road Mileages for Belize, 1998

| Location | Belize City | Orange Walk Town* | Corozal Town* | San Ignacio | Dangriga | Punta Gorda | Benque Viejo | Santa Elena (Corozal)* | Belmopan |
|---|---|---|---|---|---|---|---|---|---|
| Belize City | *** | 54 | 81 | 67 | 102 | 197.5 | 75 | 89.5 | 51 |
| *Orange Walk Town | 54 | *** | 27 | 121 | 156 | 251.5 | 129 | 35.5 | 105 |
| *Corozal Town | 81 | 27 | *** | 148 | 183 | 278.5 | 156 | 8.5 | 132 |
| San Ignacio | 67 | 121 | 148 | *** | 73 | 168.5 | 8 | 156.5 | 20 |
| Dangriga | 102 | 156 | 183 | 73 | *** | 107.5 | 81 | 191.5 | 54 |
| Punta Gorda | 197.5 | 251.5 | 278.5 | 168.5 | 107.5 | *** | 176.5 | 287 | 149.5 |
| Benque Viejo | 75 | 129 | 156 | 8 | 81 | 176.5 | *** | 164.5 | 28 |
| *Santa Elena (Corozal) | 89.5 | 35.5 | 8.5 | 156.5 | 191.5 | 287 | 164.5 | *** | 140.5 |
| Belmopan | 51 | 105 | 132 | 20 | 54 | 149.5 | 28 | 140.5 | *** |

** represents new road*
*Source: Ministry of Works*

**Other Road Mileages for Belize**

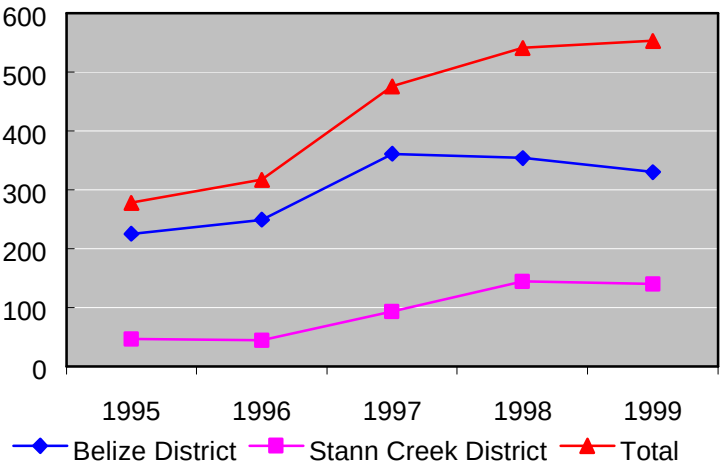
Belize City to Orange Walk Town (Old Road) : 64 miles
Belize City to Corozal Town (Old Road) : 91 miles
Belize City to Santa Elena, Czl (Old Road) : 99.5 miles
Belize City to Maskall Village : 39 miles
Dangriga to Mango Creek : 50.5 miles
Mango Creek to Punta Gorda : 70 miles

**Highways**

- *Northern Highway*: Belize City to Santa Elena, Corozal…..89.5 miles (New Road),
- *Western Highway*: Belize City to Guatemala Border…..76 miles,
- *Hummingbird Highway*: Dangriga Town to Western Highway Intersection…..54 miles,
- *Southern Highway*: Stann Creek Valley Road to Punta Gorda…..101.5 miles
- *Manatee Road*: Western Highway Intersection to Stann Creek Valley Road Intersection….36 miles,
- *Manatee Road*: Western Highway Intersection to Dangriga…..45 miles,
- *Boom - Hattieville Road*: Western Highway Intersection to Northern Highway Intersection…..12 miles.

# TRANSPORT

## Chart 61.1
## Number of Passenger Boat Licenses, 1995 - 1999




*Source: Belize Port Authority*

## Table 61.2
## Cargo Handled at the Belize Port, 1999

| Types of Cargo | # of Ships | Import | Exports | Total |
|---|---|---|---|---|
| Carol Containers | 31 | 34,599 | 15,811 | 50,410 |
| Container Lo Lo | 104 | 167,171 | 13,353 | 180,524 |
| Break Bulk | 12 | 5,419 | 770 | 6,189 |
| Fuel | 29 | 191,816 | - | 191,816 |
| Banana | 52 | - | 63,526 | 63,526 |
| Concentrate | 11 | - | 36,361 | 36,361 |
| Fertilizers | 15 | 20,543 | - | 20,543 |
| Pine Stumps | 4 | - | 4,192 | 4,192 |
| Wheat | 5 | 14,949 | - | 14,949 |
| Insecticides | - | 273 | - | 273 |
| Butane | 13 | 4,580 | - | 4,580 |
| Cement | 13 | 10,817 | - | 10,817 |
| Sugar | 13 | - | 110,255 | 110,255 |
| Explosives | 7 | 144 | - | 144 |
| Feed | 2 | 3,001 | - | 3,001 |
| Molasses | 5 | - | 40,895 | 40,895 |
| Steel | 3 | 4,435 | - | 4,435 |
| Dolomite | 2 | - | 1,743 | 1,743 |
| **Total** | **321** | **457,747** | **286,986** | **744,653** |

*Source: Belize Port Authority*

Water transport is becoming a major alternative transportation system for tourists in Belize. This is so since this transportation means is cheaper and tourists can also appreciate all the richness and beauty of Belize. Since there is a growth in the tourism industry there is also a greater demand in water transportation services. In a five year span the number of passenger boat licensed has increased sharply, in fact, it has doubled since 1995. Belize District has the highest number of boat licenses with San Pedro alone representing 37 % of those licenses. In addition, the Stann Creek District is becoming an important attraction center for the tourism industry and 25 % of the boats are licensed in that region.

The use of the our ports for importing and exporting of products have been on the rise over the years. There was an increase of 14.3 % in the cargo handled at the port and a 16 % increase in the number of ships arriving at the port between 1998 and 1999. It is visible that our imports of goods are increasing at a higher rate than our exports. The most important type of cargo handled at the port in 1999, in terms of volume or amount, was fuel which was followed by Container Lo Lo cargo type.

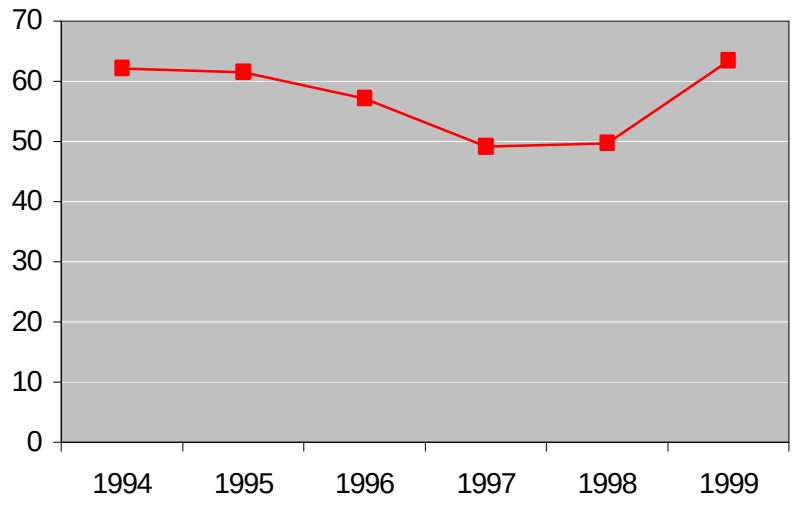
## TRANSPORT

### Table 62.1
### Total Number of Domestic and International Flights by Airstrip, 1994 - 1999

| Airport/Airstrips | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| PGIA International | 12,375 | 13,005 | 12,795 | 11,089 | 10,925 | 14,848 |
| Belize Municipal Airstrip | 17,645 | 17,274 | 15,939 | 12,066 | 10,915 | 15,786 |
| San Pedro Airport | 15,167 | 14,129 | 13,022 | 10,014 | 9,975 | 13,869 |
| Caye Caulker Airstrip | 4,498 | 5,088 | 4,733 | 4,017 | 3,555 | 3,415 |
| Caye Chapel Airstrip | 729 | 441 | 320 | 143 | 171 | 455 |
| Pelican Beach Airstrip | 3,476 | 3,316 | 2,621 | 3,492 | 4,510 | 5,075 |
| Big Creek Airstrip | 1,517 | 1,733 | 1,351 | 1,007 | 565 | 283 |
| Punta Gorda Airstrip | 2,297 | 1,918 | 1,756 | 2,056 | 2,416 | 2,679 |
| Placencia Airstrip | 3,165 | 3,367 | 3,226 | 3,597 | 4,612 | 4,963 |
| Corozal Airstrip | 1,202 | 1,193 | 1,320 | 1,573 | 2,080 | 2,043 |
| **Total Domestic Flights** | **62,071** | **61,464** | **57,083** | **49,054** | **49,725** | **63,416** |
| **International Flights** | **6,020** | **7,222** | **6,946** | **8,041** | **9,264** | **9,350** |

*Source: Civil Aviation Department*

### Chart 62.2
### Total Number of Domestic Flights ('000), 1994 - 1999




*Source: Civil Aviation Department*

Domestic airlines provides the schedule public passenger services between Belize's International Airport and the municipal airstrips. During the period 1994 and 1998 their was a significant decline in domestic flights. In 1999, the domestic flights increased by 27.5 % over the 1998 flights, and has been the highest record in the last six years. The increase in domestic flights are due mainly to the increase of tourist in Belize. International flights have been on the rise also. It increased from 9,264 in 1998 to 9,350 in 1999. International flights increased from 6020 in 1994 to 9,350 in 1999, an increase of 55 % for that same period.

# TRANSPORT

## Table 63.1
## Local Airstrips in Belize, 1998

| Airstrip | Location | Dimensions | Surface | Owner |
|---|---|---|---|---|
| Silva Airstrip | Belmopan | 2477 x 60 ft | Asphalt | Government |
| Mattew Spain Airstrip | Central Farm | 2200 x 60 ft | Asphalt | Government |
| Privacion Airstrip | Mt. Pine Ridge | 2500 x 50 ft | White Marl | Government |
| Pelican Beach Airstrip | Dangriga | 2092 x 27 ft | Asphalt | Government |
| Big Creek Airstrip | Independence | 2800 x 30 ft | Gravel | Private |
| Melinda Airstrip | Melinda | 2080 x 25 ft | Asphalt | Government |
| Placencia Airstrip | Placencia | 2135 x 25 ft | Asphalt | Government |
| Northern Two Cayes Airstrip | Lighthouse Reef | 1800 x 30 ft | Asphalt | Private |
| Corozal Airstrip | Ranchito | 2000 x 25 ft | Asphalt | Government |
| Blue Creek Airstrip | Blue Creek | 2000 x 30 ft | White marl | Private |
| Caye Chapel Airstrip | Caye Chapel | 3100 x 20 ft | Asphalt | Private |
| Caye Caulker Airstrip | Caye Caulker | 2650 x 30 ft | Asphalt | Government |
| Gallon Jug Airstrip | Gallon Jug | 3100 x 40 ft | Asphalt | Private |
| San Pedro Airstrip | S.P.Ambergris | 3500 x 60 ft | Asphalt | Government |
| Belize Municipal Airstrip | Belize city | 1800 x 45 ft | Asphalt | Government |
| Punta Gorda Airstrip | Punta Gorda | 2355 x 25 | Asphalt | Government |
| Cisco Airstrip | Pomona | 1200 x 40 ft | Asphalt | Private |
| Lamanai Airstrip | Lamanai | 2230 x 35 ft | Sand & Gravel | Private |
| Spanish Lookout Airstrip | Spanish Lookout | 2150 x 28 ft | White Marl | Private |
| Ladyville Airstrip | Ladyville | 2230 x 35 ft | Compact Clay | Private |
| Augustine Airstrip | Mt. Pine Ridge | 2000 x 30 ft | Clay & Gravel | Private |
| Savannah Airstrip | Independence | 3100 x 25 ft | Asphalt | Government |
| Tower Hill Airstrip | Orange Walk | 2230 x 33 ft | White Marl | Government |

*Source: Civil Aviation Department*

## Table 63.2
## Number of Civil Aircrafts Registered in Belize, 1995 - 1999

| Category | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|
| Transport | 27 | 26 | 23 | 22 | 24 |
| Private | 10 | 12 | 11 | 11 | 10 |
| Aerial Work | 5 | 6 | 6 | 5 | 5 |
| **Total** | **42** | **44** | **40** | **38** | **39** |

*Source: Civil Aviation Department*

The Phillip S. W. Goldson International Airport (PGIA) is Belize's only international airport and port of entry via air. It is administered by the Belize Airport Authority and is located in Ladyville. It has a runaway length of 7,100 ft by 150 ft in width and a taxi width of 75 ft. The runaway and taxiway are equipped with aerodome lights thus enabling the PGIA for the day and night operations. In addition, the airport is equipped with navigational and visual landing aids.

Of the 39 civil aircrafts registered in 1999, 62 % are mostly used in the tourism industry. Private flying aircrafts are for personal pleasure, sports or recreational and some other aircrafts are used for spreading of agricultural chemicals, fertilizers, or other substances including for pest and disease control.

# TRANSPORT

## Table 64.1
## International Regular Public Transport Air Service, 1995 - 1999

| Year | Aircraft Takeoffs and Landings (number) | Passenger Arrivals and Departures (number) | Freight Inbound and Outbound (tons) | Mail Inbound and Outbound (tons) |
|---|---|---|---|---|
| 1995 | 5,734 | 266,863 | 1,435 | 203 |
| 1996 | 6,160 | 261,965 | 1,321 | 186 |
| 1997 | 7,314 | 288,355 | 1,346 | 189 |
| 1998 | 8,434 | 393,095 | 1,248 | 165 |
| 1999 | 8,232 | 330,044 | 1,694 | 152 |

*Source: Civil Aviation Department*

## Table 64.2
## Domestic Regular Public Transport at PGIA, 1995 - 1999

| Year | Aircraft Departures (number) | Passenger Departures (number) |
|---|---|---|
| 1995 | 13,005 | 48,900 |
| 1996 | 12,795 | 52,200 |
| 1997 | 11,089 | 54,600 |
| 1998 | 10,925 | 61,600 |
| 1999 | 14,848 | 62,600 |

*Source: Civil Aviation Department*

## Table 64.3
## Aviation Activity by Hours Flown, 1995 - 1998

| Year | Aviation Activity | | |
|---|---|---|---|
| | Business | Agriculture | Charter |
| 1995 | 330 | 754 | 1,900 |
| 1996 | 421 | 1,089 | 2,000 |
| 1997 | 875 | 1,508 | 1,500 |
| 1998 | 500 | 1,313 | 1,325 |

*Source: Civil Aviation Department*

International aviation activity at the Belize International Airport has grown significantly over the last five years. Between 1995 and 1999 the aircraft takeoff and landings increased by 43.6 %, with an annual average increase of 9.5 %. However, a decrease of 2.4 % in the number of aircraft takeoff and landing was registered in 1999 as compared with the 1998 period. The highest number of passenger arrivals and departures over the last 15 years was registered in 1998, with a growth of 36.3 % over the 1997 figure. However, the case was different in 1999 when a decrease of 16 % was recorded. The freight carriage during 1995 and 1999 increased by 18 %, while the mail carriage has decreased over the last five years.

Domestic airline provide scheduled public passengers services between the Belize International Airport and the Municipal Airstrips. Table 64.2 shows the changes in domestic flights from 1995 to 1999. In 1999, aircrafts and passenger departures increase by 35.6 % and 28 % respectively. In addition, it could be mentioned that there are also some non-schedule services provided as shown in table 64.3.

# TRANSPORT

**Table 65.1**
**Aviation Accidents and Fatalities, 1995 - 1999**

| Year | Accidents | Fatalities |
|---|---|---|
| 1995 | 7 | - |
| 1996 | 1 | - |
| 1997 | 2 | 1 |
| 1998 | 1 | 4 |
| 1999 | - | - |

*Source: Civil Aviation Department*

When considering transportation modes it is important to look not only to the immediate benefits we receive but also the negative effects they pose to the natural environment and the human society. Aviation accidents and fatalities are low and at this point in time this transportation mode is pretty much safe as indicated by the statistics on table 65.1. Statistics on water transport accidents and fatalities is not available but it is assumed that accidents and fatalities in water transportation is fairly low. However, not the same could be said about road transport where the accidents and fatalities were high in 1998 where 628 casualties were registered.

**Table 65.2**
**GHG Emissions in the Transport Sector for 1994**

| Sub Sector | $CO_2$ Emission (Gg) | % $CO_2$ Emission |
|---|---|---|
| Road | 263.6 | 84 |
| Navigation | 37.5 | 12 |
| Aviation | 11.9 | 4 |
| **Total** | **313** | **100** |

*Source: Belize Climate Change Project Report, 2000*

The transport sector comprises three sub sectors; road, navigation and aviation. The road sub sector accounts for 84 % of the emissions while the navigation sub sector accounts for 12 % and aviation for only 4 % of the emissions on this sector.

Carbon dioxide is the principal gas emitted through vehicle tailpipe emissions. To a lesser extent there are also tailpipe emissions of CO, $N_2O$ and $NO_x$'s in road transport.

GHG emissions in the transport sector is estimated to be around 313 tons which is equivalent to 310,316 tons $CO_2$ equivalent emissions. This represents 10 % of the total $CO_2$ equivalent for the 1994 baseline year.

# CLIMATE CHANGE

It has been shown beyond reasonable doubt that human activity has led, and is still leading, to increased atmospheric concentrations of *greenhouse gases (GHGs)*, and introducing new ones such as the *chlorofluorocarbons (CFCs)*. Natural greenhouse gases include *carbon dioxide ($CO_2$), methane ($CH_4$), carbon monoxide (CO), nitrous oxide ($N_2O$),* other *nitrogen oxides ($NO_x$),* a range of *volatile organic compounds other than methane (NMVOCs),* and *sulphur dioxide ($SO_2$).*

Apart from CFCs all of the other gases occur naturally. Together, they make up less than 1% of the atmosphere. This is enough to produce a "natural greenhouse effect" that keeps the planet some $30^0$C warmer than it would otherwise be essential for life, as we know it. Most of these gases, once released into the atmosphere, persist for hundreds of years, with an associated long-term impact on background atmospheric levels.

Levels of all key greenhouse gases (with the possible exception of water vapour) are rising as a direct result of human activity. Emission of carbon dioxide (mainly from burning coal, oil, and natural gas), methane and nitrous oxide (due to agriculture and changes in land use), ozone (generated by the fumes in automobile exhausts) and CFCs (manufactured by industry) are changing how the atmosphere absorbs energy. Water vapour levels may also be rising because of a "positive feed back". This is happening at an unprecedented speed. The result is known as the "*enhanced greenhouse effect*".

**The Enhanced Greenhouse Effect**

Short wave solar radiation passes relatively unhindered through the earth's atmosphere to the surface of the planet. The surface absorbs this incoming radiation back into the atmosphere.

The warmed surface, in turn, re-emits longer wavelength (infra-red) radiation back into the atmosphere. However, the atmosphere is less transparent to infra-red radiation than it is to short wave radiation. Trace quantities of atmospheric gases absorb some of the outgoing infra-red radiation, re-radiating it back to the Earth's surface. In this way, they act like the glass in a greenhouse. By preventing a small portion of infra-red radiation from escaping to space, atmospheric temperatures much warmer than would be the case in their absence. An equilibrium situation is reached whereby as much energy is lost to space as is gained from the sun, otherwise the Earth would become steadily hotter. Consequently, without the greenhouse effect, which helps to moderate the effect of temperature on Earth, life in its present forms would not be possible. However, the addition of greenhouse gases through human activities, theoretically more infra-red energy will accumulate in the lower atmosphere and, consequently, there will be an accumulation of heat on the surface and in the lower atmosphere (Australian Bureau of Statistics).

There is some evidence to suggest that much of the extra carbon in the atmosphere is absorbed by seawater and plants, thereby reducing the effects of increased atmospheric carbon dioxide levels on global temperature. Although the ocean and plant photosynthesis are thought to be major sinks for carbon, there still appears to be a 'missing sink', that is, not all the carbon absorption processes which occur within the system seem to have been identified. Without detailed knowledge of the types and relative contribution of the various carbon sinks, it is unclear exactly how an increase in anthropogenic carbon will lead to changes in global temperatures.

## CLIMATE CHANGE

**Table 67.1**
**Principal Greenhouse Gas Emission by Sector and Process/Activity in Belize**

| Sector | Emission Process/Activity | Emission Gases | |
|---|---|---|---|
| | | Principal GHG | Other GHGs |
| Land-use change &Forestry | ❖ Forest conversion to agriculture,<br>● Biomass stock change and abandoned land (sink process),<br>● Reforestation, Plantations and Silviculture practices (sink process). | $CO_2$ | $CH_4$, $N_2O$, $NO_x$ and CO |
| Energy | ❖ Energy industry/production,<br>❖ Manufacturing and construction,<br>❖ Transportation. | $CO_2$ | $CH_4$, $N_2O$, $NO_x$, CO, $SO_2$ and NMVOC |
| Waste | ❖ Solid waste disposal sites,<br>❖ Wastewater handling and sludge,<br>❖ Sewage. | $CH_4$ | $N_2O$ |
| Agriculture | ❖ Domestic livestock production (enteric fermentation and animal manure decomposition),<br>❖ Rice cultivation in flooded fields,<br>❖ Savanna burning,<br>❖ Field burning of crop residues,<br>❖ Fertilizer use,<br>❖ Cane burning,<br>❖ Agricultural soils. | $CO_2$ | $CH_4$, $N_2O$, $NO_x$ and CO |
| Industrial Processes and solvents | ❖ Road asphalting,<br>❖ Lime production,<br>❖ Brewing and distilling,<br>❖ Foodstuff manufacture. | $CO_2$, NMVOCs | Halocarbons and sulphur hexafluoride |

*Source: Belize Climate Change Project Report, 2000*

## CLIMATE CHANGE

In order to describe both the extent and the effect of GHGs, it is necessary to state both the tonnage and the so-called Global Warming Potential (GWP). The GWP for each gas is expressed in the corresponding amount of $CO_2$ that would have the same effect. Methane has a greenhouse effect 24.5 times, and nitrous oxide 320 times, more powerful than $CO_2$.

**Table 68.1**
**Estimated Greenhouse Emissions for Belize, 1994**

| GHGs | Gigagrams | % of Total | $CO_2$ Equivalent Factor | $CO_2$ Equivalent (Gg) |
|---|---|---|---|---|
| $CO_2$ | 599.81 | 63.96 | 1.0 | 599.81 |
| $N_2O$ | 0.32 | 0.03 | 320.0 | 100.86 |
| $NO_x$ | 4.44 | 0.47 | N/A | N/A |
| CO | 63.73 | 6.76 | N/A | N/A |
| NMVOCs | 3.38 | 0.36 | N/A | N/A |
| $CH_4$ | 265.06 | 28.27 | 24.5 | 6492.77 |

*Source: Belize Climate Change Project Report, 2000*

In 1994, the National Inventory identifies Belize as a net remover (sink) of GHGs from the atmosphere. Tree growth in logged forests, plantation, and on cleared lands absorb about 6 million metric tons of $CO_2$ per year, against a total emission estimated just under 3 million metric tons.

However, if GWP is used, Belize becomes a net contributor to global warming by emitting about 9.5 million GWP units ($CO_2$ equivalents) and only absorbing about 3 million GWP units. This can be attributed mainly to methane emissions from waste management, especially emissions from septic tanks.

Table 68.2 indicates that out of the five sectors, land-use change and forestry was the greatest single contributor (64.022 %) of total GHG emission, mostly due to the release of $CO_2$ from burning during land clearance and from soil during cultivation. The energy sector (23.70 %) was the second major contributor, mainly through fossil fuel uses in transportation and energy production.

**Table 68.2**
**Total Volumes of Emissions by Sector for 1994**

| Sector | Gigagrams | % of Total |
|---|---|---|
| Land-use Change & Forestry | 1666.64 | 64.02 |
| Energy and Transportation | 616.91 | 23.70 |
| Waste | 259.66 | 9.98 |
| Agriculture | 56.88 | 2.18 |
| Industrial Processes & Solvents | 3.13 | 0.12 |
| Total | 2603.23 | 100 |

*Source: Belize Climate Change Project Report, 2000*

# CLIMATE CHANGE

If the emissions of GHGs continues unabated, the world must expect serious climatic changes within a time frame of 50 - 100 years. However, climate models predict that the global temperature will rise by about 1-3.5 $^{0}$C by the year 2100. This will cause waters in the oceans to expand and some of the water stored permanently in the polar ice caps and glaciers to melt. These will all contribute to a levels are expected to rise by 20 to 100 cm by 2100 (mean sea level rise of 50 cm), causing flooding of low lying areas and other damages. There are many uncertainties about the scale and impacts of climate change, particularly at a regional level. These changes will vary by latitude, longitude and region.

**Biological Diversity and Ecosystems**

Changes in temperature, water availability and atmospheric conditions will affect most plants, animals and micro-organisms in some way or the other. A diverse range of ecological impacts have been predicted, although the magnitude and rate of changes remain uncertain. Some examples are listed below:

- Increased rates of habitat loss,
- Changed distribution of bio-climatic habitats,
- Changed competitive and predatory interactions may result in elimination of species,
- Changes in thermal and chemical structures of water bodies will affect distribution and diversity of aquatic species,
- Contraction of coral reefs and estuarine wetlands,
- Localized terrestrial extinction due to changes in fire regimes,
- Entire forests may disappear, while new combination of species, and hence new ecosystems, may be established.

**Oceans and Coastal Areas**

- Coastal areas loss and small island loss.
- Flooding and coastal erosion would worsen.
- Sea level rise could damage key economic sectors, e.g. fisheries and aquaculture.
- Human health will be threatened.
- Valuable coastal ecosystems will be at serious risk.

**Climate Disasters and Extreme Events**

Natural variability will lead to extreme heat waves, floods, droughts, severe storms, and other extreme events.

**Food and Water Resources**

Food security is likely to be threatened in some regions. Water will be affected as precipitation and evaporation patterns change.

**Infrastructure, Industry and Human Settlements**

Some of the most vulnerable infrastructure includes industrial plants and products; equipment for producing and distributing energy; roads, ports and other transportation facilities; residential and commercial properties; and coastal embankments. Most susceptible to extreme events are agro-industry; the production of hydroelectricity, biomass, and other forms of renewable resources; energy use; construction; some transportation activities; and infrastructure located in coastal zones.

**Human Health**

Increased risks of infectious diseases. Water and air borne diseases may become more frequent. There is risks of new diseases emerging as a result of change in climatic conditions.

# TOURISM

Tourism is one of the most important sources of income for Belize, and developing tourism is of high priority. Tourism success is closely linked to the environment. The unique environmental assets of Belize, ranging from the coastal zone with beaches, coral reefs, and excellent possibilities for diving, deep sea fishing, sailing and yachting; the vast rain forest areas with wildlife, exuberant vegetation, and big rivers to the impressive archaeological remains, are attracting large numbers of the tourists

Clearly, these aspects of the environment must be preserved, in order for Belize to continue attracting tourists. There are of course many other reasons to conserve the environment, and therefore requiring the same kind of actions. Belize is well-known for extensive protection of land and marine areas, not only by creating national parks and other reserves, but also by active support for various international conventions in this area, and by other protective action that the country has taken. Permanent inhabitants, as well as, tourists are concerned about the measures taken to improve the environment and if properly managed, in a sustainable manner, it can bring about beneficial effects of many kinds, including those for the tourism industry.

Development of tourism itself also exerts pressure on the environment. Changes in the physical environment are caused by the construction of hotels, increased traffic, and related infrastructure. These changes caused by increased tourism activity have to be monitored. The use of resources such as water and energy increases manifold, and in the coastal areas at least, these are not abundant; and further infrastructure is needed. Visitors generate waste and sewage, which must be disposed of in an organized way. The extra energy use generates emissions and discharges. The effects of tourism on the environment is very complex since one impact can be caused by various human actions.

In this sector too, it is necessary to see all sides of the desired development, to welcome the positive sides and to make sure that the negative effects are kept under control.

**Table 70.1**
**Total Number of Passenger Arrivals by Purpose of Visit, 1988 - 1999**

| Tourism Type | 1988 | 1991 | 1995 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Business | 6,924 | 9,003 | 8,234 | 9,764 | 8,285 | 7,412 |
| Official | 497 | 111 | 1,305 | 1,849 | 1,026 | 1,091 |
| Tourist | 134,318 | 77,542 | 121,270 | 134,289 | 166,743 | 172,292 |
| **Total** | **141,739** | **86,656** | **130,809** | **145,902** | **176,054** | **180,795** |
| Cruise Ship | 267 | 428 | 7,975 | 2,678 | 14,183 | 34,130 |

*Source: Belize Tourist Board*

The Immigration Department classifies recreational visitors as tourists. The International Tourism Statistics, however, incorporates recreational, as well as, business and official visitors under this category. The total number of passenger arrivals increased to a total of 180,795 in 1999, an increase of 2.3 % over the previous year. Since 1991, there has been an average annual increase of 2.7 % in the total number of tourist arrivals. After, the increase recorded in 1997 business and official arrivals have been showing a decreasing trend. The international community classifies cruise ship arrivals as tourist arrivals but they are one day visitors only. In 1999, by far the highest record in the number of cruise ship tourist arrivals was registered. This represents 2.5 times more cruise ship passenger arrivals than 1998.

# TOURISM

## Table 71.1
## Number of International Arrivals [(1)] by Mode of Arrival, 1988 - 1999

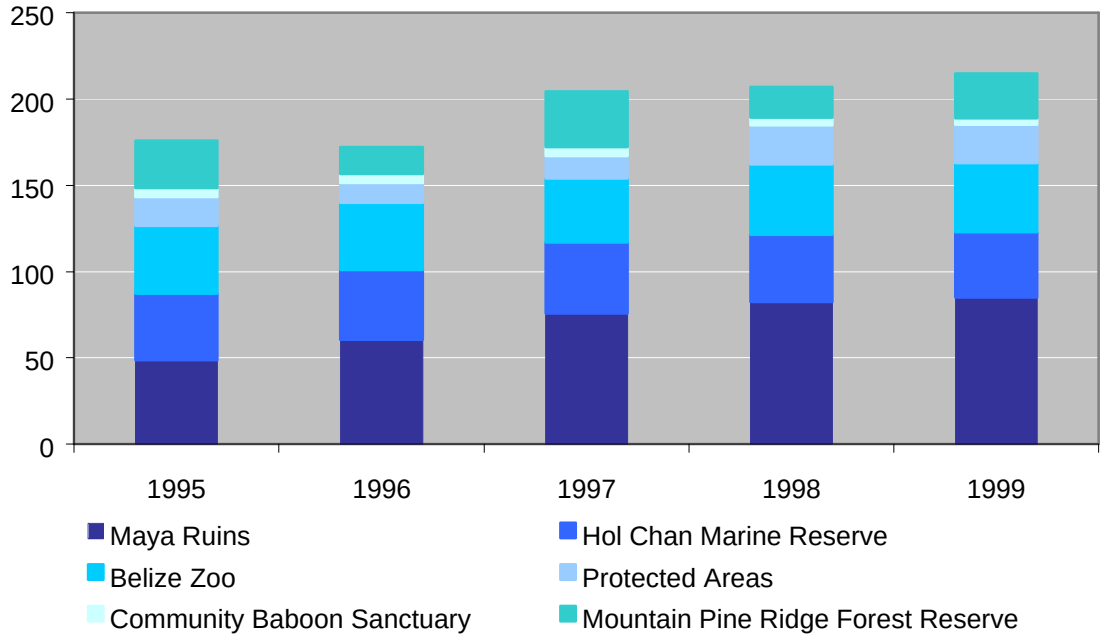
| Mode of Arrival | 1988 | 1991 | 1995 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|
| Cruise Ship | 267 | 428 | 7,953 | 2,678 | 14,183 | 34,130 |
| Sea | 9,386 | 7,201 | 1,892 | 11,465 | 11,884 | 11,312 |
| Air | 49,409 | 106,957 | 94,130 | 98,208 | 107,568 | 112,400 |
| Overland | 82,959 | 100,857 | 224,785 | 192,211 | **154,463** | 168,800 |
| **Total** | **142,021** | **215,443** | **328,760** | **304,662** | **288,098** | **326,642** |

*(1) International arrivals excludes Belizeans and Returning Residents*
*Source: Belize Tourist Board*

Total international arrivals (excluding Belizeans and returning residents) to Belize in 1999 numbered 326,642 arrivals. This represents an increase of 13.4 % in international arrivals compared to the 1998 arrival records.

Overland arrivals dominated the mode of arrivals into the country in 1999. In 1999, 34 % of the total international tourist arrivals came through air transport.

## Chart 71.2
## Number of Visitors for Selected Attractions ('000), 1995 - 1999



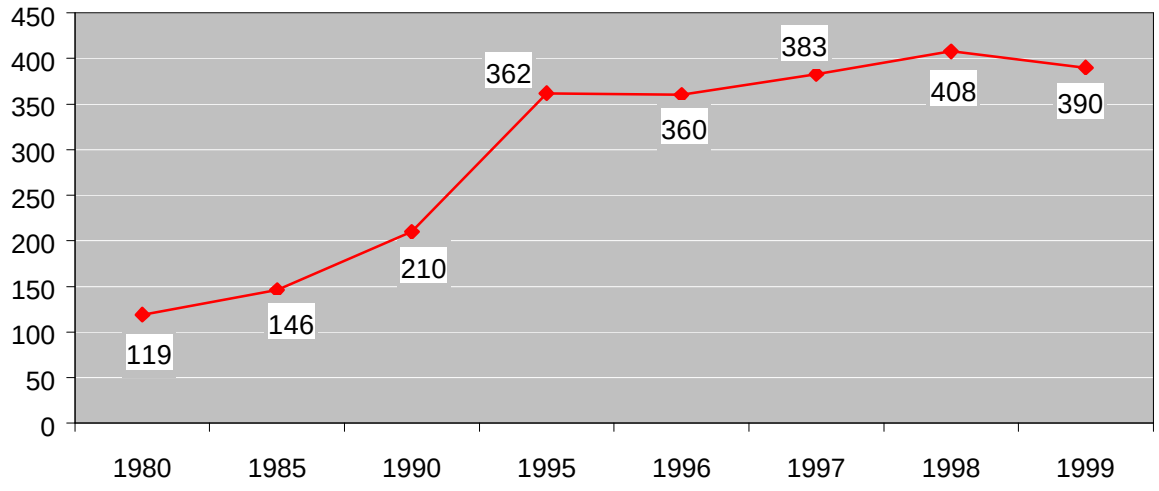

*Source: Belize Tourist Board*

Visitation to the various selected sites have been showing a very slow increase. The most visited site out of the selected ones is the Maya Ruins.

Approximately 40 % of the visitors tend to visit the Maya Ruins instead of the other sites. Even the overall trend seems to be pretty steady during the last 5 years.

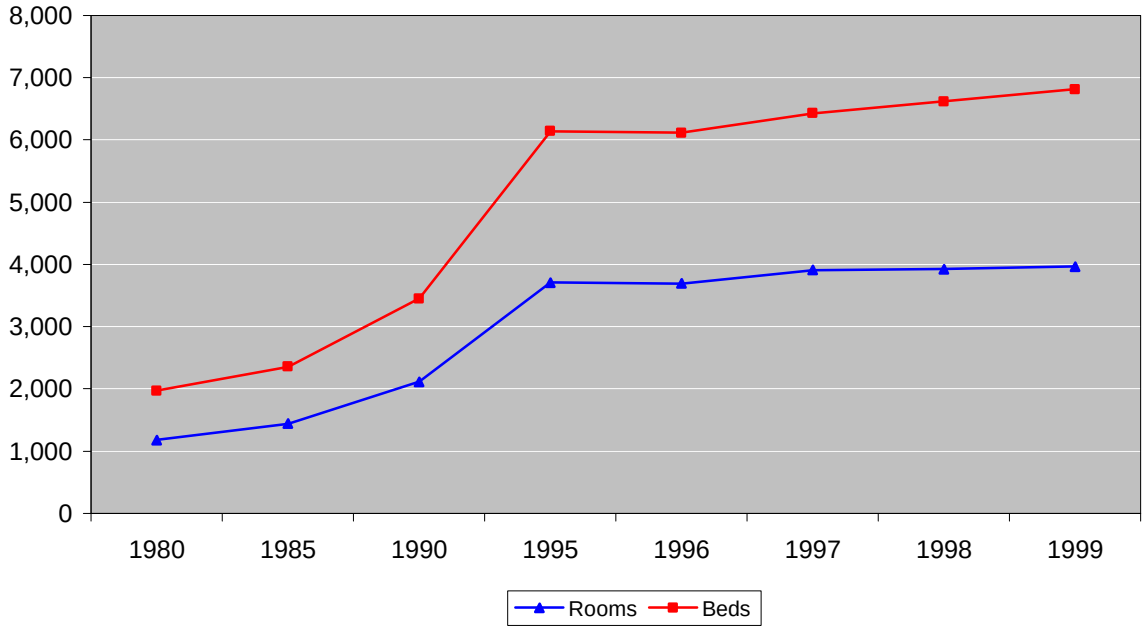
# TOURISM

## Chart 72.1
## Total Number of Hotels Registered in Belize, 1980 - 1999




*Source: Belize Tourist Board*

## Chart 72.2
## Total Number of Hotel Rooms and Beds, 1980 - 1999

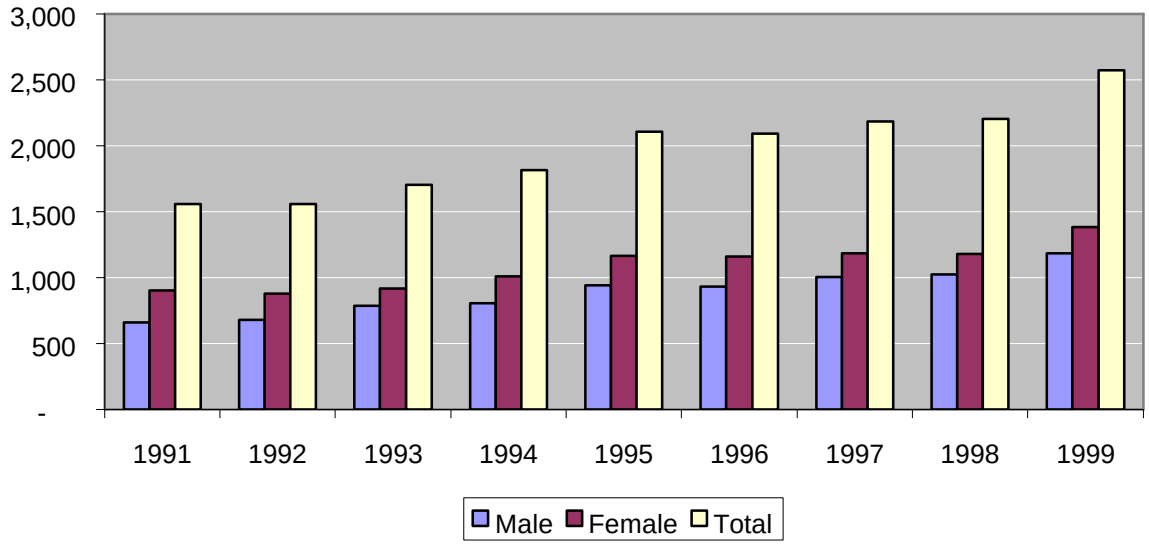



*Source: Belize Tourist Board*

# TOURISM

The Belize Tourist Board describes all accommodation under the generic term "Hotel" simply as convenient short-hand for all tourist accommodation, including apartments, guest houses cottages, etc.. The total number of hotels and rooms has more than triple between 1980 and 1999, with most of the increases registered in the coastal areas, though a considerable increase has occurred in the Cayo District where a number of nature reserves and archeological sites are located. The Toledo District recorded the highest decrease of 37.9 % in the number of hotels registered, while a few other places recorded just small increases. In addition, about 67.2 % of the hotels have 10 rooms or less, while 24.4 % had between 11 and 20. There are only 5 hotels with 50 rooms and over and they are located in the Belize District.

## Chart 73.1
## Employment in the Hotel Industry by Sex, number, 1991 - 1999




*Source: Belize Tourist Board*

There were 2,570 person employed in the hotel industry in 1999. This represents an increase of 367 employees (16.7 %) from the previous year. The hotel employment includes 1,185 males and 1,385 females, while nationals and foreigners comprised of 2,469 and 101 respectively. For the period 1991 to 1999, employment in the hotel sector has increase tremendously by 64.7 %, with an annual average increase of about 6.4 % for the same period.

## THE ENVIRONMENT AND HEALTH

Understanding the complex links between health and the environment is important. Humans are exposed to multiple health risks on a daily basis. Identifying which exposure or combinations of exposures degrade health, and to what extent, is a big challenge. However, without argument environment-related risks can be reduced through preventative actions. These actions can only be achieved through good public policies and making financial investments. One way to reach a better situation is through efforts to improve household and community environment. Such actions include expanding access to water, sanitation and hygiene education, ensuring that garbage is collected and disposed properly, promoting the use of clean household fuels, and controlling the insect and animal vectors that transmit diseases.

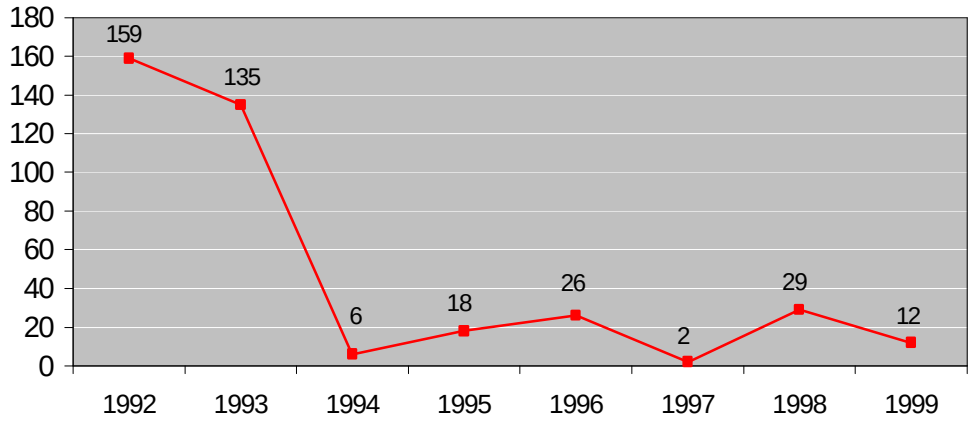
However, some of the environmental health problems are associated with poverty and lack of essential resources, particularly sufficient and clean water, food, shelter, fuel and air. Other environmental threats to health are associated with development itself. Yet, if not well managed, economic growth and development can become a major threat to the environment and therefore, a major threat to human health.

This section describes the links between environment change, development and health. For instance, agricultural intensification, a change in the environment factor, through clearing and irrigation projects, facilitate increases in vector-borne diseases such as malaria. Economic growth and development sometimes occurs without proper planning of safe water and sewage facilities which can lead to water contamination and hence an increase in diseases, such as cholera. In Belize, the cases of cholera have decreased dramatically over the past eight years. Belize, with Costa Rica and Panama, are the three Central American countries with the lowest incidence of cholera over the last ten years as reported by PAHO.

Malaria cases in Belize have decreased by almost eighty percent over the last five years. Even though this is a progress, Belize has the highest malaria incidence per capita in Latin America. Adequate programs should be highly encouraged in the nation to avoid such problems.

Although Belize is taking positive steps towards the improvement of health, our efforts for improvement should continue.

**Chart 74.1**
**Number of Confirmed Cholera Cases, 1992 - 1999**




*Source: Public Health Bureau , MOH*

## THE ENVIRONMENT AND HEALTH

Information on health suggests that the incidence of infectious diseases associated with deficiencies in water supply and sanitation are rising in Belize, particularly in the southern and western part of the nation. Poverty and poor environmental living conditions are the main contributing factors, especially among the Maya Indians who often live in remote areas in the Toledo District and among the refugees and displaced persons who live in the Cayo District.

Contamination of water remains a major hazard, with cholera perhaps the most dangerous consequence. In January 1992 , was the cholera outbreak with the first three cases being reported in the Toledo District, rising to a total of 159 Cases with 80 % of the reported cases occurring in the Toledo District in that same year. As a result, a monitoring program for the country was established and focused mostly in the Toledo and Cayo Districts where the majority of cases were occurring. Cholera has been controlled and is reflected by the decrease in the number of registered or reported cholera cases. For example in 1999, only 12 cases were registered all in Toledo District and all cases occurring in May. Special attention should be placed forward to infected rivers coming from across the borders as these are permanent threat for new outbreaks of water-borne diseases like cholera.

### Table 75.1
### Number of Confirmed Cholera Cases by District, 1992 - 1999

| District | 1992 | 1993 | 1994 | 1995 | 1996 | 1997 | 1998 | 1999 |
|---|---|---|---|---|---|---|---|---|
| Corozal | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| Orange Walk | 0 | 0 | 0 | 5 | 0 | 0 | 2 | 0 |
| Belize | 1 | 0 | 1 | 0 | 0 | 0 | 2 | 0 |
| Cayo | 34 | 105 | 5 | 2 | 2 | 0 | 22 | 0 |
| Stann Creek | 0 | 0 | 0 | 9 | 0 | 0 | 0 | 0 |
| Toledo | 124 | 30 | 0 | 1 | 24 | 2 | 3 | 12 |
| **Total** | **159** | **135** | **6** | **18** | **26** | **2** | **29** | **12** |

*Source: Public Health Bureau, MOH*

### Table 75.2
### Malaria Incidence by District and Sex, 1998 - 1999

| District | 1998 | | | 1999 | | |
|---|---|---|---|---|---|---|
| | Male | Female | Total | Male | Female | Total |
| Corozal | 66 | 33 | **99** | 44 | 23 | **67** |
| Orange Walk | 46 | 39 | **85** | 20 | 10 | **30** |
| Belize | 51 | 20 | **71** | 32 | 12 | **44** |
| Cayo | 437 | 316 | **753** | 187 | 140 | **327** |
| Stann Creek | 182 | 105 | **287** | 198 | 109 | **307** |
| Toledo | 388 | 303 | **691** | 537 | 541 | **1,078** |
| **Total** | **1,170** | **816** | **1,986** | **1,018** | **835** | **1,853** |

*Source: Vector Control Unit, MOH*

Malaria is a tropical disease transmitted by the anopheles mosquito. The most predominant vector is P. Vivax which represents about 97.2 % of the total cases reported in 1999. Malaria seems to be occurring more frequent in males than in females.

## THE ENVIRONMENT AND HEALTH

After the sharp increase in the incidence of malaria for the period 1992 - 1994 the incidence of malaria has been decreasing. The highest number of cases registered during the last ten years was 10,411 case in 1994. In 1999, there was a 7 % decrease in the number of cases from the 1998 figure.

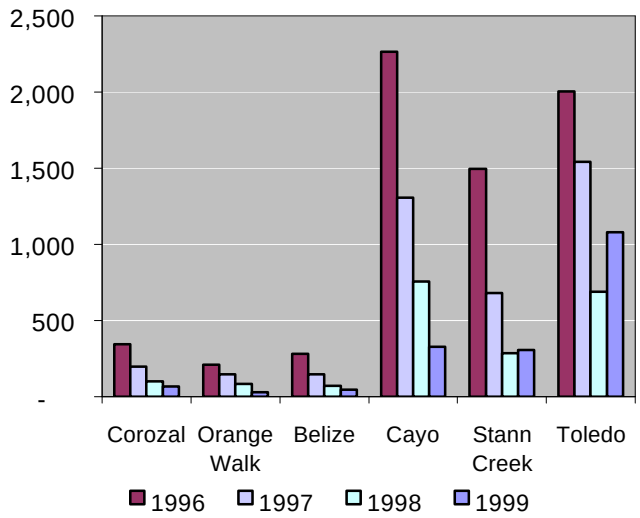
Of the total number of cases of malaria reported in 1999 approximately 58 % occurred in Toledo District. Considerable decreases the incidence of malaria in 1999 from 1998 were registered in the districts except for Toledo and Stann Creek Districts where increases of 56 % and 7 % were recorded from 1998 to 1999.

### Table 761
### Incidence of Malaria, 1990 - 1999

| Year | Malaria Cases |
|---|---|
| 1990 | 3,052 |
| 1991 | 3,036 |
| 1992 | 5,175 |
| 1993 | 8,671 |
| 1994 | 10,411 |
| 1995 | 9,413 |
| 1996 | 6,604 |
| 1997 | 4,014 |
| 1998 | 1,986 |
| 1999 | 1,853 |

*Source: Vector Control Unit, MOH*

### Chart 76.2
### Incidence of Malaria by District, 1996-1999




*Source: Vector Control Unit, MOH*

### Table 76.3
### Insecticides Used for Malaria Spraying, 1994 - 1999

| Year | DDT (tons) | K-othrine (tons) | ULV-Melathaion (gals) |
|---|---|---|---|
| 1994 | 3.0 | 0 | 1,120 |
| 1995 | 4.0 | 0 | 1,400 |
| 1996 | 10.0 | 3 | 1,680 |
| 1997 | 8.7 | 4 | 1,400 |
| 1998 | 8.9 | 1.2 | 1,500 |
| 1999 | - | 1.2 | - |

*Source: Vector Control Unit, MOH*

There are three different types insecticides used for combating malaria. These insecticides are DDT, K-othrine and ULV-Melathaion. The most frequent used insecticides are K-othrine and ULV-Melathaion. Because of DDT's effects on living organisms and humans the Government has been trying to avoid using DDT at all. In 1999 no DDT and ULV-Melathaion were used.

## THE ENVIRONMENT AND HEALTH

### Table 77.1
### Numer of Communities Sprayed by District, 1998

| District | | Number of Communities | # of Houses Sprayed | Population Covered | Quantity Used in Lbs. (k-otrin) |
|---|---|---|---|---|---|
| Corozal | Cycle 1 | 12 | 1,698 | 7,614 | 198 |
| | Cycle 2 | 13 | 1,679 | 7,541 | 186 |
| Orange Walk | Cycle 1 | 12 | 1,584 | 6,890 | 234 |
| | Cycle 2 | 12 | 1,736 | 7,690 | 309 |
| Belize | Cycle 1 | 8 | 362 | 1,538 | 40 |
| | Cycle 2 | 8 | 378 | 1,286 | 43 |
| Cayo | Cycle 1 | 10 | 1,589 | 6,283 | 284 |
| | Cycle 2 | 10 | 1,605 | 7,083 | 219 |
| Stann Creek | Cycle 1 | 13 | 1,587 | 5,997 | 248 |
| | Cycle 2 | 13 | 1,603 | 6,204 | 262 |
| Toledo | Cycle 1 | 14 | 1,536 | 7,038 | 396 |
| | Cycle 2 | 14 | 1,629 | 7,839 | 418 |
| **TOTAL** | **Cycle 1** | **69** | **8,356** | **35,360** | **1,400** |
| | **Cycle 2** | **70** | **8,630** | **37,643** | **1,437** |

*Source: Vector Control Unit, MOH*

The cases of malaria have occurred mainly in the western and both southern districts. Spraying of houses has reduced significantly from about 12,000 in 1997 to just over 9,000 in 1999. However, there was an increase in 1999 of 10.6 % over the 1998 figure. Until 1996, DDT was the main pesticide used to combat malaria. Due to pressure from environmental groups (due to the potential threat DDT had on living organisms) DDT was banned in Belize, but due to the high rise in malaria cases the following years it was then restricted for the sole use of the Vector Control Unit. Presently the Government of Belize has taken positive steps towards the elimination of all DDT substances in the country and will ship all DDT substances to another country for its complete eradication

### Table 77.2
### Number of Communities Sprayed by District, 1999

| District | | Number of Communities | # of Houses Sprayed | Population Covered | Quantity Used in Lbs. (k-otrin) |
|---|---|---|---|---|---|
| Corozal | Cycle 1 | 12 | 1,721 | 7,909 | 225 |
| | Cycle 2 | 14 | 1,817 | 7,925 | 210 |
| Orange Walk | Cycle 1 | 14 | 1,943 | 7,857 | 235 |
| | Cycle 2 | 13 | 1,683 | 7,481 | 194 |
| Belize | Cycle 1 | 8 | 372 | 1,179 | 48 |
| | Cycle 2 | 8 | 396 | 1,386 | 52 |
| Cayo | Cycle 1 | 12 | 1,577 | 6,111 | 176 |
| | Cycle 2 | 13 | 1,598 | 6,281 | 183 |
| Stann Creek | Cycle 1 | 13 | 1,798 | 6,986 | 242 |
| | Cycle 2 | 14 | 1,759 | 6,897 | 230 |
| Toledo | Cycle 1 | 28 | 1,887 | 7,896 | 409 |
| | Cycle 2 | 34 | 2,179 | 9,008 | 543 |
| **TOTAL** | **Cycle 1** | **87** | **9,298** | **37,938** | **1,335** |
| | **Cycle 2** | **96** | **9,432** | **38,978** | **1,412** |

*Source: Vector Control Unit, MOH*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## What do we mean by sustainable development?

Sustainable development means living on the earth's income rather than eroding its capital. It means keeping the consumption of renewable natural resources within the limits of replenishment. It signifies handing down to successive generations not only man-made wealth, but also natural wealth, such as clean and adequate water supplies, good arable land, a wealth of wildlife, and ample forest.

## What are indicators?

Indicators are quantified information, which help to explain how things are changing over time. Key indicators for the environment have been proposed by the United Nations Commission on Sustainable Development (UNCSD). Indicators in the economic area have been calculated for many years and used to judge how the economy is performing. A few examples of economic indicators are, the level of employment, the rate of inflation, the balance of payments, public sector borrowing, etc. These are broad brush aggregated statistics which give an overall picture. They do not explain why particular trends are occurring, and they do not necessarily reflect the situation in a particular sector of industry or society, or in a particular geographical area. But, overall they provide policy decision taking and allowing the public to judge for themselves, how the economy is performing. Environmental indicators should work in the same way.

## Why do we need indicators?

There are three basic functions of indicators – simplification, quantification and communication. Indicators generally simplify in order to make complex phenomena quantifiable so that information can be communicated. More specifically we need indicators because:

- People are concerned about sustainable development and the environment. They need to be informed about the state of the environment and the economy and how they are changing, so that they can understand and monitor government policies, and see how their own actions may have an impact. Indicators are therefore needed in a form which is relevant to the general public and can be readily understood;
- They can provide a means of linking environmental impacts to socio-economic activity, and may in some cases provide early warnings of potential problems arising from human activities;
- They can help to measure the extent to which policies aimed at sustainable development are being achieved;
- They can help to clarify the confusion caused by the mass of environmental and economic data available.

## UNCSD indicators for Belize

In the following pages, we present some of the UNCSD indicators for Belize. About 40 further environmental indicators have been proposed, see the list at the end of this section, but sufficient data for them is not available at present. A few are not applicable to Belize.

For each we provide a brief description, and the purpose of the indicator. Its relevance to sustainable development is also explained. In addition, a reference is given to the corresponding chapter of Agenda 21.

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## ARABLE LAND PER CAPITA

### Brief description:
Arable land is land allocated to perennial crop production in a country.

### Alternative definition:
Agricultural land per capita could be used as a more inclusive definition of land available for food production.

### Agenda 21 reference:
Chapter 14: Promoting Sustainable Agriculture and Rural Development.

### Purpose:
This indicator shows the amount of crop land area for food production.

### Relevance to Sustainable/ unsustainable development:
This indicator shows whether agriculture and technology can satisfy the increasing demands for food. Certain factors, such as urbanization, which increases pressure on the available agricultural land, may limit the capacity of agricultural production to ensure a level of food security. Changes in indicator value over time may show increased/decreased pressure on land resources. This indicator is of value to land planning decision making.

### Table 79.1

| Year | Agriculture Land* (acres) | Population (1992 mid-year estimates) | Rate (acres per capita) |
|---|---|---|---|
| 1992 | 535,078 | 199,000 | 2.7 |

** The alternative definition was used in this indicator.*

*Source*: *Land information Center and CSO*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## AGRICULTURAL EDUCATION

### Brief description:
Public expenditure on agricultural education (both secondary schools and post secondary that teach agriculture) reflecting national investment in human capital for Sustainable Agricultural and Rural Development (SARD).

### Agenda 21 reference:
Chapter 14: Promoting Sustainable Agricultural and Rural Development.

### Purpose:
The purpose of this indicator is to measure the public sector investment in human resource

### Relevance to sustainable/ unsustainable development:
The challenge for agriculture is to respond to meet the future needs of an expanding population. This must be accomplished in a sustainable way by protecting the land and associated resources. Investment in human capital through agricultural education represents an effective avenue to enhance food production and protect the natural resource base.

### Table 80.1

| Year | Expenditure on Agricultural Education (Bz$m) | Gross Domestic Product (Bz$m) | Rate (%) |
|---|---|---|---|
| 1998/1999 | .9 | 1064.0 | 0.1 |
| 1999/2000 | 1.0 | 1,063.3 | 0.1 |

*Source: Belize Estimates of Revenue and Expenditure for Fiscal Year 1999/2000.*
*Includes: Belize High School of Agriculture, Belize College of Agriculture, Belize Natural Resource College of Agriculture - LYNAM*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## PROTECTED FOREST AREA AS A PERCENT OF TOTAL FOREST AREA

### Brief description:

A protected area is an area of land and /or sea especially dedicated to the production and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

### Agenda 21 reference:

Chapter 11: Combating deforestation.

### Purpose:

This indicator measures that part of the forest area, which has been delineated for protection purposes. It includes areas established to protect wildlife, special ecosystems, soil and water resources, etc. It is understood that the higher the percent of the indicator, the better the performance of the country in protecting and conserving its forest resources.

### Relevance to sustainable/ unsustainable development:

Forest serves multiple ecological, socioeconomic, and cultural roles in many countries. They are among the most diverse and widespread ecosystems of the world. Forests provide many significant resources and functions including: wood products, recreational activities, habitat for wildlife, water and soil conservation, and a filter for pollutants.

This indicator measures societal response to protect biodiversity and landscapes throughout the nation of representative reserves of various forest ecosystems.

### Table 81.1

| Year | Protected Forest Area (acres) | Total Forest Area (acres) | Rate (%) |
|---|---|---|---|
| 1994 | 1,004,945 | 4,188,638 | 24.0 |
| 1996 | 1,080,323 | 4,065,184 | 26.6 |

*Source: Forest Department and LIC, MNREI*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## PROTECTED AREA AS A PERCENT OF TOTAL LAND AREA

### Brief description:
A protected area is an area set aside for the preservation and protection of highly important natural and cultural features, for the regulation of the scientific, educational and recreational use.

### Agenda 21 reference:
Chapter 15: Conservation of Biological Diversity.

### Purpose:
This indicator represents the extent to which areas that are important for conserving biodiversity, cultural heritage, scientific research, recreation, natural resource maintenance, and other values, are protected from incompatible use.

### Relevance to sustainable/ unsustainable development:
Protected areas are an essential tool for ecosystem conservation, with functions going beyond the conservation of biological diversity. As such, it is one of the building blocks of sustainable development.

### Table 82.1

| Year | Protected Area (acres) | Total Land Area (acres) | Rate (%) |
|---|---|---|---|
| 1996 | 1,705,317 | 5,674,240 | 30.1 |
| 1998 | 2,184,479 | 5,674,240 | 38.5 |
| 2000 | 2,215,211 | 5,674,240 | 39.0 |

*Source: Forest Department and LIC, MNREI*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## PROTECTED MARINE AREA AS A PERCENT OF MARINE AREA

### Brief description:
A protected area is an area set aside for the preservation and protection of highly important natural and cultural features, for the regulation of the scientific, educational and recreational use.

### Agenda 21 reference:
Chapter 15: Conservation of Biological Diversity.

### Purpose:
This indicator represents the extent to which areas that are important for conserving biodiversity, cultural heritage, scientific research, recreation, natural resource maintenance, and other values, are protected from incompatible use.

### Relevance to sustainable/ unsustainable development:
Protected areas are an essential tool for ecosystem conservation, with functions going beyond the conservation of biological diversity. As such, it is one of the building blocks of sustainable development.

**Table 83.1**

| Year | Protected Marine Area (acres) | Marine Area (acres) | Rate (%) |
|---|---|---|---|
| 1996 | 83,996 | 5,844,998 | 1.4 |
| 1998 | 265,664 | 5,844,998 | 4.5 |
| 2000 | 392,051 | 5,844,998 | 6.9 |

*NB. The national territory ( including territorial sea) is 46,620 sq. km, of which 49 % is land. The offshore territorial sea limits is 20 km (12 miles).*

*Source: Forest Department and Belize Country Environmental Profile, 1984*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## EMISSIONS OF GREENHOUSE GASES (GHGs)

### Brief description:
National anthropogenic emissions of carbon dioxide ($CO_2$), methane ($CH_4$) and nitrous oxide ($N_2O$).

### Agenda 21 reference:
Chapter 9: Protection of the Atmosphere.

### Purpose:
This indicator measures the major anthropogenic emissions contributing to global warming.

### Relevance to sustainable/ unsustainable development:
The main greenhouse gases are carbon dioxide ($CO_2$), methane ($CH_4$), and nitrous oxide ($N_2O$). While there are natural emissions of GHGs , anthropogenic emissions have been identified as a source of climate change (IPCC Second Assessment Report, 1995) and are the subject of an international instrument (the UN Framework Convention on Climate Change). Such Emissions are largely influenced by a country's energy use and production systems, its industrial structure, its transportation system, its agricultural and forestry sectors, and the consumption patterns of population. Methane and nitrous oxide emissions are particularly influenced by a country's agricultural production, waste management, and livestock management.

**Table 84.1**

| GHGs | GHGs Emission for 1997 (Gg) | Carbon Equivalent (Gg) |
|---|---|---|
| Carbon Dioxide ($CO_2$) | 599.8 | 599.8 |
| Nitrous Oxide ($N_2O$) | 0.3 | 100.8 |
| Methane ($CH_4$) | 265.1 | 6492.8 |
| **Total Carbon Equivalent Emission** | | **7,193.4** |

*Source: Belize Climate Change Project Report, 2000.*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## GENERATION OF INDUSTRIAL AND MUNICIPAL SOLID WASTE

### Brief description:

The generation of industrial and municipal solid waste is derived from the production of waste on a weight basis at the point of production.

### Agenda 21 reference:

Chapter 21: Environmentally Sound Management of Solid Waste and Sewage-related Issues.

### Purpose:

The main purpose is to represent the production of solid waste produced by all types of human settlement activity.

### Relevance to sustainable/ unsustainable development:

Generation of waste as an indicator is intimately linked to the level of economic activity in a particular country. It is also an indicator of the patterns of consumption of raw materials. In many developed countries a reduction in the volume of waste generated is an indication of changes in the consumption patterns with respect to raw materials and increase in recycling and reuse.

### Table 85.1

| Year | Industrial Waste (tons) | Municipal Waste (tons) | Tons/Capita/Annum |
|---|---|---|---|
| 1998 | 301,355 | 38,148 | 1.4 |

*Source: Belize Solid Waste Inception Report and CSO.*
*Industrial waste includes waste from banana, citrus, shrimp, and the sugar industry.*
*Data for municipal waste includes nine municipalities with waste collection systems. Rural waste generated was not taken into account.*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## MUNICIPAL WASTE DISPOSED PER CAPITA

### Brief description:

The volume of waste disposed per capita is derived from the actual volume of waste that is disposed of at a point outside the producer premises. Some proportions may be disposed of by the formal waste management system. The volume of waste disposed should be considered as that which is either landfill or incinerated, not that which is recycled or reused.

### Agenda 21 reference:

Chapter 21: Environmentally Sound Management of Solid Waste and Sewage-related Issues.

### Purpose:

The main purpose of this indicator is to represent the amount of waste which is disposed of from the household, some of which is disposed through the official waste management system.

### Relevance to sustainable/ unsustainable development:

An increase of waste disposal is clearly unsustainable in the long term. The amount of waste reflects on society's production and consumption patterns, and has a potential impact on human health and the environment. An indicator on the amount of waste generated is, therefore, a first approximation of environmental pressures on air, water and land resources. A sustainable waste management program will strive to minimize the amount of waste, maximize the amount of reuse and recycling, and promote waste disposal and treatment.

### Table 86.1

| Year | *Municipal Waste (tons/annum) | Municipalities Population (1997 mid-year estimates) | Kg/capita/day |
|---|---|---|---|
| 1997 | 38,148 | 15,975 | 0.89 |

*Source: Belize Solid Waste Inception Report and CSO.*
*Data includes nine municipalities with waste collection systems. Rural waste generated was not taken into account.*

** NB. It has not been possible to use the amounts of pure household waste, instead the amount of municipal waste was used.*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## EXPENDITURE ON WASTE MANAGEMENT

### Brief description:
This indicator relates to the amount of municipal and/or private money spent on waste collection and treatment compared to GDP.

### Agenda 21 reference:
Chapter 21: Environmentally Sound Management of Solid Waste and Sewage-related Issues.

### Purpose:
The main purpose is to give an indication of the type and level of service that the city authority provides for waste management and the relative importance that it attaches to waste management in relation to other services. It is also an indication of the efficiency of waste collection service when expressed per ton of waste disposed and can be used to compare relative efficiency within a country or region where overall costs are of the same order.

### Relevance to sustainable/ unsustainable development:
Expenditure on waste management is an important factor in determining the commitment of sustainable development. If health is not handled properly, there is a significant level of deterioration in the health and the living environment, which results in the loss in productivity and reduces economic output. There have been examples of poor waste management leading to disease epidemics, which have seriously affected human health, tourism, and other industries.

### Table 87.1

| Year | Municipal Expenditure (Bz$m) | Gross Domestic Product (Bz$m) | Rate (expenditure/$1m GDP) |
|---|---|---|---|
| 1997 | 2.6 | 1,063.3 | 2,450 |

*Source: Belize Solid Waste Inception Report and CSO.*
*Data includes annual expenditure by nine municipalities with waste collection systems.*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## MUNICIPAL WASTE DISPOSAL

### Brief description:
This indicator relates to the volume of waste collected and disposed of by official means, landfilling, incineration, or other processing.

### Agenda 21 reference:
Chapter 21: Environmentally Sound Management of Solid Waste and Sewage-related Issues.

### Purpose:
The volume of waste disposed by the municipal authority is an indicator, which relates to the efficiency of service provision for waste management. In addition , when compared to the waste generation rate, it will give some indication of both the amounts of waste that are dumped indiscriminately and that are recycled and reused by the formal and informal sector.

### Relevance to sustainable/ unsustainable development:
High waste levels result from consumption and production. Policies and decision making with respect to waste are significant in terms of budgets, potential human health, and environmental effects. Authorities who attach little importance to waste management will have very low levels of waste disposal, in relation to the volume produced, unless recycling and reuse are extensive. Generally, adequate waste management indicates that the authorities are aware of the preventive nature and reduction of health and environment risk.

**Table 88.1**

| Year | Municipal Waste (tons/ annum ) | Gross Domestic Product (Bz$m) | Rate (tons/Bz$1m GDP) |
|---|---|---|---|
| 1997 | 38,148 | 1,063.3 | 35.9 |

*Source: Belize Solid Waste Inception Report and CSO.*
*Data includes nine municipalities with waste collection systems. Rural waste generated was not taken into account.*

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## LIST OF ENVIRONMENTAL INDICATORS PROPOSED BY UNCSD by Chapters in Agenda 21

### Ch 18: Protection of the quality and supply of freshwater

- Annual withdrawals of ground and surface water;
- Domestic consumption of water per capita;
- Groundwater reserves;
- Concentration of faecal coliform in freshwater;
- BOD demand in water bodies;
- Waste water treatment coverage;
- Density of hydrological networks.

### Ch 17: Protection of the oceans, all kinds of seas and coastal areas

- Population growth in coastal areas;
- Discharge of oil into coastal waters;
- Releases of nitrogen and phosphorus to coastal waters;
- Maximum sustained yield for fisheries;
- Algae index.

### Ch 10: Integrated approach to planning and management of land resources

- Land use change;
- Changes in land conditions;
- Decentralized local-level natural resource management.

### Ch 12: Managing fragile ecosystems combating desertification and drought

- Population living below poverty line in dryland areas;
- National monthly rainfall index;
- Satellite derived vegetation index;
- Land affected by desertification.

### Ch 13: Managing fragile ecosystems: sustainable mountain development

- Population change in mountain areas;
- Sustainable use of natural resource in mountain areas;
- Welfare of mountain populations.

### Ch 14: Promoting sustainable agriculture and rural development

- Use of agricultural pesticide;
- Use of fertilizers;
- Energy use in agriculture;
- Arable land per capita;
- Area affected by salinization and water logging;
- Agricultural education.

### Ch 11: Combating deforestation

- Wood harvesting intensity;
- Forest area change;
- Managed forest area ratio;
- Protected forest area as a percent of total forest area.

### Ch 15: Conservation of biological diversity

- Threatened species as a percent of total native species;
- Protected areas as a percent of total area: and ditto for marine area.

### Ch 16: Environmentally sound management of biotechnology

- R&D expenditure in the area of bio-technology;
- Existence of bio-safety regulations and guidelines.

# ENVIRONMENTAL INDICATORS FOR SUSTAINABLE DEVELOPMENT

## LIST OF ENVIRONMENTAL INDICATORS PROPOSED BY UNCSD by Chapters in Agenda 21

### Ch 9: Protection of the atmosphere

- Emission of greenhouse gases;
- Emission of sulphur dioxides;
- Emission of nitrogen oxides;
- Consumption of ozone depleting substances.

### Ch 21: Environmentally sound management of solid wastes and sewage-related issues

- Generation of industrial and municipal solid waste;
- Household waste disposed per capita;
- Expenditure on waste management;
- Rate of waste recycling and reuse;
- Municipal waste disposal.

### Ch 19: Environmentally sound management of toxic chemicals

- Chemically induced acute poisonings;
- Number of chemicals banned or under severe restrictions.

### Ch 20: Environmentally sound management of hazardous wastes

- Generation of hazardous waste;
- Imports and exports of hazardous wastes;
- Area of land contaminated by hazardous wastes;
- Expenditure on hazardous waste treatment.

### Ch 22: Safe and environmentally sound management of radioactive wastes

- Generation of radioactive wastes.

## TREATIES/CONVENTIONS/AGREEMENTS

| TREATIES/CONVENTIONS/ AGREEMENTS (Place/Date of Adoption) | OBJECTIVE |
|---|---|
| International Plant Protection Convention. (Rome, 1951) | To maintain and increase international cooperation in controlling pests and diseases of plants and plant products, and in preventing their introduction and spread across national boundaries. |
| Convention Concerning the Protection of Workers Against Ionizing Radiation. (Geneva, 1960) | To protect workers, as regards their health and safety, against ionizing radiation. |
| International Convention on Civil Liability for Oil Pollution Damage and the 1992 protocol amending the International Convention on the establishment of an International fund for compensation for oil pollution damage, 1971 and Instrument of denunciation to the International Convention on Civil Liability for oil pollution damage.... October 20, 1998. (Brussels, 1969) | To ensure that adequate compensation is available to persons who suffer damage caused by pollution resulting from the escape or discharge of oil form ships. |
| Conventions on Wetlands of International Importance Especially as Waterfowl Habitat. (Ramsar, 1971) | To stem the progressive encroachment on and loss of wetlands now and in the future, recognize the fundamental ecological functions of wetlands and their economic, cultural, scientific and recreational value. |
| Convention on the Prohibition of the Development, Production and Stockpiling of Bacteriological (Biological) and Toxin Weapons, and on their Destruction. (London, 1972) | To prohibit the development of biological weapons and eliminate them, as a step towards general disarmament for the sake of all mankind. |
| Convention Concerning the Protection of the World Cultural and Natural Heritage. (Paris, 1972) | To establish an effective system of collective protection of the cultural and natural heritage of outstanding universal value, organized on a permanent basis and in accordance with scientific methods. |
| Convention on International Trade in Endangered Species of Wild Fauna and Flora. (Washington, 1973) | To protect certain endangered species from over-exploitation by means of a system of import/export permits. |
| International Convention for the Prevention of Pollution From Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78). (London, 1973) | To preserve the marine environment by achieving the complete elimination of international pollution by oil and other harmful substances and the minimization of accidental discharge of such substances. |

## TREATIES/CONVENTIONS/AGREEMENTS

| TREATIES/CONVENTIONS AGREEMENTS (Place/Date of Adoption) | OBJECTIVE |
|---|---|
| United Nations Convention on the Law of the Sea, 1982, as modified by the agreement of 1994 (New York, 1994). (Montego, 1982) | To set up a comprehensive new legal regime for the sea and oceans and, as far as environmental provisions are concerned; to establish material rules concerning environmental standards as well as enforcement provisions dealing with pollution of the marine environment. |
| Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region. (Cartagena de Indias, Colombia, 1983) | To protect and manage the marine environment and coastal areas of the Wider Caribbean Region. |
| Protocol concerning cooperation in combating Oil Spills in the Wider Caribbean Region. (Cartagena de Indias, Colombia, 1983) | To provide a framework for regional cooperation and assistance in the event of oil spill incident in the Caribbean region. |
| Vienna Convention for the Protection of the Ozone Layer. (Vienna, 1985) | To protect human health and the environment against adverse effects resulting from the modifications of the ozone layer. |
| Montreal Protocol on Substances that Deplete the Ozone Layer. (Montreal, 1987) | To protect the ozone layer by taking precautionary measures to control global emissions of substances that depletes it. |
| Basel Convention of Transboundary Movement of Hazardous Waste and their Disposal. (Basel, 1989) | Control of trans-boundary movements of hazardous wastes and their disposals. |
| International Convention on Oil Pollution Preparedness, Response and Cooperation. (London, 1990) | To strengthen the legal framework for the control of environmental pollution by oil, in general, and marine pollution by oil in particular, by providing a basis for preparedness, and for a response-capability, to deal with incidents of oil pollution in the marine environment. |
| Protocol Concerning Specially Protected Areas and Wildlife to the Convention for the Protocol and Development of the Marine Environment of the Wider Caribbean Region. (Kingston, 1990) | To establish protected areas of coastal and marine areas of the wider Caribbean region to ensure the protection of endangered species of wild fauna and flora in the region. |
| Belize and Mexico: Bilateral Agreement on Cooperation for the Protection and Improvement of the Environment and the Conservation of Natural Resources in the Border Zone. (September 21st, 1991) | Cooperation for the protection and improvement of the environment and the conservation of natural resources in the border zone. |

## TREATIES/CONVENTIONS/AGREEMENTS

| TREATIES/CONVENTIONS/ AGREEMENTS (Place/Date of Adoption) | OBJECTIVE |
|---|---|
| Convention on Biological Diversity. (Rio de Janeiro, 1992) | To conserve biological diversity, promote the sustainable use of its components, and encourage equitable sharing of benefits arising out of the utilization of genetic resources. Such equitable sharing includes appropriate access to genetic resources, as well as appropriate transfer of technology, taking into account existing rights over such resources and such technologies. |
| United Nations Framework Convention on Climate Change. (New York, 1992) | To regulate levels of greenhouse gas concentrations in the atmosphere, so as to avoid the occurrence of climate change on a level that would impede sustainable economic development, or compromise initiatives in food production. |
| Convention for the Conservation of the Biodiversity and the Protection of Priority Wilderness Areas in Central America. (Managua, 1992) | To conserve biological diversity and the biological resources of the Central American Region by means of sustainable use. |
| Agreement for the Implementation of the Provisions of the UN Convention on the Law of the Sea of 10 December 1982 Relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks. (New York, 1995) | To ensure long-term conservation and sustainable use of straddling fish stocks and highly migratory fish stocks through effective implementation of the relevant provisions of the UN Convention on the Law of the Sea of December 10, 1982. |
| United Nations Convention to Combat Desertification. (Paris, 1994). | To combat desertification and mitigate the effects of drought in the countries affected through effective action at all levels supported by International cooperation and partnership arrangements in the framework of an integrated approach which is consistent with Agenda 21, with a view to contributing to the achievement of sustainable development in those areas. |
| International Convention for the Protection and Conservation of Sea Turtles for the Western Hemisphere. (December 21, 1997) | Protection and conservation of sea turtles for the western hemisphere. |

## TREATIES/CONVENTIONS/AGREEMENTS

| TREATIES/CONVENTIONS / AGREEMENTS (Place/Date of Adoption) | OBJECTIVE |
|---|---|
| Lome IV Convention. | The Lome IV Convention, although not generally considered an Environmental Convention, contains a provision (Article 39) which prohibits the importation of hazardous waste in the ACP states (African, Caribbean and Pacific countries). |
| Mundo Maya Agreement. | The basic purpose is to coordinate, serve and to promote the Cultural and Environmental Tourism development in the region, where the Maya civilization had developed, recognizing the importance of preserving and maintaining our common cultural heritage and our Natural Resources of the region for the present and future generations. |

*Source: DOE, Register of International Treaties and other Agreements in the Field of the environment, 1996*

**Additional Conventions and Agreements.**

- Convention on Marine Pollution from Ships
- International Convention for the Protection of Pollution From Ships
- International Tropical Timber Agreement
- Convention on the Conservation of Migratory Species of Wild Animals
- Convention Concerning the Prevention and Control of Occupational Hazards Caused by Carcino-genic Substances and Agents
- Convention on Protection of Archeological, Historical and Artistic Heritage of American Nations
- UNESCO Man and Biosphere Program
- Agreement Between Belize and the United Mexican States on Cooperation for the Protection and Improvement of Natural Resources in the Border Zone
- Convention Concerning Indigenous and Tribal People of Independent Countries
- General Agreement on Tariffs and Trade
- Uruguay Round Agreement Establishing the World Trade Organization
- Alliance for the Sustainable Development of Central America.

The DOE is currently participating in the development of the Convention on Persistent Organic Pollutants (POPs) and the Protocol on Land Base Sources of Marine Pollution, under the Cartagena Convention. In addition, the DOE is in the process of renewing the following international instruments to determine whether Belize should become a signatory to these conventions:

- Convention on Prior Informed Consent (PIC) Procedure for Certain Chemicals and Pesticides in International trade,
- International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC Convention).

## INFORMATION, RESEARCH & DEVELOPMENT

| Sponsoring Agency/Body | Scheme | Aim/Objective |
|---|---|---|
| United States Agency for International Development (USAID). | Environmental Water Quality Monitoring Program. | To establish baseline water quality conditions including normal ranges of seasonal variations and periodic fluctuations. To monitor the state of the watersheds and reservoirs and identify appropriate actions that may be required. |
| U.S. Agency for International Development (USAID). | Deforestation in Belize | To determine the extent of deforestation that has occurred in mainland Belize between 1989/92 and 1994/96. |
| The World Bank and its consultants provided technical assistance, and the British Development Division provided the financial assistance. | The National Environmental Action Plan (NEAP). | To provide the blueprint for the development and implementation of environmentally sustainable development policies by the Government and the implementation of inter-sectoral coordination of the various environmental players. To provide a program of policy reforms, institution building, studies and investments that will improve the state of the environment of Belize and put the country on a path of sustainable development. |
| The Inter American Development Bank (IDB). | Environmental Law Manual Of Belize. | To draft under common regional model training materials and manuals which identify and put together the existing ecological and environmental norms and which explains the possibilities that environmental law offers for the resolution of cases. |
| U.S. Agency for International Development | National Symposium on the State of the Belize Environment. | To identify the critical environmental issues that should be addressed and make recommendations for the resolution of some of this issues. |
| U.S. Agency for International Development (USAID). | Belize Country Environmental Profile | To aggregate in one definitive document the information, data and analyses on national environmental problems and to identify possible environmental improvement programs that could be undertaken by the Government and/or private sector with financial assistance from international agencies. |

*Source: DOE*

## INFORMATION, RESEARCH & DEVELOPMENT

| Sponsoring Agency/Body | Scheme | Aim/Objective |
|---|---|---|
| The World Bank and its consultants provided technical assistance, and the British Development Division provided the financial assistance. | National Environmental Report. | To provide the blueprint for the development and implementation of environmentally sustainable development policies by the Government and the implementation of inter-sectoral coordination of the various environmental players. To provide a program of policy reforms, institution building, studies and investments that will improve the state of the environment of Belize and put the country on a path of sustainable development. |
| PACT is financed by a BZ $7.50 conservation fee imposed on tourists through purchase of airline and cruise ship tickets. In addition, 20% of entry fee is contributed to PACT. | Protected Areas Conservation Trust Act (PACT). ` | To provide a long term financial mechanism to ensure the protection and enhancement of natural and cultural resources of Belize. |
| The U.S. Army Corps of Engineers, The U.S. Army Topographic Engineering Center and The U.S. Southern Command. | Water Resources Assessment for Belize. | To document the findings of the water resources assessment team and to present suggestions on water resources investments in Belize. |
| Government of Japan, through the Inter-American Development Bank (IDB). | Belize Solid Waste Management Project. | To prepare a Solid Waste Management Plan to assist the Government of Belize to operationalize the Solid Waste management Authority using a combination of public and private financing. In addition, they are to provide the Government with regional site designs for at least three disposal sites and make them operate. Prepare a public awareness campaign in support of improved solid waste management in Belize. |
| Assistance provided by the United nations Development Programme and Global Environmental Facility. | Coastal Zone Management Programme. | Establish and strengthen national institutions entrusted with ensuring the sustainable use and conservation of the coastal resources of Belize. To update and improve information base on coastal resources for use in informal decision making. Develop a strong commitment amongst all sectors to the importance of environmentally sound development of coastal resources through sustainable management. |

## INFORMATION, RESEARCH & DEVELOPMENT

| Sponsoring Agency/ Body | Scheme | Aim/Objective |
|---|---|---|
| European Union. | Watershed-Reef Inter-connectivity Scientific Study (WRISCS). | To investigate through field observation the relationship between sediment dynamics and changing land use practices within watersheds and the coastal zone in a region Southern Belize. This will provide scientific information that can be used in the direction of an integrated approach to the local management of land and coastal resources. |
| | National Protected Areas System Plan (NPASP) | To provide guidance to policy formulation for the establishment of protected areas; advise on management objectives; suggest an enabling administrative and managerial structure; identify resource requirements and support mechanisms; integrate the National Protected Areas System within the national land use and economic development planning as a component of a national policy. |
| United Nations Developmental Project (UNDP)/Global Environmental Facility (GEF) | Climate Change Project | To present to the United nations framework Convention on Climate Change (UNFCC) Belize's actions to address climate change. |
| Belizean Government | Inland Fisheries Unit | To cater for fresh water endemic species and help farmers with the fishing industry. |
| Belizean Government | Belize Animal Health Authority | To monitor that all marine products are safe for the consumer. |
| Belizean Government | Aquaculture Unit | Provide technical assistance to all aquaculture operations, to monitor the introduction of exotic species, to promote the diversification of aquaculture. |
| UNDP/GEF | Ecosystem Management Program | To build a fisheries management tool. To preserve the protective areas and provide a tool for research. |
| Ministry of Finance, Central Statistical Office, Environmental Statistical Unit through the IDB and Statistics Sweden as Consultants | Environmental Statistics for Belize. | To provide statistics of the main environmental concerns in Belize - land use, the impact of agriculture, forestry issues, coastal zone, freshwater quality, solid waste, the impact of tourism and environmental related health issues. |

*Source: DOE and CSO*

## ENVIRONMENTAL ORGANIZATIONS

| Organization | Purpose/Objective |
|---|---|
| The Belize Audubon Society | Its is dedicated to the sustainable use of Belize's natural resources in an effort to maintain the balance between people and the environment. |
| Programme for Belize | To promote the conservation of the natural heritage of Belize and to promote wise use of its natural resources. |
| Association of Friends of Water Creek Forest Reserve | To assist in the preservation of the Freshwater Creek Forest Reserve which is the only remaining forest reserve in northern Belize. |
| Sibun Watershed Association | To develop and implement a mechanism for community participation for the protection and sustainable management of the natural resources found in the Sibun Watershed area. |
| Toledo Institute for Development and the Environment (TIDE) | To preserve the biodiversity and natural ecosystem processes within the Maya Mountain Marine Areas Transect. To develop an eco-tourism business for local residents. |
| Green Reef | To help maintain a sustainable balance between people and marine resources, allowing for its enjoyment while at the same time minimizing the impact. |
| Friends of Gra Gra Lagoon | To work towards the maintenance of the natural condition of the Lagoon's mangrove eco-system and advocating for its official declaration as a Protected Area. |

*Source: Belize Alliance of Conservation Non - Government Organizations (BACONGO)*

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## ABBREVIATIONS

| | |
|---|---|
| BCES | Belize Center for Environmental Studies |
| BEL | Belize Electricity Limited |
| CITES | Convention on International Trade in Endangered Species |
| CPI | Consumer Price Index |
| CSO | Central Statistical Office |
| FAO | Food and Agriculture Organization |
| GDP | Gross Domestic Product |
| GHG | Greenhouse Gases |
| IUCN | International Union for the Conservation of Nature |
| kWh | Kilowatt Hour |
| LFS | Labour Force Survey |
| LIC | Land Information Center |
| MNREI | Ministry of Natural Resources, Environment and Industry |
| MOH | Ministry of Health |
| MPRFR | Mountain Pine Ridge Forest Reserve |
| MT | Metric Tons |
| NBC | National Bio-diversity Committee |
| NGO | Non-Governmental Organizations |
| PAHO | Pan American Health Organization |
| PCB | Pesticides Control Board |
| PGIA | Phillip Goldson International Airport |
| RWSSP | Rural Water Supply and Sanitation Program |
| TFR | Total Fertility Rate |
| UNCSD | United Nations Commission for Sustainable Development |
| USAID | United States Agency for International Development |
| WASA | Water and Sewerage Authority |
| WHO | World Health Organization |

**Country Districts**

| | |
|---|---|
| Czl | Corozal District |
| O/W | Orange Walk District |
| Bze | Belize District |
| S/C | Stann Creek District |
| Tol | Toledo District |
| Cyo | Cayo District |

| | |
|---|---|
| - | zero nothing to report |
| 0 | less than 0.5 of unit used |
| .. | Data not available or too uncertain to report |

## WEIGHTS AND MEASURES

| Metric | to Imperial | Imperial | to Metric |
|---|---|---|---|
| 1 mm | 0.0394 inches | 1 inch | 25.4 mm |
| 1 metre | 1.0936 yard | 1 yard = 3 ft | 0.9144 m |
| 1 km | 0.6214 mile | 1 mile | 1.6093 km |
| 1 ha | 2.4712 acres | 1 acre | 0.4047 ha |
| 1 sq. km ($km^2$) = 100 ha | 0.3861 sq. mile | 1 sq. mile = 640 acres | 2.590 $km^2$ |
| 1 litre | 2.113 pint = 1.76 pint UK | 1 gal = 0.8327 gal UK | 3.7854 litre |
| 1 cu. m ($m^3$) | 1.3080 yard ($yd^3$) | 1 cu. Yd ($yd^3$) | 0.7646 $m^3$ |
| | | 1 cu. ft. | 1.0283 $m^3$ |
| | | 1000 board ft. | 2.3597 $m^3$ |
| 1 kg = 1000 g | 2.2046 lb | 1 lb | 0.4536 kg |
| 1 metric ton | 0.9842 ton | 1 ton | 1.016 metric tons |


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