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Assessment of Land-based Sources and Activities Affecting the Marine, Coastal and Associated Freshwater Environment in the Wider Caribbean Region

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PREFACE

The Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities (UNEP (OCA)/LBA/IG. 2/7) was adopted by an intergovernmental conference held in Washington, DC., from 23 October to 3 November 1995. The goal of the Global Programme of Action is to prevent degradation of the marine environment from land-based activities, by facilitating the realisation by States of their duty to preserve and protect the marine environment.

The Washington Conference designated the United Nations Environment Programme (UNEP) as Secretariat of the Global Programme of Action and requested that, as co-ordinator and catalyst of environmental activities within the United Nations system and beyond, it should:

(a) Promote and facilitate implementation of the programme of Action at the national level;

(b) Promote and facilitate implementation at the regional (including sub-regional level) through in particular a revitalisation of the UNEP regional seas programme; and

(c) Play a catalytic role in the implementation at the international level with other organisations and institutions.

The overview presented in this document was commissioned by the Co-ordination Office of the GPA in co-operation with the Regional Co-ordinating Unit (RCU) of the Caribbean Environment Programme (CEP) to assist the countries of the Wider Caribbean region in their efforts to protect the marine environment and achieve sustainable development. This overview will also be used to provide data and information for a global review on land-based sources and activities affecting the quality of the marine, coastal and associated freshwater environment. This global review is currently being prepared (under the leadership of UNEP) by the Working Group on Marine Environmental Assessments of the UN-sponsored Joint Group of Experts of the Scientific Aspects of Marine Environmental Protection (GESAMP). The overview presented here identifies and assesses the problems related to land-based activities for countries for which information was found and the region as a whole.

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1. EXECUTIVE SUMMARY

This document provides a regional overview on land-based sources and activities affecting the marine, coastal and associated freshwater environment in the Wider Caribbean Region (WCR).

As stated in article 2 of the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention) "The "Convention area" means the marine environment of the Gulf of Mexico, the Caribbean Sea and areas of the Atlantic Ocean adjacent thereto, south of 30° north latitude and within 200 nautical miles of the Atlantic coast of the states referred to in article 25 of the Convention". The area of the Cartagena Convention includes twelve continental States, thirteen Island States, the Commonwealth of Puerto Rico, three overseas Departments of France, a territory shared by Netherlands and France (St. Marteen) and eleven dependent Territories. [96]

The above description encompasses the following nations and territories: Anguilla (United Kingdom), Antigua and Barbuda, Aruba (Netherlands), Bahamas, Barbados, Belize, British Virgin Islands (United Kingdom), Cayman Islands (United Kingdom), Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, France, Grenada, Guadeloupe (France), Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique (France), Mexico, Montserrat (United Kingdom), Netherlands Antilles Federation (Netherlands), Nicaragua, Panama, Puerto Rico (U.S.A.), St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands (United Kingdom), United States of America, U.S. Virgin Islands (U.S.A.) and Venezuela.

The WCR is not an exception when it comes to the serious impacts and threats that affect the coastal and marine ecosystems owing to the excess of uncontrolled land-based activities and sources of pollution. As a result of this research, several initiatives taken by international development banks were identified as important steps to control some of the main land-based sources and activities affecting the marine, coastal and associated freshwater environment in specific countries of the region. The majority of these initiatives are going to assist some of the countries of the region in developing the necessary infrastructure and treatment facilities to deal with domestic sewage, solid waste and ship generated waste.

Although many countries in the region such as Barbados, Belize, Colombia, Costa Rica, Cuba, Dominica, Grenada, Guatemala, Jamaica, Mexico, St. Kitts and Nevis, St. Lucia, Suriname, Trinidad and Tobago, United States and Venezuela have adopted national legislation that in principle should have assisted them in controlling the factors that cause pollution or degradation problems of their marine, coastal and associated freshwater environment, and they have acceded to the majority of the international environmental agreements, the problems identified in 1992 (UNEP(OCA)/CAR IG.9/INF.5), are still valid in mid 1998. Enforcement of existing legislation, duplication of efforts at the national and international level, lack of co-ordination and clear lines of responsibilities at the national level, lack of public awareness, strong institutions and human resources continue to impair the sustainable use of the natural resources of the region.

It is of paramount importance that the countries undertake periodic assessments of the status of pollution and that they provide all reports prepared to the Caribbean Environment Programme Regional Co-ordinating Unit in Kingston.

Under the Cartagena Convention, a Protocol on the prevention, reduction and control of marine pollution from land-based sources and activities (LBS Protocol) is currently under negotiation. The draft Protocol sets forward obligations, institutional responsibilities and its specific annexes establish priority source categories and management practices. The full implementation of the Protocol on land-based sources (LBS) of pollution in the future could be the most efficient tool to control land-based pollution in the region.

2. BACKGROUND

The Global Programme of Action (GPA) for the Protection of the Marine Environment from Land-based Activities was adopted in Washington, D.C. at the Intergovernmental Conference, held from 23 October to 3 November 1995. [98] To facilitate the implementation of the GPA by member States, the United Nations Environment Programme (UNEP) has provided support for the preparation of national and regional overviews about land-based activities affecting the coastal and marine environment in several regions of the world. This overview follows as closed as possible the layout suggested by the XXVII Session of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), which took place in Nairobi in April 1997. [24]

National profiles have been drafted based on a comprehensive library search, documents provided by some international organisations, and some reports provided by a very few countries in the region, i.e. Colombia, Cuba and the United States. This report has been prepared based on the analysis of the National profiles and available information gathered from multiple organisations and libraries. National profiles are not included for the Cayman Islands, French Guiana, US ~~and British~~ Virgin Islands and the United States of America because information was not collected for these Territories and State

The National profiles and the draft of this document were circulated to focal points of the Caribbean Environment Programme (CEP) on 24 October 1998, for their revision, amendment and provision of additional information on their country's status of and measures to control land-based sources and activities affecting the marine, coastal and associated freshwater environment. Comments were received from Costa Rica, Jamaica and the Netherlands Antilles. In the cases where information was available, an attempt to prepare draft tables has been made, in others, only some general aspects are mentioned. National profiles were prepared as means of securing inputs from Governments in the process of preparing this Overview, and as such they were submitted to Governments in their original language and are reproduced in this report but have not been translated.

It is hoped that such National profiles will serve as a tool in assisting Governments in identifying the most pressing problems and priorities for future action plans and strategies to protect the marine, coastal and associated freshwater environment, and the international organisations and other donors to focus their aid and assistance to tackle the countries' main environmental issues.

In 1994, a Regional Overview of Land-based Sources of Pollution in the Wider Caribbean was published, as CEP Technical Report No. 33. An effort to identify the status of seven types of pollutants, i.e. sewage; oil hydrocarbons; sediments; nutrients; pesticides; solid waste and marine debris; and, toxic substances in the WCR was made. The report was prepared based on pollution data collected between 1975 and 1989. According to this report "the only survey conducted to date in the Caribbean to estimate pollutant loads from industrial and domestic point sources was sponsored by UNEP/CARICOM/PAHO", in 1992. Estimates for oil pollution are based on information from 1978, 1982, 1983, 1985, 1986, and 1987. For nutrients the only up-dated information is from the Gulf of Mexico Programme, published in 1992. For seventeen countries the information available on use of fertilisers covers the period 1979-1989. Regarding pesticides the information covers the period 1974-1984 for 13 selected countries. [96]

In an effort to provide more up-dated information on point sources, the former CEPPOL programme of the Caribbean Environment Programme (now renamed Programme for Assessment and Management of Environmental Pollution-AMEP) supported the preparation of land-based inventories, based on the methodology proposed by the World Health Organisation (WHO) document "Management and Control of the Environment". Based on the information received from focal points of the Caribbean Environment Programme and the results of a CEPPOL meeting of experts to review progress and make recommendations in the data collection of point sources of pollution in the Wider Caribbean (December 1991) five comparative tables were prepared regarding waste loads from domestic sources; industrial activities and number of plants; waste loads from industrial sources; relative BOD_5 contribution per type of industry and pollutant load discharges from 8 rivers in the Region. (BOD_5, TSS, TN, and TP). [96]

Under the Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region (Cartagena Convention), a Protocol on the prevention, reduction and control of marine pollution from land-based sources and activities (LBS Protocol) is currently under negotiation. The draft Protocol sets forward obligations, institutional responsibilities and its specific annexes establish priority source categories and management practices. The first annex to the Protocol establishes a list of the

sources, activities, and contaminants of specific concern for the Wider Caribbean Region as a whole. The second annex establishes the process for developing regional source-specific controls. The third and fourth annexes, which are the first of the two source-specific annexes, to be adopted together with the Protocol, established effluent limitations for domestic sewage and best management practices that are to be incorporated into national plans to control pollution from agricultural non-point sources. Future annexes will be negotiated to address these priority source categories, activities and contaminants of concern listed in Annex I and, using the factors set forth in Annex II. These future annexes will set regional effluent limitations and best management practices. Such annexes will also contain timetables for achieving the effluent limitations and management practices.

To assist Governments and territories of the region in implementing the LBS protocol and take additional measures to control the degradation of the marine, coastal and related freshwater environments, this document reflects more up-dated information of the main pollution and degradation issues that the region as a whole, and countries and territories individually, must face in the forthcoming years.

To finalise this report countries of the region were encouraged to provide to the RCU the most up-dated information they had on pollution by point and non-point sources, making reference in particular to sources, amounts, levels, pathways and effects of sewage, persistent organic pollutants, radioactive substances, heavy metals, oil hydrocarbons, nutrients, sediments and pesticides. They were also requested to provide information about all relevant strategies and measures they had taken to control land-based sources and activities affecting the marine, coastal and associated freshwater environment, as these could be used by other countries of the region to tackle their own problems.

From the information search it was concluded that there are important gaps at the National level regarding updated information on the status of land-based sources and activities and the main pollution or degradation problems affecting the marine, coastal and associated freshwater environment. The difficulty in finding accurate and updated information shows that it is of paramount importance that the countries undertake periodic assessments of the status of pollution and that they provide all reports prepared to the Caribbean Environment Programme Regional Co-ordinating Unit (CAR/RCU) in Kingston. This will facilitate the provision, upon request, of up-to-date information to the countries; international community, etc; to keep all documents in a central location and to assist in the design of programmes that will endeavour tackle the major evolving marine, coastal and associated freshwater environmental problems in the region.

The Wider Caribbean Region covers an area of 4.3 x 10^6 km^2. [71] (See figure 1). Although it is not easy to estimate the number of coastal dwellers in the Wider Caribbean, if we consider that nearly 100 per cent of the population of small island developing States and Territories are part of the coastal population and we take into consideration some estimates made by several organisations like the National Oceanic and Atmospheric Administration (NOAA), the Inter-American Development Bank (IDB), the World Bank (WB) and the Governments themselves in their national reports to UNCED, we could easily conclude that the coastal population must be around 70 million people. [14, 15, 18, 20, 32, 36, 41, & 96] (See Annex 1).

It is evident that Belize, Colombia, Costa Rica, Guatemala, Guyana, Honduras, Mexico, Panama, Suriname, United States of America and Venezuela have extensive land resources (See National Profiles). In the island States and Territories many of the renewable natural resources are seriously threatened with degradation due to population growth and unsustainable economic development. [68]

The majority of surveys and assessments that have been carried out to date stressed that the main problems of the Wider Caribbean basin are habitat destruction, depletion of resources, coastal erosion and marine pollution. Within pollution, the discharge of untreated waste and sewage from human settlements, agricultural runoff, agrochemical pollution and industrial activities have been identified as the major sources. (Section 4).

Economic activities such as oil and gas exploration, exploitation, refining and transportation have caused major pollution problems in certain countries of the Region. (See section 4 and National profiles)

Mining is another industry that is expanding rapidly in the Wider Caribbean region. Between 1994 and 1996, 28% of the world spending on exploration took place in this region and this is expected to increase to 39% by the year 2000, with its possible environmental implications. [14]

In the islands where tourism is the main economic activity, according to UNEP's Global Environmental Outlook, with 11 million visitors a year between 1983 and 1993, and 8 million tourists from cruise vessels in 1991-1992, there is an extra load of solid and liquid wastes. There is also an increasing need to build hotels, resorts and other types of facilities. [100]

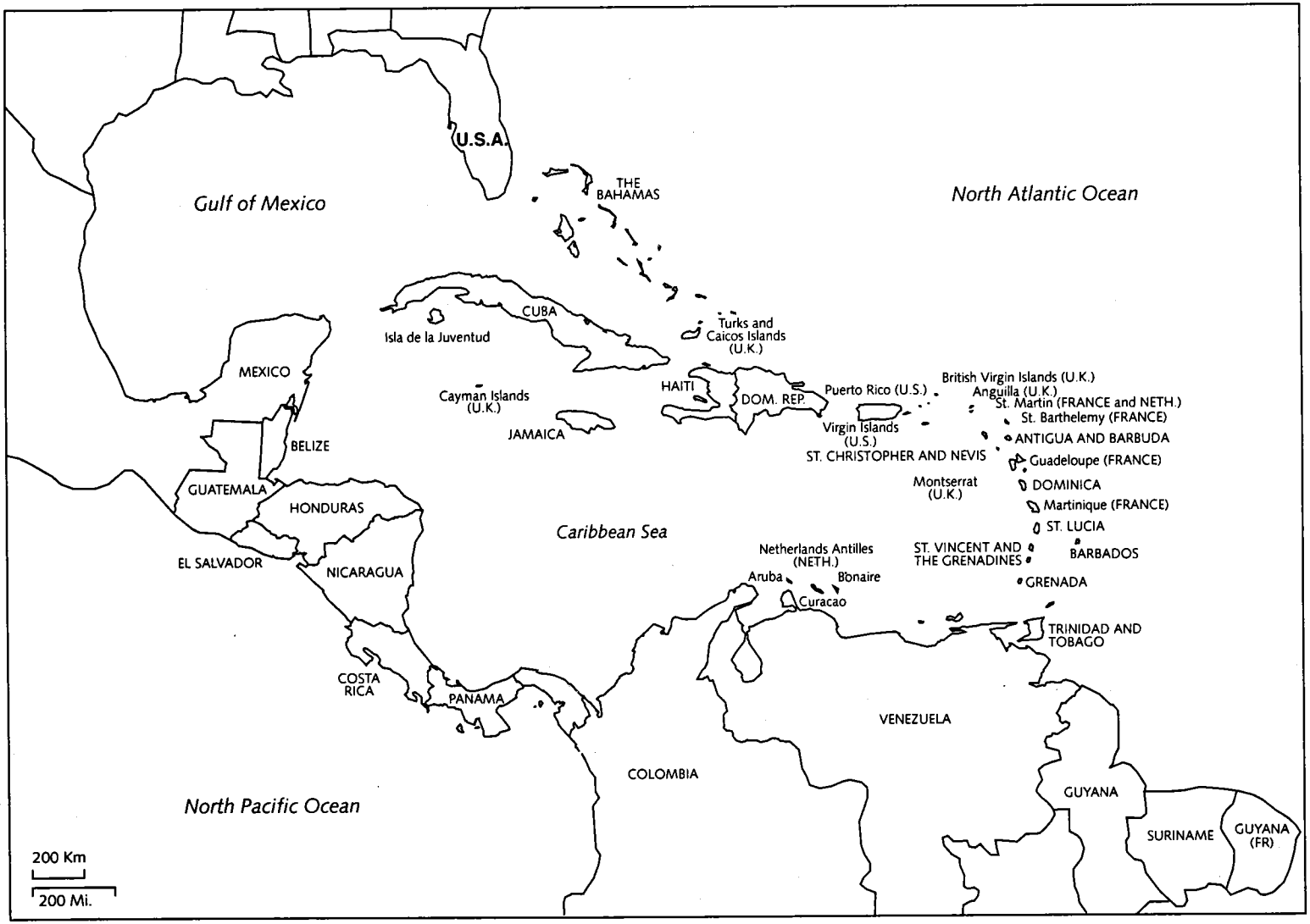

Figure 1. The Wider Caribbean Region

The agroindustry accounts for almost 70% of export earnings in the region and employ a significant portion of the labour force. Bananas, sugar, coffee, non-traditional fruits and cigars are some of the most common exported products. [14]. Although important measures have been taken by some countries in the Region to avoid the use of some pesticides the use of agrochemicals is very generalised. [12, 15, 26, 33, 35, 36, 66 & 89]

Fishing is important for some countries in the region, in particular, in Mexico, Colombia and Venezuela. [22]. Prawn aquaculture is important in Colombia, Cuba, the Dominican Republic, Mexico and Suriname. Mexico has also been successful with oyster (*Crassostrea virginica*) aquaculture in the Caribbean. [21]. Major impacts of aquaculture developments will be identified and reviewed in Section 4. Colombia, Dominican Republic, Honduras, Jamaica and Turks and Caicos are important exporters of Queen Conch (*Strombus gigas*) to the United States. [67]

3. INTRODUCTION

3.1 Natural Conditions and Processes

The Wider Caribbean Region is a complex region conformed by 36 States and Territories that exhibit wide disparities in the distribution of population, level of economic development, and access to wealth and physical resources. There is an important human capital and an impressive richness of multiple cultures. Despite this heterogeneity, they all share similar environmental problems.

The majority of the States and Territories of the Wider Caribbean are facing similar problems to those found in the rest of the developing world as there is a permanent and increasing need to improve the quality of life of the inhabitants of the region and to accelerate economic growth. The efforts of many countries have serious implications on their natural resources and particularly the coastal areas, which in many countries are some of the most populated areas

3.1.1 Climate and Oceanography

The climate in the region is generally between sub-humid and humid tropical, characterised by little seasonal or diurnal variation.

The Caribbean Sea has clear and warm waters (24°C) and has a very low tidal range. The waters enter through the Lesser Antilles and exit via the Yucatan channel.

Rainfall varies from 395 mm annually (in Aruba) to 10,000 mm (in Dominica) and temperature ranges between 31 and 16 degrees Celsius depending on the altitude. In the case of the Central American countries, the tropical lowlands of the Caribbean region are perennially hot and humid and receive rainfall throughout the year. The soils in this area were formed under thick covers of tropical lowland forest and they tend to have slow internal drainage, can be highly acidic and are normally deficient in nutrients after clearing the forest. [63].

The Region has had a long history of devastating encounters with tropical hurricanes, which in the last century alone have killed thousands of people and left many more homeless, causing serious economic problems to many of the inhabitants of the Caribbean. The hurricane season normally starts in late June and ends by mid-October; however, severe tropical storms can often go through to late November. [27, 29, 33, 34, 35, 37 & 68].

El Niño is an oceanic and atmospheric phenomenon, during which unusually warm ocean conditions appear along the southeast Pacific coast, causing climatic disturbances of varying severity. Although this phenomenon used to appear in December, every three to seven years, affecting in particular, Colombia, Chile, Ecuador and Peru, lately it has being reported that El Niño is appearing more frequently and affecting the climate world-wide. The southeast Pacific countries considered the period 1982-1983 as one of the worst in the history of El Niño. There were heavy rains and flooding in South America, while in other countries of the world there were droughts. In 1986, about 130 scientists from around the world met to discuss modelling and predicting, meteorological aspects, physical oceanography, the effects of El Niño on natural resources and habitats and needs for future research, under the auspices of the Comisión Permanente del Pacífico Sur (CPPS), the Intergovernmental Oceanographic Commission (IOC), the World Meteorological Organisation (WMO) and the American Geophysical Union (AGU). [54]

3.1.2 Geology and Geomorphology

Geologically, the Caribbean Sea consists of two main basins separated by a broad submarine plateau. Large areas of the sea exceed a depth of 3,660 m and between Jamaica and the Cayman Islands it reaches 7535m (the Caribbean's deepest point). The Lesser Antillean Archipelago volcanic islands are the summits of a submerged mountain range, which forms the eastern boundary of what is known as the Caribbean Tectonic Plate. This archipelago began to form probably 50

million years ago, during the Miocene period of the Cenozoic era.
The countries and territories of the region have quite distinct geomorphologies. Some are of volcanic origin and are mountainous; others are just coral and limestone deposits.

3.1.3 Watersheds and Freshwater Resources

In all countries of the WCR, as a result of many years of agriculturally-based economies, expansion of the agriculture frontier, human settlements, industrial development, etc. upper slope catchment areas have been seriously affected. Deforestation for commercial logging, collection of firewood for household use, and road construction has had a serious impact on the rate of deforestation for the Latin American and Caribbean Region. As stated in the national profiles in almost all countries of the region there is heavy pressure to clear more forest to give way to other development activities. It is common knowledge that deforestation in the catchment areas generates serious soil erosion and downstream sedimentation that affects river basins, deltas, dams, coastal lagoons and other coastal habitats. Pollution of freshwater resources with bacteria and pesticides is also a main concern, because as is mentioned in the national profiles, the majority of the countries have limited access to drinking water and waterborne diseases are common. As stated in St. Lucia's national profile, its main source of freshwater is rainfall, and because of mismanagement of the freshwater resources the country is facing a scarcity problem, as well as Antigua and Barbuda where rainfall is low and the watersheds have been mismanaged. [8 & 12].

As with the rest of the natural resources in Latin America and the Caribbean (LAC), although it is said that 13% of the world's continental waters are found in LAC, the distribution is quite variable. At the same time, it is stated that two thirds of the LAC region is arid or semi-arid, including some parts of Colombia and Mexico. It is further stressed that the rivers of the region are polluted by several sources, the most important ones being industrial and urban wastewater from large cities, wastewater from mining industries, and agricultural run off. The Colombian rivers for example, have been heavily polluted by very diverse sources, and many of these contaminants are flowing through the streams into the Caribbean Sea. [100]

3.1.4 Biodiversity

The Wider Caribbean Region is considered by many scientists as one of the richest of the world from the biological point of view. Colombia and Mexico, for example, are two of the ten richest countries in the world in terms of terrestrial and plant species; Colombia with only 0.77 percent of the world's area contains 10 per cent of the world's animals and plants species. [65]

The coral reefs, seagrass beds, mangrove meadows, swamps and coastal lagoons present high diversity and are found in all the countries of the region. In the coastal area of Belize, the second largest barrier reef of the world is located, stretching some 220 km. These habitats and their health are of fundamental importance for the productivity of inshore fisheries. The majority of bottom-dwelling fish species in the region are associated with coral reefs as adults and with the seagrass beds and mangrove swamps during the nursery and post-larval stage. Mangroves and coral reefs also act as natural protection against coastal erosion. [25 & 100]

According to the International Council for Bird Preservation (ICBP), 10% of the world's 9,000 bird species are restricted to islands; therefore, land degradation and deforestation could have a serious impact on the overall diversity of birds. Species like the peregrine falcon (*Falco peregrinus tundrius*), the red-necked parrot (*Amazona arausiaca*) and the imperial parrot (*Amazona imperialis*) are considered as endangered by the World Conservation Union (IUCN). [61]

Other ecologically important species present in the WCR are four endangered species of marine turtles, greenback (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelis imbricata*) and olive ridley (*Lepidochelys olivacea*), and one vulnerable species, the loggerhead (*Caretta caretta*). The blue whale (*Balaenoptera musculus*), endangered, humpback whale (*Megaptera novaeangliae*), vulnerable and the sperm whale (*Physeter catodon*) – status unknown. [60]

According to IUCN and WCMC there are many threatened species in the region. Species like the giant armadillo (*Priodontes maximus*), vulnerable in Colombia, French Guiana, Guyana, Suriname and Venezuela; the giant anteater (*Myrmecophaga tridactyla*), vulnerable in Belize, Colombia, Costa Rica, French Guiana, Guyana, Honduras, Nicaragua, Panama, Suriname and Venezuela, and several species of bats are vulnerable or have an unknown status in Aruba, Colombia, Cuba, Dominican Republic, Guatemala, Haiti, Jamaica, Mexico, Netherlands Antilles, USA and Venezuela. [60 & 107]

The protected areas system is one of the most efficient tools in protecting biodiversity and in the Wider Caribbean there are many areas subject to this regime in the region. According to CEP technical report No. 31

there are 32 marine protected areas and 5 planned in the countries of the WCR. In the coastal areas Venezuela is at the top of the list with 28 protected areas, followed by Turks and Caicos with 24, of the 96 coastal protected areas in the region. [94]

3.2 Economics

3.2.1 Tourism and Coastal Urbanisation

Tourism is a large and fast growing industrial sector in the Wider Caribbean Region. Tourist arrivals in the Region increased by 6.7% in 1996. In the island states and territories, it provided about 2.4 million jobs and contributed to about 25% of the gross domestic product (GDP) and the expectation is that in the next ten years tourism will increase its contribution up to 36% of the GDP. [14]

The Caribbean attracts about 57% of the world scuba divers and it has been estimated that by the year 2005, diving will be generating about $1.2 billion. [14]

Ecotourism is also a developing industry in the Caribbean, although according to UNEP's CEP Technical Report 31, several countries of the region understand ecotourism in a different way. [94]. Despite the difference in concept and approaches, the Environment Division of the World Travel & Tourism Council as a model ecotourism destination chose Dominica in 1997. [14]

The cruise industry in the Caribbean region is extremely important as it hosts 50% of the cruising passengers of the world, generating about $ 3 billion per year. The growth of this industry was 10.8 % in 1996 and it is expected that it will continue growing at an average of 6.6% until the year 2000, increasing the number of cruise passengers to 13.4 million. [14]

The fast expansion of the tourist industry has required huge investments in coastal developments, as there is an increasing demand for hotels, marinas, harbours, shops, sports facilities, etc. [14]

3.2.2 Industrial Activity, Harbours and Ports

The manufacturing industry is not very developed in the region, with the exception of Puerto Rico where 41.4% of the GDP is generated by the textile, furniture, foodstuffs, beverages, construction materials, chemicals, electronic products and cigarettes production. [14]. In the case of Colombia, 10% of its national industry is located close to the Caribbean Sea. [20]

The rest of the industry in the region is connected with mining and agriculture, and they are described in those sections. [14]
Owing to the establishment of free trade and industrial zones some of the island states have increased substantially the production of clothes and textiles and electronic products. [14]

In the last decade ports have expanded substantially in the region to face the growing cargo trade and the cruise ship industry. In 1997 the Bahamas inaugurated a very large container port between the Americas and Europe. [14].

Ports and harbours create serious environmental disturbances during the construction phase through dredging and reclamation, impacting on coral reefs and mangrove swamps. During the operation phase the generation of solid and liquid waste and accidental spills of various substances cause pollution. It has been reported in several countries that coastal erosion has occurred in port areas due to the construction of jetties, breakwaters, etc. Air pollution is also common from handling a range of fine particulate materials such as cement, coal, etc. [102]

The ports of Curaçao, Bridgetown in Barbados, Puerto Limón in Costa Rica, Pointe-à-Pitre in Guadeloupe, Haina in Dominican Republic, Puerto Cortés in Honduras, Kingston in Jamaica, Veracruz in Mexico, Cristobal and Balboa in Panama, Point Lisas in Trinidad and Tobago and Vieux-Fort in Saint Lucia have been in the process of up-grading and making major investments to increase their efficiency and capacity. [14]

The Florida seaports account for 300,000 jobs and generate about $ 600 million in revenues. [14]

3.2.3 Agricultural Activity

The agricultural sector contributes with about 25 % of the GDP in the region. Sugar production in the region accounts for about 33 % of the world's production and 40 % of the world's exports. Bananas account for 50-60% of total exports of the Eastern Caribbean countries, and the region accounts for 3% of the total world's exports. Coffee is also an important product, as well as non-traditional fruits. Generalised use of pesticides and pest control is a key issue in the region. [14]

The main impacts caused by agriculture could be deforestation, causing an important change in the hydrology of ground and surface waters; soil erosion and sedimentation; loss of soil fertility; pollution with agrochemicals; solid wastes; loss of habitats and

wildlife; and untreated sewage from labourers and livestock.
The LAC region contributes significantly to economic growth, ranking the region high among the world's largest producers of fish. [14]. However, the majority of the fish comes from the South American cone and the Pacific Ocean. [22]. Aquaculture as mentioned earlier is an important sector in some of the countries of the region. [21].

3.2.4 Mineral development and quarrying

The Wider Caribbean region is also very rich in mineral resources. It accounts for 29.3 % of the world production of Bauxite, 22.3 % of alumina and 10.1% of aluminium. Jamaica is the world's third largest producer of Bauxite, and Dominican Republic, Haiti, Guyana and Suriname are also important producers. Colombia has the largest steam coal mine in the world and is one of the top five producers of coal in the world. Mexico and Colombia are important producers of copper and Panama is considered to have the largest un-exploited copper reserves of the world. The Dominican Republic is the world's third largest exporter of nickel. [14]

The oil and gas industry is very important in the Region. In 1996, Venezuela (seventh largest producer of the world) had the highest production in the region, followed by Mexico, Colombia and Trinidad. There is a small production in Cuba, Guatemala, Suriname, and Barbados. (See Table 1). There are important refining facilities in particular in Aruba, Bahamas, the Netherlands Antilles Federation and Venezuela. [14]

Table 1 – Oil and Gas Production in the Caribbean Basin Countries (1996)

Country	Oil (10^3 bbl)	Natural Gas ($10^6 m^3$)
Barbados	382	56
Colombia	227,579	5,815
Cuba	8,084	43
Guatemala	3,089	11
Mexico	1,945,882	43,477
Suriname	1,793	0
Trinidad & Tobago	47,144	9,058
Venezuela	1,013,377	37,338
Total	2,347,330	95,798

Source: Caribbean Basin Profile (1998) [14]

4. IDENTIFICATION AND ASSESSMENT OF PROBLEMS

4.1 Nature and Severity of Problems

The population of the WCR will exceed 70 million people by the year 2,000. The existing problems such as poverty, desertification, fuel wood deficits, loss of forest, fish and other important economic resources, will continue to increase in the region if actions of considerable magnitude are not taken in the next few years.

Degradation of the resource base generally translates into decreases in production or income and thus in the availability of food. Declining soil fertility leads to lower crop yields while rangeland depletion reduces offtake and any deterioration in water quality adversely affects the fish catch. Degradation of common property resources pulls labour away from directly productive activities towards gathering - simply collecting non-wood and minor forest products - and probably diminishes opportunities for deriving income from this source. Linkages with food security can also be less direct. Shortages of biomass may result in a transition to lower-nutrition foods that require less fuel for cooking. In addition, hurricanes or other natural calamities also directly result in progressive loss of food security prospects.

In the case of WCR tourism, recreational and commercial fishing, diving and other water sports so common in the region can be seriously affected by poor water quality in the coastal areas causing deleterious impacts on the economy of the countries and the well being of the people.

4.1.1 Food Security and Poverty Alleviation

As stated in Rio in 1992, poverty is a complex multidimensional problem with origins in both the national and international domains. (UNCED, 1992). The Gross National Product (GNP) per capita in the Wider Caribbean Region varies immensely, at one extreme are the United States followed by France, with $ 28,020 and $ 26,270 respectively. Aruba, the Bahamas, Cayman Islands (United Kingdom), Puerto Rico (USA), and the Netherlands Antilles (Netherlands), and the Martinique, with more than $ 9,636 are high income countries/territories and at the other extreme Haiti, Guyana, Honduras and Nicaragua are low income with less than $ 785. (See Annex 1)

Poverty is not only related to per capita GNP, but to elements such as the expenditures needed to buy a minimum basket of food and other basic necessities, life expectancy, literacy, quality of health, access to water and sanitation etc. Other countries in the Caribbean are

also facing serious poverty problems, particularly in the rural areas. UNDP estimated in 1990 that 42.6 % of the population in Jamaica lives below the poverty line and 16.2 % in the case of Trinidad and Tobago. (See table 2) [88]. CORPES (1992) estimated that 60 % of the Colombian population in the Caribbean basin cannot satisfy their basic needs and 38,4 % live below the poverty line. [20]. In 1995 the Caribbean Development Bank estimated that 34.6 % of Belize's population live in poverty. [89] The World Bank estimated that more than 11 million people (about 14 % of the total population) live under the poverty line in the Caribbean region. [88]. (For other poverty factors see table 3) [104]

Table 2 – People below the Poverty Line in Selected Countries, 1990

Country	People Below Poverty Line (% of population)
Dominican Republic	44.6
Guyana	64.8
Haiti	75.7
Jamaica	42.6
Trinidad & Tobago	16.2
Total	**55.1**

Source: Human Resources Development Report, 1991, UNDP [cited in 88]

4.1.2 Public Health

In 1994, the highest infant mortality rate at birth was found in Haiti with 87 per thousand, followed by Guyana with 62, Nicaragua with 48, Guatemala with 45 and Honduras with 40 per thousand. These high mortality rates are closely related to the lack of potable water, poor waste disposal systems, crowded housing conditions and under nourishment. The lowest life expectancy rates are found in Haiti with 54, followed by Guyana and Guatemala, with 63 and 66 respectively. [104]

Table 3 – Social Indicators of UNDP for Selected Countries (%)

Indicator	Dominican R.	Guyana	Honduras	Guatemala	Nicaragua	Haiti
Human Develop-ment Index	87	104	116	117	127	156
Life expectancy rate	70	63	68	66	67	54
Adult illiteracy rate	18,5	2	28	44,3	34,7	55,9
Population without access to safe water	35	-	13	36	47	72
Population without access to health services	22	-	31	43	17	40
Infant mortality under 5 years old (per thousand)	10	-	18	27	25	28

Source: Human Resources Development Report, 1997, UNDP [104]

The profound socio-economic crisis faced by several Caribbean Basin countries, the inadequacy of the social services and physical infrastructure are the causes of high levels of communicable diseases such as cholera, filaria, dengue, malaria, tuberculosis, gastro-enteritis, typhoid, hepatitis and even cancer, which has been associated with chemical pollution.

4.2 Impact of Anthropogenic Activities

4.2.1 Tourism and Coastal Development

The main impacts of tourism development in the coastal areas of the region occur during the construction phase, although in some cases there are problems during the operation phase as well. The main issues during the construction phase are the sudden influx of workers, deforestation, land reclamation, bulldozer operations, minor oil spills, dust, and disposal of solid waste, sewage and sludge. In many countries of the region sand mining for building purposes is a very serious issue, in particular in the small island States and Territories, such as Antigua and Barbuda, Jamaica, Montserrat, St. Kitts and Nevis, St. Lucia and St. Vincent and the Grenadines. [8, 11, 12, 13, 33, 37 &38]

During the operation period, the main problems that the countries have to face are sewage and solid waste disposal and treatment, not only of the waste generated in hotels and resorts, but the ship generated waste, which is a problem of increasing magnitude. From the national assessments we conclude that Aruba, the British Virgin Islands (United Kingdom), the French Overseas Departments and Turks and Caicos (United Kingdom) do not have major problems with the sewage generated by tourist resorts. (See national overviews).

According to Simmons & Associates, cited in CEP Technical Report No. 38, sewage is the largest source of pollution of tourism in the WCR, as 80 to 90% of the sewage generated is disposed of in nearshore coastal waters without adequate treatment. CEP Technical Report No. 38 provides a very thorough analysis of impacts of tourism in the WCR and the best management practices to avoid the detrimental effects. [97]

Although the majority of the tourists visit the Caribbean to enjoy the sandy beaches and many go there to enjoy the beauty of the coral reefs, there is a problem with divers standing on corals, coral and shell collecting as souvenirs, and boat anchors.

According to the Caribbean Basin Profile (1998), the Wider Caribbean Region received more than 35 million tourists in 1996, without taking into account the number of visitors to the United States of America [14] (See Annex 1). If each visitor generated about 2kg of solid waste a day and they spent an average of ten nights in the region, they produced more than 700,000 tons of solid waste in that year.

4.2.2 Industry, Ports and Harbours

Although the manufacturing sector is not very developed, release of hazardous waste into the environment has been mentioned in the National Environment Action Plans (NEAP) of many countries of the region as a major threat. Up to date there is no quantification of the magnitude of the problem. [27, 28, 29,31, 33, 35, 36, 37, 38 & 39].

The development of ports and harbours can be have major impacts on physical and ecological resources. In the case of physical resources, the construction and operation of ports/harbours can change significantly the hydrologic regime through dredging and reclamation. Deterioration of water quality in these areas is generalised during construction with sediments and particulate matter and sanitary waste from the work force. Destruction of natural habitats is also common. [102]

During the operation, sewage, solid waste, oil discharges and leakages of harmful materials can cause serious pollution problems. In the Caribbean region ports and harbours complexes include in many cases, shops, housing, restaurants, etc. which increase the demand for potable water and other basic services. It is evident that the risk of oil spills by tanker accidents in the region is considerable due to the substantive movement of tankers and the high exports of crude oil by some countries in the region. (See section 3.2.4). During the construction stage there is also an air pollution problem with dust and particulate matter and with the movement of soils there is a risk of beach erosion. [102]

From the ecological point of view there could be three main impacts. Destruction of coral reefs, by dredging or excess of sediments; degradation of coastal habitats as estuaries and mangrove swamps by reclamation or excess load of sediments and solid wastes, and deforestation of coastal and estuarine vegetation with the consequent impact on marine wildlife. [102]

4.2.3 Agriculture

As agriculture is so important in the region the impacts caused by this activity throughout the region are innumerable. Historically the expansion of agriculture was done at the expense of forested areas in the region, and at present the forest cover in many of the islands is half of what it was in the 60s. From the countries that have prepared a National Environment Action Plan or a Country Environmental Profile, fourteen identified soil erosion as a serious problem. In 1976 Martin and

Meybeck estimated that approximately 10,000 million tons per year of sediment loads where discharged into the Wider Caribbean. (Cited in [96]). There is no doubt that this figure has increased substantially in the last two decades with the high rate of deforestation of watersheds and poor land management practices in place in many countries of the region. The Mississippi and Magdalena (Colombia) rivers are the largest entering the sea and between the two of them contribute half of the load of sediments. As stated by UNEP's CEP Technical Report No. 33, the data on distribution of sediments and turbidity in the coastal areas of the region is insufficient to assess the magnitude of the problem. [96]

Table 4 - Estimated sediment loads from rivers reaching the Wider Caribbean Coastal Areas

River/Regions	Sediment loads 10^6 t/y
Mississippi river	320
Other rivers discharging into the Gulf of Mexico	121
Rivers of Central America and the Antilles	300
Magdalena river	235
Orinoco river	85
Other rivers from Colombia and Venezuela	50

Source: UNEP CEP Technical Report No. 33 [96]

Biocides and fertilisers are another major problem caused by agriculture. Excessive use of fertilisers has caused major algal blooms and eutrophication of coastal lagoons, and as they are non-point sources their control is very difficult. According to UNEP's CEP Technical Report 33, the average use of fertiliser was 81.6 kg/ha in 1989. [96]

The use of pesticides is generalised throughout the region. In Costa Rica in 1996 Mora & Rodriguez found in the soils the following concentrations: HCB (1-5 ug/kg), Dieldrin (4-16ug/kg, DDT (1-4 ug/kg), Gamma BHC (1-7 ug/kg), Gamma-chlordane (6 ug/kg) and Mirex (2 ug/kg). [82]. In surface waters in Bluefields in Nicaragua, in 1995 an average concentration of heptachlor 10.12 ng/l and dieldrin 6.85 ng/l was found. [17]. For the rest of the countries of the region, the available data on pesticides is based on yearly imports, but there is very little information on impacts on the marine environment. The banana, sugar, rice and coffee production has become heavily dependent on inputs of fertilisers, pesticides and herbicides. In table 5 there is an estimate of pesticides imported into selected OECS countries in 1988. [10]

The sugar, banana, citrus and coffee industries generate large amounts of solid and liquid waste, containing high amounts of BOD and suspended solids. At abattoirs the slaughtering of animals causes pollution with faecal coliforms, blood, skin, hair and edible portions. This load of pollutants is also very rich in biological oxygen demand and suspended solids.

Table 5 – Pesticide Imports in the OECS countries in 1988

Country	Pesticide Imports	No. of US EPA restricted
St. Lucia	759,182 lb.	13
Grenada	224,488 lb.	20
St. Vincent	906,697 lb.	10
Dominica	2,345,712 lb.* or 847,076**	11

*Based on Pesticide Control Board
** Based on Dominica Banana Market Co.
Source: Grenada Environmental Profile (1991) [10]

Shrimp aquaculture has developed in several countries of the region at the expense of mangrove areas, as is the case in Colombia and the Dominican Republic. The mangrove areas are very important to the coastal ecosystems as they provide habitat for a wide variety of organisms such as birds, crabs, oysters, etc. and are a nursery area for fish, shrimps, prawns and lobsters, and provide protection to the shorelines from wave action, preventing beach erosion.

According to the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), aquaculture may have important impacts on natural resources and habitats. The main impacts of aquaculture projects are enrichment with nitrogen and phosphorus, interaction with the food web, oxygen consumption, disturbance of wildlife and habitat destruction, interaction between escaped farmed stocks and wild species, introductions and transfer of exotic species, biotic compounds (including pesticides and antibiotics), chemicals and hormones and growth promoters. [25].

4.2.4 Mining and Minerals Processing

During the extraction phase, mining generates large volumes of waste. Soil, coarse tailings and rock movement produces a large amount of dust.

Although there is not much hard data on pollution caused by mining in the region, it is known that the mobilisation of some mineral contaminants such as lead, copper and zinc can produce pollution of groundwater

by leaching. Cyanide and mercury are often used to extract gold in some countries of the region, like Colombia and Suriname, where fish kills have occurred.

In the processing of the minerals, a great deal of particulate matter is released from Bauxite and coal calcining burners and drying processes. Acid leaching is common in the soils, ground water and water courses around the mines. In the case of "El Cerrejon" in Colombia a thorough environmental impact assessment was carried out before the mine entered into operation and permanent monitoring of atmospheric and liquid wastes is performed in the mine. [20]. In the case of Guyana, serious degradation of rivers and streams was caused by the mining activities. [29]

Oil and gas extraction, processing, storing and transporting have caused major pollution problems in the region. There is however not much up-dated data on the status of oil pollution in the region except for the United States, Havana Bays, and Bluefields Lagoon in Nicaragua and Puerto Limón in Costa Rica [16, 17 & 82]. In Bluefields the concentration of dissolved petroleum hydrocarbons was between 1-5 ug/l, with the highest concentration (5.98ug/l) in the station close to the town of Bluefields. [17] In Puerto Limón the concentration of hydrocarbons in the surface water was between 1ug/l and 1.85ug/l and in Havana Bay it was between 1.27 mg/l and 0.35 mg/l and in the sediments it was 994 ug/g, which shows high level of hydrocarbons pollution in Havana Bay. (See table 6) [17]

Table 6 – Average Concentration of Hydrocarbons in Sediments in the Caribbean Region

Area	Range of values (ug/g)	Average	Reference
Havana Bay, Cuba	865-1240	994	CIMAB/1997
Laguna de Ostión, Veracruz, Mexico	16-575	120	Botello/1984
North Coast, Yucatan Peninsula	50-127	70	Botello/1982
Nipe Bay, Cuba	46-400	206	Beltran/1993
Cartagena Bay, Colombia	23-890	436	Garay/1986
Bluefields Lagoon Nicaragua	6-53	26.6	CIMAB/1996

Source: Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1996 & 1997) [16&17]

There has been evidence that passing ships in the region perform routine release of oily waters, which has a serious impact on coral reefs and beaches.

4.2.5 Human Settlements

Almost every country and territory in the region reports solid waste as a major problem. The average production of solid waste per capita estimated by PAHO in 1993 was 0.8-kg/ cap for residents and 2 kg/cap. per day per tourist. (cited in [89]). The amount of waste generated per person in the region varies slightly with the level of economic development of each country. Table 7 shows estimates of solid waste produced by several countries in the region. Taking the average of 0.8 kg/cap/d, with a population of more than 70 million in the region, the daily production of solid waste would be more than 56,000 tons, with a yearly production of more than 20 million tonnes.

Table 7 - Solid waste in selected countries of the Wider Caribbean Region

Country or Territory	Solid waste tons/year	Date
Bahamas	244,100	1996 (?)
Barbados	150,000	1994
Belize	166,000	1993-1996
Dominica	16,276	1996
Guyana	547,500	1994
Jamaica	730,000	1996 (?)

Source: IDB project proposals and NEAPs [26, 44, 45, 47, 48 & 89]

Sewage is a very serious problem in the region and although there are no on-going systematic monitoring programmes it is evident that the lack of sewage collection and treatment is generalised in almost all countries and territories of the region. In table 8 there are some estimates regarding access to water and sanitation of some countries in the region. In Havana Bay it is reported that there are concentrations of 70 umol/l of ammoniac nitrogen and between 0.7 umol/l and 2.5 umol/l of phosphorus, causing eutrophication in certain areas. [16]. In Jamaica it has been estimated that the country generates about 455 million litres of sewage per day, of which only 25 % is collected and treated. [33]

Table 8 - Access of Population to Water and Sanitation (1988)

Country	Potable Water Urban (%)	Potable Water Rural (%)	Sanitation Urban (%)	Sanitation Rural (%)
Belize	100	75	59	35
Costa Rica	100	84	100	93
Dominican R.	75	37	77	36
Guatemala	78	42	72	48
Honduras	89	60	88	44
Panama	100	66	100	68
Trinidad & Tobago	100	87	88	44

Source: World Bank 1996 (Belize Environmental Report) [89]

CARDIQUE estimated that in 1996, 41,900 cubic meters of sewage was discharged per day into Cartagena Bay. [7]. According to CORPES (1992) only 53,92% of the population of the Colombian Caribbean has access to potable water and only 24% has access to sanitation. [20]

Table 9 - Population with access to sanitation according to UNDP (1990-1996)

Country	Access to Sanitation (% of population)
Colombia	85
Cuba	92
Dominican Republic	78
Guatemala	59
Haiti	24
Honduras	87
Jamaica	89
Mexico	72
Nicaragua	60
Panama	83
Trinidad and Tobago	79
Venezuela	59

Source: Human Resources Development Report, 1997, UNDP [104]

As we can see from the above tables, and the information discussed in previous paragraphs, there appears to be a lot of disagreement between international organisations and governments themselves regarding their access to sanitation systems. Another question that arises from this discussion is whether sanitation has different meanings for the people and institutions that are doing the multiple analysis.

Box 1: Major Impacts of Water Resources Development Projects

* Resettlement of human populations
* Encroachment into precious ecology
* Encroachment on historical/cultural values
* Watershed erosion & silt runoff
* Impairment of navigation
* Effects on groundwater hydrology
* Migration of valuable fish
* Inundation of mineral resources
* Road erosion
* Reservoir site preparation
* Water right conflicts
* Loss of fish stocks
* Water pollution
* Dust, odours and noise
* Quarrying hazards
* Loss of scenic values
* Downstream flow variations
* Downstream erosion
* Eutrophication
* Impairment of downstream water quality
* Insect vector disease

Source: United Nations Guidelines for Water Resources Development [103]

4.2.6 Water Resources Development

In the countries of the region freshwater resources are used for human consumption, industrial use, irrigation projects, hydropower projects, channelization, dredging and to build dams or water reservoirs. Although not much information was found regarding these activities in the countries of the WCR, is important to take into account that these types of projects can have considerable detrimental impacts on the environment. (See box 1 for possible major impacts). [103]

5. EMERGING AND FORESEEABLE PROBLEMS

According to the Caribbean Profile (1998), Venezuela concluded a feasibility study on building a 300,000 barrel per day crude oil pipeline from Puerto la Cruz to

Florida, including several pumping stations in the Caribbean islands. If this project is carried out, a comprehensive EIA should be carried out and information on possible transboundary impacts should be provided to the countries in the region. [14]

For the period 1994-1996, the region accounted for an average share of 28% of world-wide spending on mineral exploration, with projections to grow to 39% by the year 2,000. If this is the case, countries in the region should ensure that the exploration and future exploitation of mineral resources is not done in detriment to the coastal resources of the region. [14]

In mid 1997, the European Union allocated $ 165 million to assist banana-producing countries to improve productivity as well as to diversify production. Expansion of the agricultural land should not be done at the expense of forested areas and use of biocides should be carefully controlled and monitored. [14]

6. STRATEGIES AND MEASURES

6.1 Measures to Promote Sustainable Use of Coastal and Marine Resources and to Prevent or Reduce Degradation of the Marine Environment

6.1.1 Integrated Coastal Zone Management

The coastal areas are heavily populated and they have an important ecological and economic value for the countries and territories of the region. Therefore, all countries of the region should evaluate and design a coastal zone management programme, trying to avoid the piecemeal approach of only doing partial coastal zone management for selected sites.

UNEP has published two good sets of guidelines to undertake this task and Countries and territories of the region should make a serious effort to find or generate the needed resources to carry out this task in the immediate future. [74 & 101]. It is important to keep in mind as stated by Cambers in 1993, that coastal zone management is a long process that might take up to 20 years, it is important that the countries that have not started the process yet, initiate it as soon as possible. [6]

The initial coastal zone management plan should take into account areas that should be designated for conservation or development, permit system for development activities, legislation and enforcement, environmental impact assessment, monitoring, conflict resolution and institutional responsibilities.

6.1.2 Integrated Land-use Management

Taking into account that adequate arable land in the countries of the region are more scarce everyday and that the population and its needs continue growing, Governments should make serious efforts to undertake land use plans designating areas for agriculture, mining, tourism and industrial development, etc. The old sectorial plans should be avoided to guarantee that activities are really compatible with the environmental conditions of the area and the needs of the people.

The ultimate objective of all Governments is to improve the quality of life of the people and promote economic growth, but not just for today's generation, but for generations to come. Carrying out this task may seem expensive to start with, but it is a lot more expensive, for example, to destroy areas that are only suitable for silviculture, to use the land for a banana plantation.

There is an urgent need to designate zoning restrictions so that for example, a polluting industry is not placed side by side with an aquaculture project.

6.1.3 Tourism Development Plan

It is widely discussed that tourism is an extremely important economic activity in the region and to guarantee its survival and improve its contribution to the regional GDP, the quality of the resources, the beaches, the wildlife, the water, is basic for visitors to return. A development plan analysing carefully the carrying capacity of the environment, the financing mechanism of all infrastructure developments, provision of basic services, and financing alternatives are a key to the future of this industry.

Eco-tourism should also be included as one good alternative in the general management plan.

It is important that the tourism management plan is not drafted as another document, which reflects only the interest of the industry to expand and to increase the economic growth. The plan should be based on the real availability of areas (previously identified by the coastal zone management plan and the land use plan) and services.

6.1.4 Port and Harbours Development Plan

Ports and harbours are expanding in the region and they are extremely important in facilitating economic development in the WCR. As discussed in previous sections, these can be very damaging to the environment if the necessary measures are not taken in advance. A

long-term plan to identify where, when and what kinds of facilities need to be developed, are very important.

6.1.5 Living Marine Resources Management Plan

Living marine resources are important in the region, if not so much for export in many cases, then for local communities and tourists to consume them. Fisheries management plans should be adapted to the particular needs of the Islands and of the continental States.

It is basic to collect information on the status of living marine resources and the area to decide what levels of extraction are sustainable.

6.2 Measures to Modify Contaminants or Other Forms of Degradation

6.2.1 Solid Waste Management Plan

Solid waste was identified by the vast majority of countries as a serious threat to human health and the environment, and comprehensive, long-term management plans should be adopted, learning from the experience of the countries in the region that are already involved in this process. Recycling should be analysed carefully for certain countries, as this could be the most efficient way to deal with some of the waste.

Legislation and enforcement is a key issue to stop dumping of wastes everywhere, and it is evident that to make the plan work a realistic tariff system will have to be put in place. Community participation is basic to get this programme to succeed.

6.2.2 Sewage Management Plan

Sewage is another major threat to human health and the environment, and some serious and maybe expensive measures should be taken promptly. At present only very few Governments are negotiating projects on sewage management. Governments should keep in mind that in the medium term it is more expensive to take care of sick people that cannot work due to water borne diseases, than to take effective measures to control once and for all the sewage problem. The tourist industry can be seriously affected if tourists start getting sick or the coral reefs they go to see die because of an excessive load of nutrients or particulate matter.

International assistance should be sought to undertake this initiative, taking into account that almost all sewer systems in the region need up-grading and very few countries are treating the sewage before discharging it into rivers and nearshore waters.

6.2.3 Industrial Waste Management Plan

Industries in the region should be encouraged to comply with ISO 14000 (International Standards Organisation) and draft plans of compliance. Through these plans the industry should review the environmental consequences of their operations, define a set of policies and objectives for environmental performance, monitor performance against objectives, report the results appropriately, and review the system to make the necessary improvements.

Adoption of Clean Production Agreements is a very helpful tool to decrease industrial pollution. In the Caribbean region the successful example of Cartagena Bay maybe used by other countries in the Region. [7]

6.2.4 Oil Spills and Other Hazardous Substances Contingency Plans

Oil pollution has been identified as an important environmental issue in the WCR and that due to the amount of oil tankers and frequency of navigation through out the region there is a big risk that accidents happen. It is of paramount importance that flexible oil contingency plans be drafted to deal with emergencies not only for crude oil but other harmful substances that can also be transported in the region.

The big producers in the region have an extensive experience in drafting, up-dating and training on oil spill preparedness, and this vast experience should be used by other countries to draft their plans and get the needed training. Purchase of the necessary equipment should be the responsibility of the importers and exporters of the materials.

6.3 Measures to Prevent, Reduce or Ameliorate Degradation of Affected Areas

6.3.1 Watershed Management and Soil Erosion Control

Watershed management plans for the continental States are of paramount importance to protect the living marine resources in the WCR. The majority of these States have extensive experience in river basin management; however, the lack of success of these programmes is closely related to the lack of involvement of the affected communities. Land use practices by small farmers continue being detrimental to the watersheds, and government efforts have not succeed to convince these communities that it is for their own benefit that they must change their traditional practices. There are well known techniques to control erosion and sedimentation, but without the interest and

co-operation of the local communities no initiative is ever going to work.

Legislation and enforcement of forestry policies should be a priority. The drafting of forestry action plans is a priority, although is important to keep in mind that drafting a document is never sufficient to solve a problem. Political will, financial support, strong institutions and local community involvement is necessary to help these plans to succeed.

The Caribbean Environment Programme published an excellent set of guidelines for sediment control practices in the insular Caribbean. All islands in the region to reduce erosion and sedimentation should make an effort to apply them. [95]

6.3.2 Provision of Alternative Energy Sources or Rationalise Use of Existing Ones

Charcoal and fuelwood are still extensively used in many countries particularly in the rural areas. Community based reforestation programmes should be initiated, and other alternative sources of energy should be investigated. Countries like Colombia have been very successful in generating solar energy for household heating, cooking, etc. Research on regional capabilities to assist other countries in the region with alternative sources should be evaluated.

Financial institutions such as the World Bank, should be contacted for advice and possible assistance as they have developed for several countries of Africa sustainable and participatory approaches to manage traditional energy sources. (Per. comm. B. Utria, World Bank)

6.3.3 Management and Protection of Vulnerable Ecosystems

There are already a number of protected areas in the region; however, there are other areas that deserve to get a special protection status. National systems for management of protected areas should be designed for all countries in the WCR to guarantee that adequate human, institutional and financial resources area available to manage the existing and the future protected areas.

6.4 Requirements and Incentives to Induce Action to Comply with Measures

6.4.1. Incentives to Comply with Measures in the Caribbean Region

An incentive measure is a tool that induces different stakeholders to carry out certain activities, adopt policies, allocate funds, etc. The incentive measures should influence government bodies, NGOs, local people, industry, farmers and other users. In the beginning of the discussion about incentive measures the general understanding was that only economic measures will motivate stakeholders to comply or stop non-compliance. However, with time the concept has developed and social measures are also playing an important role.

The first step is to adopt legislation stating the rules of the game, it is obviously extremely important to set the standards, procedures, benefits, fines, etc. and its enforcement is key to success in implementing the protocol and the measures proposed in this document. For this, Governments will need incentives from donors and international organisations on the provision of technical assistance in:

i- Drafting of national legislation;
ii- Strengthening of national institutions;
iii- Information exchange;
iv- Public awareness and training;
v- Monitoring programmes; and,
vi- Research on appropriate technologies.

Within the economic measures it is possible to have incentives and disincentives. As incentives we would mention:

i- Tax deductions for contributions to NGOs or community projects that will improve the quality of the environment;
ii. No import tax for the import of sewage treatment plants or other technology that will reduce load of pollutants or emissions;
iii. User fees by way of municipal fees for water consumption, as well as sewage collection and treatment;
iv. Promotion of private sector involvement on recycling projects (solid waste from all sources)

Within the disincentives, the "polluter pays principle" will also be applied by imposing heavy fines to those that do not comply with the existing legislation/regulations followed by closing down operations that repeat the offence. High taxes can be imposed on products that pose a serious threat to the environment, or that require high levels of water and electricity consumption, etc.

As social incentives we would mention:

i- Prizes and awards for good management of the environment;
ii- Promotion of public awareness;
iii- Empowerment of local communities to take care of their resources and control their use;
iv- Support the creation of joint ventures Government – Private sector – NGOs – Local communities;
v- Reinforce and support groups of people, farmers, enterprises, etc. that take innovative measures to control pollution or other forms of environment degradation; and,
vi- Work jointly with communities on recycling programmes.

6.4.2 Other Financial Resources

Some countries of the region have managed to secure additional financial resources to undertake environmental projects through the creation of national environmental funds. Governments, NGOs or a joint mechanism can administer the funds. Each of the systems has advantages and disadvantages, and their success depends on multiple factors. The experienced gained by Belize's Protected Area Conservation Fund, the Colombian ECOFONDO, the Dominican Republic PRONATURA, Guatemala's Trust Fund for Environmental Conservation, the Honduran, Fundación Hondureña de Ambiente y Desarrollo, the Jamaican Environment Foundation, the Mexican Nature Conservation Fund, the Panamanian Fundación Natura, are extremely useful and are good examples of new approaches within the region to finance environmental initiatives.

Other countries are imposing an "environmental fee" per visitor and there has been a proposal to allocate part of airline tickets taxes as a contribution to an environment fund as a source of financing.

Some donors such as the World Bank, the Inter-American Development Bank and USAID are supporting financially the initial development of these funds. Governments of the region should be encouraged to learn from the experience of the countries that already have such a mechanism in place and request assistance to external donors, if needed, in the establishment of this new system of funding.

6.5 Identification of Institutional Arrangements Needed to Support the Implementation of Recommended Strategies and Measures

Although in many countries of the region there are several institutions involved in the management of the measures mentioned here, it is important that a co-ordinator of all institutions is selected or that an inter-institutional committee is established to divide the responsibilities and agree on budgetary allocations and procedures.

6.6 Identification of Short-term and Long-term Data Collection and Research

6.6.1 Biocides, Heavy Metals, Oil, Nutrients and Bacteria in Water, Sediments and Soils

A serious and comprehensive monitoring system for the coastal areas of the countries of the region should be designed and implemented. The CEPPOL and CARIPOL programmes since 1983 made very commendable efforts to assist countries in the WCR with the establishment of the monitoring programmes. However, the resources of international organisations such as UNEP and IOC are very limited, and they can only be a catalizer of actions, but cannot fully finance the national programmes that should be the full responsibility of the Governments themselves.

6.6.2 Impacts of Biocides in Wildlife

A few countries in the region make reference to fish kills and even cancer due to biocides. Some research should be undertaken to assess how serious is the impact of certain biocides in wildlife.

6.7 Development of Monitoring and Environmental-Quality Reporting Systems

The reporting system of the Cartagena Convention should start to be used by all Governments of the Region, so that the RUC can become a source of up-dated data and information for the entire region.

7. PRIORITIES FOR ACTION

7.1 Tourism and Coastal Development

Comprehensive coastal zone management plans defining areas to be protected and areas to be used for diverse economic activities and provision of raw materials and services appear to be one of the main priorities for the Region.

Environmental Impact Assessments should be a requirement for new developments and Governments should ensure that proper monitoring systems are in place to guarantee the compliance with the recommendations of the assessments. In some cases, legislation is required to start the EIA process, in others training is a priority to start implementing the legal

requirement, and in the best of cases, adequate monitoring systems are lacking.

With the increasing number of visitors per year, adequate sewage treatment systems and plants and solid waste management are of huge importance for the region.

Tourism master plans throughout the region should take into consideration the environmental dimension, as well as the financial objectives.

7.2 Industry, Ports and Harbours

Drafting and adopting dynamic oil contingency plans for all ports throughout the region is of paramount importance as well as complying with the MARPOL Agreement regarding port facilities.

Adoption of clean production strategies between the Government and the private sector is key to the sustainable development of the region, as well as adopting quality standards for effluents and designing and performing continuous monitoring programmes for water pollution. Governments should also require companies to adopt environmental management systems such as ISO 14000, thus enabling enterprises to understand and track their environmental performance.

No new developments should be authorised without a prior EIA and monitoring compliance is extremely important.

In the region there is a hazardous waste problem, which is not well known by the majority of the countries, and it is a top priority that these wastes are identified and quantified and a management strategy is designed.

7.3 Agriculture

Land use planning, including zoning restrictions for various forms of agricultural development on steep slopes, establishing forest reserves and national parks should be carried out. Watershed management and reforestation will be the only effective mechanism to decrease the load of sediments that is being discharged into the Caribbean Sea. Colombia and the United States of America should make special efforts to control the loads of sediments from the Mississippi and Magdalena rivers. Application of soil erosion techniques is needed in all countries of the region.

Public awareness and education campaigns for farmers on environmentally sound farming practices should be introduced.

Drafting of legislation and implementation of control mechanisms of use of biocides and collection of up-dated information on the amounts and types of agrochemicals used is strongly recommended. Monitoring of the actual amounts of pesticides and their compounds reaching the coastal waters, sediments and organisms of the WCR is a top priority.

Aquaculture developments should take into account the guidelines and recommendations proposed by the Working Group 31 of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP), [24&25].

7.4 Mining and Quarrying

All new mining developments should be subject to an EIA and tight monitoring systems for effluents should be put in place during the extraction and processing phases.

Countries in the region should set ambient standards for total particulate matter, which contains heavy metals, and are a high threat to human health and the environment.

8. MEASURES TAKEN

For the Wider Caribbean Region the most important measure already taken is the drafting of a comprehensive protocol with technical annexes to deal with land-based sources of pollution, one of the major problems affecting coastal and marine areas of the region.

There are other regional initiatives that are extremely important such as the World Bank OECS waste management project, the GEF Wider Caribbean Initiative for Ship Generated Waste, the pesticide pollution monitoring in the Windward Islands (CEHI), the ENCORE programme (Environment and Coastal Resources Management) and the Eastern Caribbean Policy project in the OECS countries, the Caribbean Basin Management Programme and the Public Health Education Programme in the CARICOM countries.

It is recognised by many international organisations, NGOs and governments that the most ambitious initiative is the Caribbean Environment Programme co-ordinated by the United Nations Environment Programme which with very limited resources is trying to assist all governments and territories of the region to achieve a sustainable use of its resources.

At the national level, many governments of the region have committed themselves to undertake important

projects to control some of the activities that are causing an impact on their coastal areas. (See Annex 2).

9. THE GLOBAL PROGRAMME OF ACTION AND THE CARIBBEAN PROTOCOL ON LAND-BASED SOURCES OF POLLUTION

9.1 Relationships between the Global Programme of Action and the Caribbean Protocol on Land-based Sources of Pollution.

The GPA is not a legally binding instrument, however its ambitious objective is to ensure that the coastal habitats and the marine environments of the world can be used in a sustainable way, through the prevention, reduction and control of marine degradation. Marine degradation is a broad term that includes aspects like habitat loss and destruction, wildlife reduction and all types of pollution. There is no doubt that one of the main problems affecting public health and marine resources is land-based sources (LBS) of pollution. That is why the adoption and proper implementation of LBS protocols throughout the regional seas of the world is a top priority.

The CEP LBS protocol, currently under negotiation, is an extremely important measure to prevent, reduce and control point and non-point sources of marine pollution in the Caribbean Region. In Art. IV the protocol introduces a practical and operational way for implementation through the adoption of technical annexes. At present there are four draft annexes. The first one deals with categories and sources of pollutants, priority pollutants and characteristics to decide on seriousness of the problem. The second one deals with elements to take into account when deciding best available practices and technologies. The third and fourth annexes deal with domestic sewage and maximum pollutant loads that can be discharged and best management practices for agricultural non-point sources, respectively. The protocol includes priorities for technical co-operation (Art. V) such as monitoring, research on chemical composition, fate and transport of pollutants, information exchange, research on best available practices and public awareness and training, which are also mentioned in specific articles. (Art. VI; VIII; XI). Art. VII includes the requirement of Environmental Impact Assessment (EIA) for projects that may generate serious pollution or considerable changes.

From the Regional overview we conclude that the main problems affecting the Caribbean Sea are domestic sewage and solid waste; therefore, there is no doubt that the implementation of the protocol will guarantee a substantial improvement of the Wider Caribbean Environment.

Despite the LBS Protocol, which is an important contribution, there are aspects such as coastal erosion, sand mining, swamp and marshes destruction, coastal lagoons siltation, expansion of aquaculture projects on mangrove areas, degradation of vulnerable ecosystems and atmospheric pollution that will not be covered by the protocol. The inclusion of EIA in the protocol text is an extremely useful contribution, but this tool should be used as a management and planning tool for all development projects even if they are not supposed to generate pollution. Many coastal areas and fragile ecosystems in the region have been degraded with infrastructure projects that do not generate a pollutant load.

Actions that are a priority in the Region and that would be outside the present draft of the protocol are:

i- Adoption of flexible Integrated Coastal Zone Management Practices
ii- Environmental Impact Assessment for all development projects
iii- Watershed Management (deforestation and erosion control, etc.)
iv- Development of national legislation
v- Education and Public Awareness (not just of pollution)
vi- Disaster preparedness programmes
vii- Integration of environmental concerns in the development process

9.2 Regional Co-operation

Regional co-operation is fundamental for the effective implementation of the protocol. The countries in the region have different needs, strengths and weaknesses that could become mutually supportive. Exchange of experts, information and technology could be extremely important for all countries. Financial support from the OECD countries, the European Union and other major donors to sub-regional or even bilateral initiatives to comply with any of the articles of the protocol should be promoted.

The CAR/RCU can and should play an extremely important role linking with the clearinghouse mechanism of the Global Programme of Action and providing assistance to Governments in any way they deem necessary.

9.3 Steps to Implement the Protocol Successfully

To implement the protocol successfully after its adoption by the Parties it would be useful if Parties would:

i. Ratify the protocol as soon as possible and adapt the national legislation to comply with the new obligations taking into account possible incentives and disincentives;
ii. select a national institution that will be responsible for overall co-ordination of the implementation of the protocol;
iii. allocate necessary funds to comply with the agreement, or if necessary explore possibilities of external assistance;
iv. select an adequate number of trained human resources or provide individuals with the training necessary to perform their duties; and,
v. establish clear reporting and monitoring systems at the national level.

10. MAIN CONCLUSIONS

Although many countries in the region such as Barbados, Belize, Colombia, Costa Rica, Cuba, Dominica, Grenada, Guatemala, Jamaica, Mexico, St. Kitts and Nevis, St. Lucia, Suriname, Trinidad and Tobago and Venezuela have adopted national legislation that in principle should have assisted them in controlling the factors that cause pollution or degradation problems of their marine, coastal and associated freshwater environment, and they have acceded to the majority of the International Environmental Agreements, the problems identified in 1992 (UNEP(OCA)/CAR IG.9/INF.5), are still valid in mid 1998. Enforcement of existing legislation, duplication of efforts at the national and international level, lack of co-ordination and clear lines of responsibilities at the national level, lack of public awareness, strong institutions and human resources continue to impair the sustainable use of the natural resources of the region.

Nonetheless, the efforts the Governments have made in controlling solid waste, which was identified by almost all countries as a major problem, is commendable. The support that eight countries of the region received from the World Bank and one from the Organisation of American States, has been of great help to identify the problems and priorities of action and draft project documents for donors. Based on these NEAPs, Governments of the Region have assumed commitments to improve their environmental performance. The support provided by the United States Agency for International Development (USAID) to the OECS Islands, Guatemala and Honduras to prepare their country environmental profiles is fundamental to generate public awareness and generate change in the national institutions.

It is evident that with all the on-going and planned projects (see annex 2) in a short period of time the quality of the marine and coastal waters is going to improve. However, the problems on land that are so closely link with the poverty issue and the lack of political will in some cases, may not be resolved as easily as the control of pollution from point sources.

From the information search it is concluded that there are important gaps at the national level regarding updated information on the status of land-based activities affecting the marine environment and their impacts. These gaps make it very difficult to make an accurate and an up-dated analysis of problems at the regional or sub-regional level.

11. RECOMMENDATIONS

It is of paramount importance that the countries undertake periodic assessments of the status of pollution and that they provide all reports prepared to the Caribbean Environment Programme Regional Co-ordinating Unit in Kingston.

The precautionary principle should be applied to every development activity in the Wider Caribbean region. As stated in CEP technical report No. 21, this approach should include aspects such as sustainable development in the region, EIA, Environmental management and planning, co-operation in technical and scientific research and programmes of control and monitoring. [75]

The full implementation of the LBS protocol in the near future could be the most efficient tool to control land-based pollution in the region.

While managing resources sustainably, an environmental policy that focuses mainly on the conservation and protection of resources must take due account of those who depend on the resources for their livelihoods. Otherwise it could have an adverse impact both on poverty and on chances for long-term success in resource and environmental conservation.

Equally, a development policy that focuses mainly on increasing the production of goods without addressing the sustainability of the resources on which production is based will sooner or later run into declining productivity, which could also have an adverse impact on poverty. A specific anti-poverty strategy is therefore

one of the basic conditions for ensuring sustainable development.

We could summarise some of the main recommendations as follow:

ii. Governments should not allow any new developments on estuarine or shoreline areas unless such developments appear to be ecologically sustainable;
ii. watersheds and rivers should be properly managed;
iii. agriculture should apply the best management practices as proposed in CEP technical report no. 41;
iv. comprehensive coastal zone management plans should be carried out as soon as feasible;
v. institutions and legislation should be strengthened; and,
vi. practices for community based management of the environment should be supported.

12. REFERENCES

[1] Atherley, K., Nurse L. A., and Toppin Y. Facing Management Challenges on the Barbados Coastline: The problem of Coastline Access. Coastlines of the Caribbean. Seventh Symposium on Coastal Zone Management. Volume edited by Gillian Cambers. Published by the American Society of Civil Engineers, New York, NY, 1991.

[2] Atherley, Smith, D.D.K., and Nurse L. A. An Assessment of Coastal Zone Management in the Smaller Islands of the Eastern Caribbean. Eighth Symposium on Coastal Zone Management. Published by the American Society of Civil Engineers, New York, NY, 1993.

[3] Bertrand, D., et. al. Coastlines of Trinidad and Tobago, A Coastal Stability Perspective. Coastlines of the Caribbean. . Seventh Symposium on Coastal Zone Management. Published by the American Society of Civil Engineers, New York, New York, 1991.

[4] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[5] Cambers, Gillian. Coastal Legislation in the British Virgin Islands. Coastlines of the Caribbean. Proceedings of Coastal Zone '91. Published by the American Society of Civil Engineers, New York, New York, 1991.

[6] Cambers, Gillian. Coastal Legislation in the British Virgin Islands. Eighth Symposium on Coastal Zone Management. Published by the American Society of Civil Engineers, New York, New York, 1993.

[7] CARDIQUE (1998). Estudio de caso: Bahía de Cartagena, Colombia. Proyecto Regional de Planificación y Manejo de Bahías y Zonas Costeras fuertemente Contaminadas del Gran Caribe. Proyecto GEF/RLA/93/G41. Cartagena, Colombia.

[8] Caribbean Conservation Association. Antigua and Barbuda Country Environmental Profile. St. Michael, Barbados, 1991.

[9] Caribbean Conservation Association. Dominica Environmental Country Profile. St. Michael, Barbados, 1991.

[10] Caribbean Conservation Association. Grenada Environmental Country Profile. St. Michael, Barbados, 1991.

[11] Caribbean Conservation Association (1991), St. Kitts and Nevis Environmental Profile. St. Michael, Barbados.

[12] Caribbean Conservation Association (1991), St. Lucia Environmental Profile. St. Michael, Barbados.

[13] Caribbean Conservation Association (1991), St. Vincent and the Grenadines, Country Environmental Profile. St. Michael, Barbados.

[14] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[15] Centro de Estudios Ambientales y Políticas (CEAP) & Fundación Neotropica (1991). Informe Nacional de Costa Rica para la Conferencia de las Naciones Unidas para el Medio Ambiente y el Desarrollo "ECO 92". San José, Costa Rica.

[16] Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1997). Estudio de Caso: Bahía de la Habana –PNUD/FMAM Proyecto GEF/RLA/93/G41, Proyecto Regional de Planificación y Manejo de Bahías y Areas Costeras Fuertemente Contaminadas del Gran Caribe. La Habana, Cuba, 1997.

[17] Centro de Ingeniería y Manejo Ambiental de Bahías. Final reports-Nicaragua case study, UNDP/GEF Project on Planning and Management of Heavily Contaminated Bays and Coastal Areas in the Wider Caribbean. Havana, Cuba, 1996.

[18] Comisión Nacional de Medio Ambiente, (CONAMA) (1991). Informe Nacional sobre la Situación Ambiental de la República de Guatemala. Guatemala.

[19] Comisión Permanente del Pacífico Sur (CPPS)/PNUMA (1996). Reunión de Trabajo sobre la Aplicación del Programa de Acción Mundial para la Protección del Medio Marino frente a las actividades realizadas en Tierra en la Región del Pacífico Sudeste. PNUMA(AGUA)/PAM/CPPS.

[20] CORPES (1992). El Caribe Colombiano: realidad ambiental y desarrollo. Santa Marta, Colombia.

[21] FAO (1990). Una Estrategia para el Desarrollo de la Acuicultura: El Caso de América Latina. Roma, 1990.

[22] FAO (1997). La Pesca y la Acuicultura en América Latina y el Caribe: Situación y Perspectivas en 1996. Roma, 1997.

[23] Freestone, David. Problems of Coastal Zone Management in Antigua and Barbuda. Coastlines of the Caribbean, Coastal Zone'91. Volume edited by Gillian Cambers. Published by the American Society of Civil Engineers, New York, NY, 1991.

[24] GESAMP (IMO/FAO/UNESCO-IOC/WMO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). 1997. Report of the Twenty-seventh Session, Nairobi, Kenya, 14-18 April 1997.

[25] GESAMP (IMO/FAO/UNESCO-IOC/WMO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection). Reducing Environmental Impacts of Coastal Aquaculture. Report and Studies No. 47, 1991.

[26] Government of Barbados. National Report to UNCED 1992. Bridgetown, Barbados, 1991.

[27] Government of the Commonwealth of Dominica (1994). Dominica National Environmental Plan.

[28] Government of Belize (1991). The Belize National Report to the Conference on Environment and Development, 1992.

[29] Government of Grenada (1994). Grenada National Environmental Plan.

[30] Government of Guyana (1992). Development Trends and Environmental Impacts in Guyana. Country Report for submission to the United Nations Conference on Environment and Development, 1992. Georgetown, Guyana.

[31] Government of Guyana (1994). National Environmental Action Plan. Georgetown, Guyana.

[32] Gobierno de Honduras (1989). Perfil Ambiental de Honduras, Tegucigalpa, Honduras.

[33] Government of Jamaica (1995). National Environmental Action Plan. Kingston, Jamaica.

[34] Government of Jamaica (1996). Status Report, National Environmental Action Plan. Kingston, Jamaica.

[35] Government of Montserrat (1994). National Environmental Action Plan. Montserrat.

[36] Government of Nicaragua (1994). National Environmental Action Plan. Managua, Nicaragua.

[37] Government of Saint Lucia (1994). National Environmental Action Plan. Castries, Saint Lucia.

[38] Government of St. Kitts and Nevis (1994). National Environmental Action Plan. Basseterre, St. Kitts and Nevis.

[39] Government of Suriname (1994). National Environmental Action Plan. Paramaribo, Suriname.

[40] Gobierno de la República Dominicana (1991). Informe Nacional para la Conferencia Mundial de las Naciones Unidas sobre Medio Ambiente y Desarrollo, Brasil, 1992. Santo Domingo, República Dominicana.

[41] Honduras, Microsoft Encarta 98 Encyclopaedia. 1993-1997 Microsoft Corporation.

[42] INDERENA (1989). A Guide to the National Parks System of Colombia. Bogota, Colombia.

[43] Inter-American Development Bank (1994). Bay Islands, Honduras, Environmental Management Programme. Washington, DC.

[44] Inter-American Development Bank (1995). Rehabilitación y Mejoramiento del Sistema Portuario, República Dominicana. Washington, DC.

[45] Inter-American Development Bank, (1996). Solid Waste Management – Project Profile, Bahamas. Washington, DC., USA.

[46] Inter-American Development Bank, (1996). Solid Waste Management Project, Belize. Washington, D.C., USA.

[47] Inter-American Development Bank (1996). Guyana, Environmental Management Programme. Washington, DC.

[48] Inter-American Development Bank (1996). Jamaica, Solid Waste Management Programme. Washington, DC. USA.

[49] Inter-American Development Bank (1997). Barbados, Comprehensive Solid Waste Management Project.

[50] Inter-American Development Bank (1997). Consolidation of Water and Sanitation Reform, Dominican Republic. Washington, DC.

[51] Inter-American Development Bank (1997). Jamaica, Land Administration and Management Programme. Washington, DC. USA.

[52] Inter-American Development Bank (1997). Jamaica, Watershed Management Programme. Washington, DC. USA.

[53] Inter-American Development Bank (1998). Cartagena Sewer System Project. Washington, DC., USA.

[54] Intergovernmental Oceanographic Commission (IOC). AGU-IOC-WMO-CPPS. An International Symposium on "El Niño". Guayaquil, Ecuador, 27-31 October 1986. Workshop Report No. 49.

[55] IUCN, (1993), Environmental Synopsis – Belize. IUCN, Gland, Switzerland.

[56] IUCN, (1993). Environmental Synopsis Barbados. IUCN, Gland, Switzerland.

[57] IUCN, (1993). Perfil Ambiental de Colombia. IUCN, Gland, Switzerland.

[58] IUCN, (1993). Perfil Ambiental de la República Dominicana. IUCN, Gland, Switzerland.

[59] IUCN, (1993). Environmental Synopsis, Jamaica. Gland, Switzerland.

[60] IUCN, (1994). Red List of Threatened Animals. Gland, Switzerland.

[61] Johnson, Timothy (1988). Biodiversity and Conservation in the Caribbean: Profiles of Selected Islands. International Council for Bird Preservation, Monograph No.1.

[62] Koe, Lawrence C.C. & M. A. Aziz (1995). Regional Programme of Action on Land-based Activities Affecting the Coastal and Marine Areas in the East Asian Seas, UNEP.

[63] Leonard, Jeffrey H. (1987). Natural Resources and Economic Development in Central America. A Regional Environmental Profile. Transaction Books, New Brunswick, USA.

[64] Lewsey, Clement. Evaluating the Efficacy of CZM in the Eastern Caribbean. Coastlines of the Caribbean. Coastal Zone 91'. Published by the American Society of Civil Engineers, New York, New York, 1991.

[65] McNeely, et al. 1990. Conserving the World's Biological Diversity. World Bank, WRI, IUCN, WWF, Washington, DC. USA.

[66] Monografía Ambiental, Región Nor-Oriente, Guatemala, 1993

[67] Mulliken, Teresa A. Status of Queen Conch Fishery in the Caribbean. TRAFFIC Bulletin, Vol. 16 No. 1, 1996.

[68] Organisation of Eastern Caribbean States (OECS). OECS Regional Report on Environment and Development. Saint Lucia, 1992.

[69] OEA, PNUMA, Gobierno de Costa Rica & Gobierno de Nicaragua (1997). Estudio de Diagnóstico de la Cuenca del Río San Juan y Lineamientos del Plan de Acción. Washington, DC. , 1997.

[70] Panama, Microsoft Encarta 98 Encyclopaedia. 1993-1997 Microsoft Corporation.

[71] PNUMA (1989). Perspectiva Regional sobre los Problemas y Prioridades Ambientales que Afectan los Recursos Costeros y Marinos de la Región del Gran Caribe. Informe Técnico del

PAC No.2. Programa Ambiental del caribe del PNUMA, Kingston, Jamaica.

[72] PNUMA (1990). La Estrategia para el Desarrollo del Programa Ambiental del Caribe. Informe Técnico del PAC No. 5. Programa Ambiental del Caribe del PNUMA, Kingston, Jamaica.

[73] PNUMA (1991). Informe del Seminario de CEPPOL sobre Vigilancia y Control de la Calidad Sanitaria de las Aguas Costeras Destinadas a la Recreación y al Cultivo de Mariscos en el Gran Caribe, Kingston, Jamaica, 8 al 12 de abril de 1991. Informe Técnico del PAC No.9. Programa Ambiental del Caribe del PNUMA, Kingston, Jamaica.

[74] PNUMA (1991). Sistema de Datos e Informaciones sobre el Medio Ambiente: SIMARNA – La Experiencia Cubana. Informe Técnico del PAC No. 10. Programa Ambiental del Caribe del PNUMA, Kingston, Jamaica.

[75] PNUMA (1993). Pertinencia y Aplicación del Principio de Acción Precautoria al Programa Ambiental del Caribe. Informe técnico del PAC No. 21.S/PSE/RT.1. (E&S) Programa Ambiental del caribe del PNUMA, Kingston, Jamaica.

[76] PNUMA (1996). Directrices para una Planificación y un Manejo Integrados de las Areas Costeras y Marinas en la Región del Gran Caribe. Programa Ambiental del Caribe del PNUMA, Kingston, Jamaica.

[77] PNUMA (1996). Directrices y Criterios Comunes para las Areas Protegidas en la Región del Gran Caribe: Identificación, Selección, Establecimiento y Gestión. Informe Técnico del PAC No. 37. Programa Ambiental del Caribe del PNUMA, Kingston, Jamaica.

[78] PNUMA (1996). Octava Reunión Intergubernamental sobre el Plan de Acción para el Programa Ambiental del Caribe y Quinta Reunión de las Partes Contratantes del Convenio para la Protección y Desarrollo del Medio Marino en la Región del Gran Caribe, Kingston, Jamaica, 9 al 13 de diciembre de 1996. Informe de la Reunión. (UNEP (WATER)/CAR IG. 13/8.

[79] PNUMA (1997). Decimosegunda Reunión del Comité de Supervisión sobre el Plan de Acción para el Programa Ambiental del Caribe y Reunión Especial de la Mesa Directiva de las Partes Contratantes del Convenio para la Protección y Desarrollo del Medio Marino en la Región del Gran Caribe, Kingston, Jamaica, 24-28 de febrero de 1997. Plan de Trabajo y Presupuesto para el Programa Ambiental del Caribe para el Bienio 1998-1999. UNEP (WATER)/CAR IG. 14/6.

[80] PNUMA (1997). Decimosegunda Reunión del Comité de Supervisión sobre el Plan de Acción para el Programa Ambiental del Caribe y Reunión Especial de la Mesa Directiva de las Partes Contratantes del Convenio para la Protección y Desarrollo del Medio Marino en la Región del Gran Caribe, Kingston, Jamaica, 24-28 de febrero de 1997. Informe de la Reunión. UNEP (WATER)/CAR IG. 14/7.

[81] PNUMA (1997). Segunda Reunión de Expertos Legales/Técnicos y Políticos para el Desarrollo de un Protocolo Relativo a la Contaminación Procedente de Actividades Terrestres del Convenio para la Protección y el Desarrollo del Medio Marino en la Región del Gran Caribe, Kingston, Jamaica, 24-28 de febrero de 1997. (UNEP (WATER)/CAR WG.21/6.

[82] Q.TEC Soluciones Ambientales S.A. PNUD/FMAM- Proyecto Regional GEF/RLA/G41, Planificación y Manejo de Bahías y Zonas Fuertemente Contaminadas del Gran Caribe". San José, Costa Rica.

[83] República Dominicana (1991). Informe Nacional de la República Dominicana a la Conferencia Mundial sobre Medio Ambiente y Desarrollo, 1992.

[84] ROPME (1997). Workshop on the Protection of the Marine Environment against Pollution from Land-based Activities in the ROPME Sea Area, Kuwait, 8-9 June 1997. (ROPME/WG-84/4).

[85] Sinserman, Carl J. (1997). Ocean Pollution Effects on Living Resources and Humans. CRC Press. New York, USA.

[86] The Government of Belize, (1992). The Belize National Report to the Conference on Environment and Development.

[87] The Government of Guatemala, (1991). The Guatemala National Report to the Conference on Environment and Development.

[88] The World Bank (1992). Caribbean Region, Current Economic Situation, Regional Issues, and Capital Flows, 1992. Washington, DC., USA.

[89] The World Bank, (1996). Belize Environmental Report. Washington, D.C., USA.

[90] The World Bank Group, (1997). Pollution Prevention and Abatement Handbook. Washington, D.C., USA.

[91] Turks and Caicos Islands, Microsoft Encarta 98 Encyclopaedia. 1993-1997 Microsoft Corporation.

[92] UNEP (1991). Directory of Marine Environmental Research Institutions in the Wider Caribbean Region CEP Technical Report No. 6. UNEP Caribbean Environment Programme, Kingston.

[93] UNEP (1991). Report of the CEPPOL Regional Workshop on Coastal Water Quality Criteria and Effluent Guidelines for the Wider Caribbean, San Juan, Puerto Rico, 5-15 November 1990. CEP Technical Report No. 8.

[94] UNEP (1994). Ecotourism in the Wider Caribbean region – An Assessment-. CEP Technical Report No. 31. UNEP Caribbean Environment Programme, Kingston.

[95] UNEP (1994). Guidelines for Sediment Control Practices in the Insular Caribbean, CEP Technical Report No. 32. UNEP Caribbean Environment Programme, Kingston, Jamaica.

[96] UNEP (1994). Regional Overview of Land-based Sources of Pollution in the Wider Caribbean. CEP Technical Report No. 33. UNEP Caribbean Environment Programme, Kingston. (E. F &S)

[97] UNEP (1997). Coastal Tourism in the Wider Caribbean Region: Impacts and Best Management Practices. CEP Technical Report No. 38. UNEP Caribbean Environment Programme, Kingston.

[98] UNEP (1995). Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, Washington, D.C., USA, 23 October - 3 November 1995. UNEP(OCA)/LBA/IG.2/7.

[99] UNEP (1995). Intergovernmental Conference to Adopt a Global Programme of Action for the Protection of the Marine Environment from Land-based Activities, Washington, D.C., USA, 23 October – 3 November 1995. UNEP (OCA)/LABA/IG. 2/6. (E, F &S).

[100] UNEP, Global Environmental Outlook, 1997. Nairobi, Kenya.

[101] UNEP/PAP/RAC (1997). Integrated Coastal Area and River Basin Management. ICARM Technical Report Series No. 1.

[102] United Nations. Environmental Impact Assessment, Guidelines for Transport Development. New York, 1990.

[103] United Nations. Environmental Impact Assessment, Guidelines for Water Resources Development. New York, 1990.

[104] United Nations Development Programme. Human Resources Development Report, 1997. New York.

[105] University of the West Indies (1997). Jamaica Case Study. UNDP/GEF project on Planning and Management of Heavily Contaminated Bays and Coastal Areas in the Wider Caribbean. Mona, Jamaica, 1997.

[106] Venezuela, Microsoft Encarta 98 Encyclopaedia. 1993-1997 Microsoft Corporation.

[107] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

[108] World Resources Institute (1993). Haiti. Pub Houghton Mifflin Co. 1993.

Annex 1

Country or Territory	Population	Number of visitors	Per capita GNP (US$)
Anguilla (United Kingdom)	10,424	86,239	6,127
Antigua and Barbuda	67,000	472,056	7,330
Aruba (Netherlands)	87,971	957,626	>9,636
Bahamas	284,000	3,400,000	>9,636
Barbados	263,000	957,058	>3,116; < 9,635
Belize	200,700	142,663	2,258
British Virgin Islands (United Kingdom)	19,000	412,032	>9,636
Cayman Islands (United Kingdom)	35,000	1,140,000	>9,636
Colombia	6,000,000	1,200,000	2,140
Costa Rica	71,451	800,000	2,640
Cuba	11,000,000	1,000,000	>786; < 3,115
Dominica	73,500	262,132	3,090
Dominican Republic	8,076,000	2,040,000	1,600
French Guiana (France)	151,788	223,336	>9,636
Grenada	98,600	386,013	3,209
Guadeloupe (France)	422,000	625,000	N.I.
Guatemala		520,085	1,470
Guyana	758,700	170,885	690
Haiti	7,329,000	146,000	310
Honduras	116,100	263,417	660
Jamaica	2,574,000	1,800,000	1,600
Martinique (France)	392,100	931,786	>9,636
Mexico	10,900,000	8,900,000	3,670
Montserrat (United Kingdom)	5,800	16,073	N.I.
Netherlands Antilles Federation (Netherlands)	400,519	1,600,000	>9,636
Nicaragua	64,350	305,450	380
Panama		442,719	3,080
Puerto Rico (U.S.A.)	3,733,000	4,100,000	>9,636
St. Kitts and Nevis	44,000	171,382	5,870
St. Lucia	147,179	426,675	3,500
St. Vincent and the Grenadines	110,724	215,963	2,370
Suriname	411,555	84,000	1,000
Trinidad and Tobago	1,320,000	365,065	3,870
Turks and Caicos Islands (United Kingdom)	14,800	87,794	N.I.
United States of America	16,615,000		28,020
U.S. Virgin Islands (U.S.A.)	109,662		>9,636
Venezuela	9,324,000	800,000	3,020
Total	69,906,923	35,451,449	

Source: Population and visitors data for the island States and Territories as provided by the 1998 Caribbean Basin Profile. For the twelve continental countries, population data is based on various reports (see references of national overviews). Data for GNP as provided by the World Development Indicators 1998 CD-ROM, World Bank.

Annex 2

Inter-American Development Bank	
BAHAMAS	Solid Waste Management
BARBADOS	Comprehensive Solid Waste Management Project
BELIZE	Environmental and Technical Assistance Project
BELIZE	Solid Waste Management Project
COLOMBIA	Cartagena's sewer System
COSTA RICA	Health Services Improvement Programme
COSTA RICA	Watershed Management Programme
COSTA RICA	Management of National Parks for Ecotourism
DOMINICAN REPUBLIC	Rehabilitation and Improvement of the Ports System
GUYANA	Environmental Management Programme
GUYANA	Health Sector Policy and Institutional Development
HAITI	Drainage and Sanitation
HAITI	Intensification of Agriculture
HONDURAS	Water Sanitation Programme
HONDURAS	Bay Islands Environmental Management Programme
HONDURAS	Puerto Cortés Sewerage Programme
JAMAICA	Solid Waste Management Programme
JAMAICA	Watershed Management Programme
JAMAICA	Land Administration and Management Programme
MEXICO	Modernisation of the Water Sector and Sanitation in Rural Areas
MEXICO	Yucatan gas Pipeline
PANAMA	Tourism Support Programme
PANAMA	Educational Development Programme
TRINIDAD & TOBAGO	Community Development Fund
TRINIDAD & TOBAGO	Short Term Support Programme for Tourism

The World Bank Group	
OECS	Sewage Project
LAC	Solid Waste Management Project Apr. 95
COLOMBIA -	Cartagena Water Supply, Sewerage and Environmental Clean-up project
COSTA RICA -	Biodiversity Resources Development Project- Jan.1, 1998
DOMINICAN REPUBLIC	Irrigated Land and Watershed Management Project, Jan 1995
DOMINICAN REPUBLIC	National Environmental Policy Reform Project, Feb. 1998
GUYANA	Water Supply Technical Assistance and rehabilitation Project. Nov. 1993
HONDURAS	Plan de Accion Ambiente y Desarrollo, June 1993
HONDURAS	Environmental development Project, Mr. 1995
HONDURAS	Biodiversity Priority Areas
MEXICO	Second Solid Waste Management Project, Mexico, Jan 1994
MEXICO	Elementos para un programa de desarrollo sostenible. Nov.1994
NICARAGUA	Water Supply and Sanitation Project
ST. LUCIA	Watershed and Environmental management Project
TRINIDAD & TOBAGO	National Parks and watershed Management project
TRINIDAD & TOBAGO	Water and Sewerage Rehabilitation Project
TRINIDAD & TOBAGO	Water and Sewerage Privatization Support project
TRINIDAD & TOBAGO	Environmental Management Project, Mar. 1995

Other Supporters	
CEHI Project	
Pesticide Monitoring Programme	
Caribbean Basin Management Programme	CIDA and the Caribbean Development Bank
Waste Management Programme	CARICOM/GTZ, CIDA
Institutional Development for the Management of Industrial Chemicals and Hazardous Wastes	CARICOM
Environmental and Coastal Resources (ENCORE) Project	USAID, WWF, OECS

On-going and Planned Initiatives

Anguilla (United Kingdom)

Population: 10,424 [2]

Natural Resource Base:

The climate in Anguilla is sub-tropical with average temperatures of 27 degrees Celsius and mean annual rainfall of 914mm. [2]

The island is mostly flat with a coral and limestone foundation. Crocus Hill, the highest elevation is located at 65m above sea level. [2]

According to the World Conservation Monitoring Centre (WCMC), Anguilla has 3 species of mammals, 61 of birds, 11 of reptiles and 1 of amphibian and there are a total of 321 species flowering plants. [3]

Economics:

Anguilla's agricultural sector consists mainly of small-scale farming and livestock raised for the local market. Other agricultural products are peas, sweet potatoes and corn. Lettuce is produced through hydroponics farming and drip irrigation was expanded recently. The Government also is promoting the commercial production of fruits. There is some lobster fishing for export mainly. [2]

Tourism decreased substantially (about 20 % in 1996) due to the serious impacts of the hurricane season in 1995, which destroyed important tourist infrastructure. The Government is at present working very hard in rebuilding the infrastructure and there is a proposal for a $25 million airport under consideration. [2]

Mining and other industrial sectors are almost non-existent in Anguilla. [2]

Identification and Assessment of Problems:

Sewage disposal is mainly done through septic tanks and according to the available information, there is no sewerage system in Anguilla. [1]

Although not much information is available, it might be possible that the agriculture activities are contributing with some pollution to the coastal areas.

Emerging issues:

The Government is building a new airport and a new tourism strategic marketing plan developed under the EU – financed Caribbean Tourism Development Program (CTDP). [2] It is expected that an increase of day excursions from the Dutch and French Territories and the start up of ship calls will create additional pressure for the scarce resources of the island.

Priorities for Action:

A sewerage treatment system appears to be the main priority for Anguilla as well as a comprehensive coastal zone management plan defining areas to be protected and areas to be used for diverse economic activities.

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Antigua and Barbuda

Population: 67,000 [2]

Natural Resource Base:

The climate in Antigua and Barbuda is tropical and humid with average temperatures of 29°C during the summer and 24°C during the winter. The annual average rainfall in Antigua is 1065mm, but it varies considerably from year to year. Barbuda is one of the driest islands in the Caribbean, with an average annual rainfall between 760mmand 990mm. [3]

Antigua has some rolling hills in the north, the central area consists of a fertile plain and in the southwest remains of volcanoes and tropical valleys are the main formations. The volcanic region consists of igneous rock producing mostly clay loams. The soils are neutral to slightly acidic. The limestone region consists of soils over calcareous sandstones, grits and marls. Barbuda is very flat and of a coral-limestone formation. [3]

The main ecosystems in Antigua and Barbuda are the humid valley forest, the mangrove, the savannahs, the grasslands, seagrass beds and the coral reefs. There are three officially designated Parks in the island, Nelson's Dockyard National Park in Antigua and two marine parks. [3]

According to the World Conservation Monitoring Centre (WCMC), Antigua and Barbuda have 7 species of mammals, 140 of birds, 13 of reptiles and 2 of amphibians and there is a total of 766 of flowering plants. [6] Species such as green turtles (*Chelonia mydas),* hawksbills (*Eretmochelys imbricata*), loggerheads (*Caretta caretta*) and leatherback turtles (*Dermochelys coriacea*) are found in the beaches and the coastal areas. [3]

Economics:

Antigua and Barbuda's main economic sector is tourism, which decreased substantially in 1989 and 1995 due to the serious impacts of the hurricane season which destroyed important tourist infrastructure. The 1995 hotel damage was estimated at $70 million. Owing to the serious damage of the port facilities in St. Marteen and the Virgin Islands there was a diversion of cruise ships in 1996 increasing the number of passengers by 9.3% in that year. In 1996, 472,056 people visited the country in comparison to 149,322 [1] that visited during 1986, that means that the number of visitors tripled in the last 10 years. It is important to note however, that according to the figures of the environmental profile [3], the number of visitors in 1987 was 326,700, and in 1977 it was 104,100. Tourism contributes with about 60% of the gross domestic product (GDP). [3]

Although agriculture used to contribute 20% of GDP in the 60's at the beginning of the 90's, it was contributing less than 5%. In 1986 it was reported that Antigua and Barbuda was the largest importer of pesticides in the Lesser Antilles and although agriculture does not play an important role in the GDP nowadays, the overuse or misuse of agrochemicals has not stopped. At present, Antigua and Barbuda have a heavy dependence on imported food and energy. The production of fruits and vegetables for domestic consumption are the main agricultural product at present [3]. Sand mining is a small industry in terms of contribution to the GDP, and despite the 1957 Beach Protection Ordinance it continues in Antigua, but as the act does not apply to Barbuda the sand-mining operation takes place there with the permission of the local council [4]. The rest of the industrial sectors such as manufacturing have decreased considerably in the past years to give preference to imported goods. [2]

Identification and Assessment of Problems:

In the early days (from the colonial days until the early 60's) agriculture was the major cause of habitat destruction, erosion and pollution mainly because of the sugar cane plantations. Antigua's main problem during the last two decades are related to the intensive tourist development which has resulted in major biophysical alterations to the coastline and destruction of coastal and marine habitats. Sewage disposal, (mainly done through septic tanks and according to the available information, there is no sewerage system in Antigua and Barbuda) solid waste, erosion and sand mining appear to be serious threats to the sustainability of the tourist industry in Antigua. [3]

The main problems affecting the marine, coastal and freshwater environments of Antigua and Barbuda are presented in table 1. [3]

Emerging issues:

In 1997 the Government signed an agreement with a group of Malaysian investors for EC$600 million to develop a tourist resort on Guiana and surrounding islands. The project will include a 1000-room hotel, villas, and condominiums, water sports facilities, two world-class golf courses and a casino. [2]

By August 1997 almost two thirds of the housing stock in Montserrat had been destroyed due to the volcanic activity and the Government of Antigua accommodated 3,000 evacuees. [2]

Table – 1 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Problem	Causes/Consequences
Inadequate Development Planning	Lack of institutional co-ordination
	Lack of environmental impact assessments
	Lack of proper legislation
	Lack of land use plan and coastal zone management plan
	Lack of public awareness
	Destruction of wetlands and coastal environment
	Sand mining
Mismanagement of protected areas	Lack of trained staff
	Lack of proper regulations
	Lack of a protected areas system
	Destruction of habitats and important heritage, such as mangroves and their associated habitats
Low productivity	Rainfall is low
	Watersheds are mismanaged
	Poor land use practices
	Lack of adequate legislation to protect forest and water resources
Pollution and public health	Solid wastes
	Sewage and other liquid domestic wastes
	Agrochemicals
	Industrial waste
	Hazardous wastes are basically unmanaged
	Lack of adequate pollution control and public health legislation
	Lack of public awareness
	Lack of financial resources
	Lack of quality criteria and standards
	Lack of regulation and control of pesticides
	Lack of a coastal zone management plan

Priorities for Action:

The main priority at this stage is to secure the financial resources to carry out all the recommendations made in the Environmental Profile (1991)[2]. In my view, although all recommendations are important, particular attention should be given to the drafting of new legislation, preparation of the comprehensive integrated coastal zone management plan and drafting of an oil contingency plan.

Although an Environmental Impact Assessment has been completed for the new tourist development in Guiana and the surrounding islands, [2] it is extremely important that the Government ensures that the recommendations contained therein are fully implemented.

Collection of up-dated information on the use, amounts and types of agrochemicals and their impacts on the terrestrial and marine environments is of paramount importance.

Public awareness campaigns are basic to get the public to understand the seriousness of the problems and to make them part of the solution.

Designing and building appropriate wastes disposal facilities is of paramount importance to avoid serious impacts to the economy, the public health and the living marine resources.

Measures taken:
In 1995 with the support of the Organisation of American States the Government of Antigua prepared the master development plan for the development of tourist infrastructure at Parham Harbour and it is hoped that through this plan all necessary environmental measures will be taken to prevent pollution and coastal degradation. [2]

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] Caribbean Conservation Association. Antigua and Barbuda Country Environmental Profile. St. Michael, Barbados, 1991.

[4] Freestone, David. Problems of Coastal Zone Management in Antigua and Barbuda. Coastlines of the Caribbean, Coastal Zone'91. Volume edited by Gillian Cambers. Published by the American Society of Civil Engineers, New York, NY, 1991.

[5] The World Bank (1992). Caribbean Region, Current Economic Situation, Regional Issues, and Capital Flows, 1992. Washington, DC., USA.

[6] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Aruba

Population: 87,971[2]

Natural Resource Base:

The climate in Aruba is tropical and windy with an average temperature of 28°C all year round. The annual average rainfall in Aruba is 395mm, which makes it very dry. [2]

Aruba's northern part is hilly, but the rest of it is quite flat. On the west coast the white sand beaches stretch for miles. [2]

The main ecosystems in Aruba are the arid and semi-arid shrubs, the mangrove, seagrass beds and the coral reefs. [2]

According to the World Conservation Monitoring Centre (WCMC), Aruba has 172 species of birds, 10 of reptiles and 2 of amphibians and there are a total of 460 species of flowering plants and of endemic higher plants. [3]

Economics:

Until the mid-1980s the refining of Venezuelan oil was the main source of employment in Aruba. In 1984, the petroleum refining industry accounted for 25% of the island's gross national product (GDP). When the refinery closed in 1985, many Arubans lost their jobs and experienced a drastic reduction in their standard of living. Rehabilitation of the refining industry began in 1989 and in 1993 the refinery's daily output was 140,000 barrels. [2]

Aruba's main economic sector is tourism followed by oil refining and production of beverages and consumer goods. Agriculture, Fisheries and Forestry do not play an important role in the GDP. The Government of Aruba is very interested in diversifying its economy and is working very conscientiously to offer comparative advantages for businesses and companies to locate to the country. [2]

The Government of Aruba invested $600 million in its Tourism Development Plan between 1986 and 1996, and at present there are several international chains that are expected to have their resorts ready by the end of 1998. [2]

Identification and Assessment of Problems:

Aruba's Government seems to have a coherent policy for balance and sustainable growth, in accordance with its macroeconomic plan. [2]

There is a sewage system serving Oranjestad and in 1988 treatment was done through the Bubali Oxidation Ditch Sewage Treatment Plant. The solid wastes were collected once a week and disposed in open dumps with no linings. [1] It is not clear from the available information if this is still the case.

Considering the amount of oil that is refined in Aruba per year, there is a serious risk of oil pollution.

Emerging issues:

In mid 1997 the Government initiated the expansion of the airport and by the end of 1998, Aruba is expected to have one of the most modern airports in the Region. [2]

The Government is also participating in a major development plan with Sasaki Consultants and the San Nicolas Business Association to invest over $300 million over the next 15 years in projects related to beautification, housing, roads and infrastructure, public parks and nature conservation. [2]

Production of refined oil increased by 30% in 1996 and in 1997 the Coastal Aruba Refining Company was awarded a contract for $21.7 million for production of aviation fuel. [2]

The total number of visitors increased by 4.9% and cruise ship passengers increased by 7.4% in 1996 in comparison to 1995. [2]

Priorities for Action:

All new developments in the island should be subject to close monitoring of the recommendations of the Environmental Impact Assessments. Considering the increasingly high number of visitors per year, the sewage system and solid wastes facilities should be up-graded to deal with the additional load that will be generated. Oil contingency plans for the storage and refining facilities should be in place and properly tested on a permanent basis.

Measures taken:

In response to increasing cargo and cruise traffic in Aruba a Ports Master Plan was drafted with the aim of guaranteeing sustainability of this activity for the next 20 years.

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

The Bahamas

Population: 284,000 [2]

Natural Resource Base:

Bahamas is an archipelago of about 700 islands and islets and nearly 2000 cays and rocks, extending for about 1200 km from a point south-east of Palm Beach, Florida, to a point off the eastern tip of Cuba. The Biminis, the westernmost of the group, is about 97 km east of Miami, Florida. Nearly 70% of the entire population lives on the island of New Providence, 35% in Grand Bahama and 15% on the remaining islands. 29 of the islands are inhabited. The total area is 13,942 km^2. [1&2]

The climate in the Bahamas is semitropical with average temperatures of 30 °C during the summer and 20°C during the winter. The annual average rainfall in Bahamas is 1318mm. [2]

The islands are surface projections of two oceanic banks of coral formations and many of them are barren and windswept. The soils are highly permeable and scant and the groundwater is shallow. [2]

According to the World Conservation Monitoring Centre, the Bahamas has 12 species of mammals, more than 222 of birds, 35 of reptiles and 2 of amphibians; there are a total of 1,172 of flowering plants and 118 of endemic higher plants. [4]

Economics:

The Bahamas are one of the most popular year-round resorts in the Western Hemisphere, visited annually by more than 3 million tourists. Tourism represents about 50 percent of the gross national product. Because of favourable tax laws, the Bahamas have become an international banking centre and are expected to base their future economic growth on the expansion of tourism and financial services. Their industrial activity is limited; it includes the transhipment and refining of petroleum and the production of steel pipe, pharmaceuticals, salt, rum, and shellfish. Agriculture and fisheries together accounted for 5% of the gross domestic product (GDP) in 1996. [2]

Identification and Assessment of Problems:

Betz (1990) reports that there is a sewage treatment system in New Providence with disposal via deep well injection and that Archer reported in 1984 that there were impacts caused in the coastal areas through infiltration of sewage through the ground. [1]

The Inter American Development Bank (IDB) estimates that the total solid waste generated in Providence is about 181,000 tons annually, in Grand Bahama is 42,800 and in the Family Islands 20,300. Although the Department of Environmental Health Services (DEHS) operates a waste disposal facility in New Providence, it has serious operational technical problems. [3]

In Grand Bahama and the Family Islands the system of disposal is to dump and burn the refuse on the disposal sites. It is important to note that there is a low frequency of collection and a proliferation of official and unofficial dumping sites with minimal technical standards. [3]

Emerging issues:

In 1997 a big aquaculture company began operating two shrimp farms on Freeport, Grand Bahama. The initial project of five acres is expected to expand to 100 acres in the next few years. The sponge industry grew in a 19.9% and the conch meat industry also rose by 14.4% during 1996. The Bahamian Government is seriously promoting investment in the agriculture and fisheries sector to achieve self-sufficiency. [2]

Priorities for Action:

A comprehensive coastal zone management plan defining areas to be protected and areas to be used for diverse economic activities and provision of raw materials and services appears to be one of the main priorities for Bahamas. It is not clear whether environmental Impact Assessments are a requirement for new developments and it is extremely important that the Government ensures that if this is not the case, the new environmental regulations include this issue.

With the increasing number of visitors per year, adequate sewage treatment systems and plants are of huge importance for the Bahamas.

Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off.

The new aquaculture developments should take into account the guidelines and recommendations proposed by the Working Group 31 of the Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP).

It would be very useful for the Bahamas to prepare a National Environmental Action Plan identifying all major problems affecting the marine, coastal and freshwater environments and proposing possible solutions through concrete actions and projects.

Measures taken:
The Ministry of Health and Environment is negotiating with the IDB a solid waste management project for a total of $27 million. The project should improve the solid waste management services for New Providence, Grand Bahama and the other Family Islands, though regulatory adjustments, priority investments for disposal facilities, education and public awareness.

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] Inter-American Development Bank, (1996). Solid Waste Management – Project Profile, Bahamas. Washington, DC., USA
[4] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Barbados

Population: 263,000 [3]
Natural Resource Base:
Barbados lies east of Saint Vincent and the Windward Islands, 150 km east of the Lesser Antilles. The island is 34 km long and 23 km wide at its widest part, and has a total area of 430 sq. km, and a coastline 92-km long. Barbados is one of the most densely populated countries in the world (611 persons per km^2)[4 and 6]

Barbados is generally flat along the coast and hilly in the interior. On the western side there is a coral limestone area, which covers about 85% of the island. The eastern side is dominated by rugged relief, which reaches a maximum altitude of 340m at Mount Hillaby. The soft tertiary rocks include relatively low-permeability sandstones, with shales and marls. [4]

Barbados has no natural deep water harbours and is largely surrounded by coral reefs.

The climate is tropical, tempered by sea breezes; the mean annual temperature is about 26°C. A rainy season prevails from July to December, with average annual rainfall of about 160mm. Hurricanes occasionally strike the island. [6]

Before colonisation began in 1627 Barbados was covered with forests, by 1974 only some 18 has. were designated as forest land. The mangrove swamps, which also used to be abundant, have disappeared to give way to coastal developments. At present only five swamps have survived and the largest one retains mangroves in significant numbers. Despite the fact that mangroves serve as nursery breeding grounds for reef fish and crustaceans due to their high productivity level and that their roots act as sediment traps decreasing amount of particulate matter reaching the coral reefs, coastal developments continue to decimate the swampy areas. [4]

In 1993 it was reported that only one protected area had been established, although several others were planned. [6]

Two reef systems surround the island: inner fringing reefs near the shoreline, and barrier bank reefs in deeper water. Seagrass beds are located in patches up to about 50m offshore in very shallow water. [4]

According to the World Conservation Monitoring Centre (WCMC), Barbados has 6 species of mammals, 172 of birds, 9 of reptiles and 1 of amphibian and there are a total of 542 flowering plants. [8] Four endangered species of marine turtles are present in Barbados, greenback (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelis imbricata*) and olive ridley (*Lepidochelys olivacea*), and one vulnerable species, the loggerhead (*Caretta caretta*) [4]. From all these turtles only the hawksbill appears listed for Barbados in the 1994 IUCN Red List. [7]

Economics:
The economy of Barbados has traditionally been dependent on the growing of sugarcane and the production and export of refined sugar, molasses, and rum. Sugarcane is grown principally on large estates rather than on small farms; the annual harvest in 1991 was 65,673 tons and in 1992, 54,000 compared to 1960 when the production was between 160,000 and 200,000 tons. Efforts have been made by the government to reduce the dependency on sugarcane products. [6]

Newly discovered reserves of petroleum and natural gas are being exploited, as well as limestone, sand clays, oceanic clays and sandstone. [6]

Fishing has also increased in importance. The most important fishery is the pelagic, which accounts for at least 90% of the annual catch and 2000 full time jobs and 1000 part time. In 1990, the commercial fish landing reached 2966 tons [4&6].

Tourist facilities have been developed, and since the late 1960s tourism has earned more foreign revenue than sugar products. The contribution to the GDP was 12%, over 20% of total employment and 60% of export earnings in 1991. [4]

Identification and Assessment Problems:

According to the Environmental Synopsis of Barbados (1993), soil erosion is one of the major environmental problems confronting Barbados, followed by coastal erosion, solid waste disposal, inadequate environmental management and marine pollution. (See table 1) [6]

Oil pollution is considered the most serious marine environmental threat due to the geographic location of the island. Several major spills have occurred in the Region and Barbados has also experienced frequent pollution of its beaches and coral reefs through the routine release of oily waters of passing ships. [4]

Domestic pollution reaches the sea through the malfunctioning of package treatment plants, from leaching from septic tanks and pits in the coastal zone, and by direct discharges. [4]

Agricultural runoff occurs primarily during the heavy rain period. Fringing reefs on the West Coast have probably deteriorated as a direct consequence of pollution from the intense hotel and residential developments occurred along the coast. Seagrass beds have also deteriorated due to pollution and their important role in trapping sediments and act as a food provider to sea urchins and parrot fish can no longer be performed. [4]

Table – 1 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Problem	Cause/Consequence
Decline of arable land	Abandon of land; housing development Increased surface runoff; reduction of water percolating in aquifers; increase susceptibility to flooding
Soil erosion	Shallow soils; deforestation; mechanisation; crop diversification Sedimentation
Coastal erosion	One third of beaches are eroded; inappropriate sea defenses; destruction of corals reefs by sediments and other pollutants; coastal developments Damage to dune belts and cliff faces; destruction of vegetation and wildlife habitats
Solid waste	Lack of adequate legislation or enforcement of existing; lack of co-ordination between institutions; duplication of efforts No recycling; lack of space to place new sites for sanitary landfills; illegal disposal into gullies and unused quarries Health risks; contamination of aquifers; air pollution through burning of ship generated waste
Marine pollution	Lack of adequate legislation or enforcement of existing; co-ordination between institutions, duplication of efforts Oil pollution main concern; shipping route of tankers; sewage from leaching and direct discharges; agricultural pollution: indiscriminate use of pesticides and solid matter particularly during rainy season; hazardous wastes and radioactive material by transboundary movement Impact on beaches, seagrass beds and coral reefs; tourism industry; decline on fisheries catch
Climate change	Sea-level rise in a low-lying island

Source: Environmental Synopsis, 1993 [6]

In 1994 the Inter-American Development Bank (IDB) estimated that between visitors and Barbadians 150,000 tonnes of solid waste are generated annually in Barbados. [5]

The National Report (1991) made an analysis of the factors contributing to coral reef decay and deterioration of near shore waster quality; identified sources of air pollution; activities affecting biodiversity; and sources of land-based pollution. (See boxes 1-4) [4]

Box 1: Factors contributing to Coral Reef Decay and Deterioration of Nearshore Water Quality

- Wastewater pollution particularly from hotels, as a result of poorly maintained septic tanks and package treatment plants.
- Soil erosion causes a reduction in water clarity and raises the biological demand of oxygen of the marine environment.
- Residues of chemicals, specifically pesticides have been found in the marine environment.
- Industrial wastes, which may contribute to increase oxygen demand as well as hazardous in nature, are thought to impact the marine environment, although they maybe negligible.
- Thermal pollution by electricity generating plants. Some 3 million litres per hour averaging 5°C more than ambient temperature are released in nearshore waters.

Box 3: Activities Impacting Negatively on Biodiversity

- Industrial activities' generating dust and fumes in residential areas.
- Motor vehicle traffic.
- Landfill operations impacting on residential areas
- Lead, ozone-depleting substances and other pollutants due to the growth in vehicular traffic and the continued use of leaded petrol.
- Pollution produced by cane fires during the cropping season.

Box 4: Sources of Pollution of the Caribbean Sea

Box 4: Sources of Land-based Pollution

- The extensive clearing of original forest cover for development of agriculture.
- Infrastructural development and the encroachment of human settlements on critical habitats, for example the effects of coastal developments on the nesting grounds of marine turtles.
- Marine pollution by land-based sources of pollution resulting in the deterioration of marine ecosystems.
- Over exploitation of marine species. This is responsible for the decline in marine turtles and sea eggs.

- Land-based activities including wastewater, agricultural runoff and industrial hazardous wastes.
- Oil residues from tanker operations and tanker accidents.
- Ship generated waste including sewage.
- Plastics
- The transboundary movement of hazardous wastes

Emerging issues:
In 1997 almost all sectors of the economy expanded. There is a proposed $30 million Tourism Development Programme be funded by the IDB. [3]

Priorities for Action:
Full implementation of the comprehensive coastal zone management plan appears to be the main priority. In 1991 Atherley & et al recommended that within the coastal zone management plan that should be drafted for Barbados free access of the public to the coastal areas should be taken into account.

Although the requirement of Environmental Impact Assessments has been in placed since 1971, it is extremely important that the Government ensures that the recommendations contained therein are fully implemented.
Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off.
Building of adequate waste disposal facilities and improvement of the sewage system is a priority, as well as the implementation of a strategy to deal with hazardous wastes generated in or transported to the island.
Drafting of new or revised legislation is an important priority, and enforcement of the existing one is top priority.

Measures taken:
In 1991 the Government with the support of the IDB, initiated a Coastal Conservation Feasibility study as well as a project in institutional strengthening. These two projects form the nucleus of the Integrated Programme for Coastal Zone Management that was to be initiated in 1994, to protect the country's coasts from erosion and decrease the environmental degradation. [2]
The public sewerage system project for the South coast is being implemented with the financial assistance of the IDB since late 1994. The Government and the IDB agreed upon a solid waste management project for a total of $25 million, and through this project it is expected that a 20-year plan to manage solid waste will be designed and adopted. [5]

References:
[1] Atherley, K., Nurse L. A., and Toppin Y. Facing Management Challenges on the Barbados Coastline: The problem of Coastline Access. Coastlines of the Caribbean, Seventh Symposium on Coastal and Zone Management. Published by the American Society of Civil Engineers, New York, NY, 1991.
[2] Atherley, K., Smith D.D. and Nurse L. A. An Integrated Coastal Zone Management for Barbados. Eighth Symposium on Coastal and Zone Management. Published by the American Society of Civil Engineers, New York, NY, 1993.
[3] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[4] Government of Barbados. National Report to UNCED 1992. Bridgetown, Barbados, 1991
[5] Inter-American Development Bank (1997). Comprehensive Solid Waste Management Project.
[6] IUCN, (1993). Environmental Synopsis Barbados. IUCN, Gland, Switzerland.
[7] IUCN, (1994). IUCN Red List of Threatened Animals. IUCN, Gland, Switzerland.
[8] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Belize

Population: 223,000 [2]

Natural Resource Base:

Located in northern Central America, bordered on the north by Mexico, on the east by the Caribbean Sea, and on the south and west by Guatemala. The total area of Belize is 22,965 sq. km.

The northern half of Belize consists of lowlands, large areas of which are swampy. The southern half is dominated by mountain ranges, notably the Maya Mountains, which rise to a maximum elevation of 1122 m atop Victoria Peak.

The climate of Belize is subtropical, moderated by sea breezes along the coast. The average annual temperature is about 26.1° C. The total annual rainfall increases from north to south and averages about 1800 mm. A rainy season extends from May to February.

Coral barrier reefs and numerous cays (islets) fringe the Caribbean coastline. The Belizean barrier reef is the second largest in the world after the Australian. Although there is no firm estimate regarding the total area of coral reefs in the country, 65 species of corals have been identified. The principal streams are the Belize River; the Hondo River, which forms much of the boundary with Mexico; and the Sarstún River, which forms the southwestern boundary with Guatemala.

Forests cover more than half the area of Belize. Deciduous trees are found in the north; tropical hardwood trees predominate in the south. Principal species include the commercially important mahogany, cedar, and rosewood, as well as pine, oak, and palms. Mangrove swamp vegetation is found along the coast and in 1989 regulations to protect mangroves were drawn up, so that a permit is required for mangrove clearing. Belize has approximately 190, 000 acres of mangroves and about 90 to 95% are estimated to be still intact. 801,598.6 acres of Belize's total area has been designated in some category of protective status, but of the total 26 protected areas, 16 are still without any formal type of management. [8]

There are 16 major watersheds in Belize which are critical to ensure the country's water supply and the health of the mangroves and coral reefs. [8]

According to the World Conservation Monitoring Centre (WCMC) Belize has 125 species of mammals, 533 of birds, 107 of reptiles and 32 Amphibian and there is a total of 2,750 of flowering plants, 134 of ferns and 150 of endemic species of higher plants. [9] Important endangered species found in Belize are green turtles (*Chelonia mydas*), jaguar (*Panthera onca*), howler monkey (*A. Villosa*),ocelot (*Felis pardalis*), giant anteater (*Myrmecophaya tridactyla*) , margay (*Felis wiedii*), Central American tapir (*Tapirus bairdii*)and hawksbills (*Eretmochelys imbricata*) and Belizean Morelet (*Crocodylus moreletti).* Vulnerable species are manatees (*Trichechus manatus*), *Crocodylus acutus* and loggerheads (*Caretta caretta*). [8][4]

Economics:

Agriculture constitutes 17% of the gross domestic product (GDP), while fisheries constitute only 2,6%. The main crops are sugarcane, citrus and bananas. Until the 1980's the citrus production was concentrated in the Stann Creek Valley, but since then it has expanded to steep slopes and the use of agrochemicals has increased substantially. Banana production concentrates in Stann Creek and Toledo districts with a total area of 2,400 hectares. [2]

Tourism contributes about 15% of the GDP, within which ecotourism plays an important role. In 1994 it was estimated that about 65% of the tourist that visit Belize practice water sports and 19% go fishing. The average stay of tourists is 8 nights per visitor. [8]

Rural poverty is intense in the Southern Districts of Toledo and Stann Creek. In the rural areas it has been estimated that there are 40% of poor people and 20% in the urban areas.

In 1994, 33% of the earnings of the fishery industry were generated through six aquaculture farms located along the mainland coast. [6]

Identification and Assessment of problems:

The main environmental problems of Belize are water pollution and water shortage; soil erosion and degradation; deforestation; loss of biodiversity; coastal development; urban development; energy sources and industrial pollution. [4] (See table 1)

Surface waters are being polluted in particular by agricultural run-off, domestic wastewater and waste, industrial wastewater and waste, and transboundary pollution from Mexico and Guatemala. Each catchment area is affected by different sources of pollution. [8]

Sugar processing and improper disposal of citrus rinds leads to water pollution. Surface water contamination with nutrients (See Table 2) and pesticides is perceived as an increasing problem and the largest source is probably agricultural runoff. In 1994 the total amount of fertilisers used was 270Kg/acre in comparison with 170 kg/acre in

1987. These amounts of nutrients are causing eutrophication of the coastal zone and the estuaries. Although Belize adopted the Pesticides Control Act in 1985, owing to lack of funding by the office responsible of implementing the Act, it is not clear what are the amounts and types of pesticides that are being used. [8]

Table - 1- Major Problems Affecting the Marine, Coastal and Freshwater Environments of Belize by Level of Importance

Problem	Comment
Water Pollution and Water Shortage	Excessive organic effluents, high counts of bacteria, coliforms and yeast.
	Fish kills and threats to human health
	Use of pesticides and herbicides like DDT and paraquat
	Oil from sugar factories
	Cyanide from a zinc roofing and nail factory
	Citrus fruit and banana waste
	Oil exploration
Soil Erosion and Degradation	Coastal erosion due to sand mining
	Heedless slash-and-burn farming
	Expansion of citrus plantations
Deforestation	Stann Creek District – Citrus plantations
	Annual deforestation 0.3% in 1983
Biodiversity	High but at risk with accelerated development
Marine living resources	Human impacts poorly studied.
	Clearing of mangroves for tourism, industry, etc.
	Lack of sewage treatment and solid waste disposal
Urban environment	Solid wastes from domestic and tourist sources, as well as hospitals
Industry	Dumping of organic matter
	Packaging of bananas, plastics, etc.
	Heavy use of chemicals
	Fish kill in New River related to sugar factories
Energy issues	Kerosene and butane generated 80% of energy source for household cooking in 1980

Source: Belize Environmental Synopsis 1993 [4]

Table - 2 - Estimate of Nitrate and Phosphate Loads into Surface Waters by Banana and Citrus Production in the District of Stann Creek (1994)

Agricultural Production	Area ha	Phosphates loads ton/year	Phosphates loads (%)	Nitrate loads ton/year	Nitrate loads (%)
Banana	1960	64	65	520	48
Citrus	6975	35	35	488	52
Total	8935	99	100	1008	100

Source: World Bank, Belize Environmental Report (1996) [8]

The expansion of the agriculture sector is being done at the expense of the forested areas. More than half of the solid wastes produced in Belize is generated by the sugar and citrus industry. (See table 3). [8]

Table – 3 - Estimates of the Amount of Waste Produced in Belize

Waste Type	Production (tons/year)	%
Municipal Solid Waste[a]	63,000	36
Industrial waste	110,000	63
Sugar[b]	40,000	21
Citrus[c]	72,000	42
Hazardous waste	No data	<1
Waste Generated by Tourists[d]	3,000	1
Ship generated waste	700	<1
Total	166,700	100

Source: Belize Environmental Report, World Bank (1996) [8]

a. Estimation of average production per capita of 0.8 kg/cap/day (PAHO, 1993)
b. Gillet, 1996
c. Hanskoning, 1993
d. Estimate of waste production per tourist: 2 kg/cap/day (PAHO 1993)
e. Estimates according the department of Environment – Belize

Industrial solid waste represents 63% of the total waste generated in Belize. It has been estimated that each resident produces about 0.8Kg/day. Hazardous waste consists of infectious waste from hospitals and some industrial waste that has not been determined yet. Solid waste represents a serious threat to the environment. [8]
Only 75% of the urban population and 35% of the rural populations are served with adequate sanitation or waste collection and disposal facilities. The sewage from Belize City is pumped to two facultative lagoons, which provide removal of 80%-85% of BOD. Belmopan has a sewer system that consists of two pumping stations that pump the water into a non-functional treatment plant, which discharges 95% of the raw sewage into the Belize River. In San Pedro a project is being carried out to treat the sewage from households and hotels in ponds before discharging it into the ocean. About 40% of the population is not connected to this new system. [6]
Owing to the serious sanitation deficiencies and the poor access to potable water, mainly in the rural areas, infectious diseases are common in Belize. In 1992 and 1993 there were two outbreaks of cholera and gastro-enteritis, along with a widespread prevalence of hepatitis A. Malaria, dengue, filariasis and leptospirosis are also reported. These diseases had a high economic cost for the country. (See table 4)

Table – 4 - Estimated costs of selected diseases, 1991 and 1995 (US$)

Problem	Diseases	Total cases 1991	Total cases 1995	Hospital cost	Labour cost	Total 1991	Total 1995
Water & Sanitation	Gastro-enteritis	1,623	925	0	19,638	19,638	11,200
Water & Sanitation	Cholera	156	18	4,212	11,148.5	15,360.5	1,300
Vector	Malaria	3,706	9,417	83,385	225,960	309,345	785,000
Crowding	TB	89	68	60,075	21,240	81,495	62,500
Total		**5,574**	**10,428**	**147,672**	**278,166.5**	**278,166.5**	**860,000**

Source: Belize Environmental Report (1996)[8]

Emerging issues:
The aquaculture sector is growing rapidly, as well as tourism. Belize's Government is working hard to achieve sustainable growth, but if this is done too quickly and without taking some precautionary measures the impact on the resources can be huge.

Priorities for Action:
Actions such as strengthening land-use management; improving waste management; reducing deforestation and unsustainable agricultural practices; strengthening legal and institutional capacity; enhancing integrated coastal zone management and improving water resources management have been identified by the Government as the main priorities. Other priority actions are to expand the use of financial mechanisms for environmental and natural resources management; to improve health conditions; to break the poverty-environmental degradation cycle and to develop a conservation strategy for tourism. The Government has developed five draft projects to deal with all these priorities and according to the timetable they must be under execution at present. [6]
It is evident that the Government of Belize has taken extremely important measures during these last few years to prevent environmental degradation. The priority now would be to train Government officials, secure the necessary funding and develop the required institutional structures that will ensure the implementation of all the priority actions.

Measures taken:
A comprehensive Environmental Protection Act was enacted at the beginning of 1993. In 1995 the Protected Areas Conservation Trust Act was passed and through this mechanism it is expected to generate sufficient financial resources to protect and enhance the natural resources of Belize. [6]
In table 5 there is a list of the most recent and relevant environmental laws. [8]

Table - 5 - Environmental Laws

Environmental Protection Law	Date	Regulations
Environmental Protection Act	1992	EIA procedures prepared; EIA regulations; effluent regulations and pollution regulations; hazardous waste regulations drafted
Public Health Act	1983	Removal and accommodation of refuse
Pesticides Control Act	1985	Registered and restricted pesticides regulations
Prohibits dumping of substances at sea by vessel	1974	None
Water and Sewerage Act	1971	Contamination of water
Solid Waste Management Authority Act	1991	None
National Parks System	1981	None
Wildlife Protection Act	1981	Wildlife Protection
Protected Areas Conservation Trust	1995	Financial mechanism for the protection of natural resources
Mines and Minerals Act	1988	Mines and minerals regulations; safety and environment
Petroleum Act	1991	Petroleum regulations
Land Utilisation Act	1981	None
National Lands Act	1992	National Land Rules

Source: Belize Environmental Report (1996) [8]

UNDP/GEF provided funding in 1993 to the Coastal Zone Management Unit and the reef's designation as one of the "Seven Underwater Wonders of the World." [8]
In 1996 an effluent regulation was implemented and the polluters should monitor pollution from industrial and commercial sources. Additionally a license is required to discharge the effluent and jointly with the Government the polluters decide on yearly improvement goals. [6]
By the end of 1998 the solid waste management plan undertaken with Inter-American Development Bank (IDB) funds should be finalised. [3]
Several detailed projects have been drafted as part of the strategy to fully implement the priority actions mentioned-above. (See table 6)

Table – 6 – List of Projects

Project	Cost (US$)
Improving Solid Waste Management	3,000,000
Improving Water Resources/Quality Management and Monitoring Programme	300,000
Legal and Institutional Development	150,000
Public Awareness	300,000
Comprehensive Land Use Plan	600,000
Total	1,650,000

Source: NEAP (1996) [6]

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] Inter-American Development Bank, (1996). Solid Waste Management Project, Belize. Washington, D.C., USA.

[4] IUCN, (1993), Environmental Synopsis – Belize. IUCN, Gland, Switzerland.

[5] The Government of Belize, (1992). The Belize National Report to the Conference on Environment and Development.

[6] The Government of Belize, (1996). National Environmental Action Plan.

[7] The World Bank, (1992). Caribbean Region – Current Economic Situation, Regional Issues, And Capital Flows, 1992. Washington, D.C., USA, 1992.

[8] The World Bank, (1996). Belize Environmental Report. Washington, D.C., USA, 1996.

[9] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

British Virgin Islands (United Kingdom)

Population: 19,000 [4]
Natural Resource Base:
The British Virgin Islands (BVI) is a group of 50 islands east of Puerto Rico forming part of the Lesser Antilles. The capital and only town in the group is Road Town and Tortola is the largest island of the group. [2]
BVI is composed of rolling hills and beaches. Most of the islands are volcanic; the highest point in Tortola is 521m. Anegada is a low-lying coralline island. [2]
The climate in BVI is sub-tropical with average temperatures of 26-31° C during the summer and 22-28°C during the winter. The annual average rainfall in BVI is 684mm. [2]
There are 14 National Parks in the BVI and there is international recognition in terms of leadership in protected area management. The BVI National Parks Trust was established in 1961. [2]

Economics:
Tourism is the main sector of the economy, which contributed in 1987 with 25.2 of the gross domestic product (GDP). [2] Construction, financial services and service industries also play an important role. Agriculture contributes with less than 10% of the GDP. [4]

Identification and Assessment of Problems:
Owing to the accelerated development of tourism in the 80's coastal resources were rapidly becoming depleted. There was widespread beach erosion due to beach sand mining, loss of mangroves, coral reefs and seagrass beds, and pollution with solid and liquid waste. [2]
Soil erosion due mainly to construction development and deforestation; air pollution due to mining operations; and dumping of trash into the sea were reported in 1990. [1]

Emerging issues:
The economy of BVI is expected to maintain its upward swing, with continued growth in its key sectors. Several major infrastructure projects for the next few years, particularly in the tourism sector will be built. [4]

Priorities for Action:
BVI is recognised internationally by its efforts in maintaining a healthy environment, however, full implementation of the existing regulations seems to be the priority to avoid pollution and deterioration of the coastal areas.

Measures taken:
Between 1987 and 1991 the Coast Conservation & Management Act was drafted, and pollution of the coastal zone from any source was to be prohibited. However, the bill was rejected in 1991 and sent back for redrafting.
BVI has made lots of progress during the last ten years in institutional strengthening to manage its coastal areas in an exemplary way. The Conservation and Fisheries Department was created in 1990 and by 1992 they had a staff of 12 persons, with specific functions regarding environmental planning and monitoring, beach maintenance and management, fisheries management, environmental education and awareness and surveillance, enforcement and legislation. [3]
Between 1992 and 1993 the Government of the United Kingdom provided the funding to prepare a coastal inventory, which shows coverage, type and health of each ecosystem. [3]

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Cambers, Gillian. Coastal Legislation in the British Virgin Islands. Coastlines of the Caribbean. Seventh Symposium on Coastal and Ocean Management. Published by the American Society of Civil Engineers, New York, New York, 1991.
[3] Cambers Gillian. Coastal Zone Management in the Smaller Islands of the Eastern Caribbean, An assessment and Future Perspectives. Eighth Symposium on Coastal and Ocean Management. Published by the American Society of Civil Engineers, New York, New York, 1993.
[4] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

Colombia

Population: 35,000,000 [3]
Natural Resource Base:
Colombia is situated in the north-western part of the continent, and bounded on the north by Panama and the Caribbean Sea, on the east by Venezuela and Brazil, on the south by Peru and Ecuador, and on the west by the Pacific Ocean. Colombia is the only country of South America with coasts on both the Caribbean Sea and the Pacific Ocean. The total land area of the country is 1,141,748 sq. km. The capital and largest city is Bogota. [4]

The distinguishing topographical feature of Colombia is the Andes mountain chain, situated in the central and western parts of the country, and extending north south across almost its entire length. The Andes comprises three principal and parallel ranges: the Cordillera Oriental, the Cordillera Central, and the Cordillera Occidental. On the Caribbean coast is the isolated mountain mass known as the Sierra Nevada de Santa Marta, which includes Colombia's highest peak at Pico Cristóbal Colón (5775 m). [4]
The principal river of Colombia, the Magdalena, flows north between the Cordillera Oriental and the Cordillera Central, across practically the entire country, emptying into the Caribbean after a course of about 1540 km. The coastline of Colombia extends for about 1760 km along the Caribbean. [4]
The climate varies with the elevation. The low regions along the coast and the deep Magdalena River valley is torrid, with average annual temperatures of 24° to 27° C. From about 500 to 2300 m the climate is subtropical, and from about 2300 to 3000 m it is temperate. Above about 3000 m is the cold-climate zone, where temperatures range from -18° to 13° C. In the Caribbean coast the average annual rainfall is about 800 mm. [4]
The indigenous flora and fauna of Colombia are as varied as the topography. Mangroves and coconut palms grow along the Caribbean coast, and the forest regions, which cover about one-half of the country, include such commercially useful trees as mahogany, lignum vitae, oak, walnut, cedar, pine, and several varieties of balsam. Tropical plants also yield rubber, chicle, cinchona, vanilla, sarsaparilla, ginger, gum copal, ipecac, tonka beans, and castor beans. [4]
Among the wildlife are the larger South American mammals, such as jaguars, pumas, tapirs, peccaries, anteaters, sloths, armadillos, and several species of monkey and red deer. Alligators, once numerous along the principal rivers, have been intensively hunted and are becoming scarce in the wild. Many varieties of snakes inhabit the tropical regions. Bird life includes condors, vultures, toucans, parrots, cockatoos, cranes, storks, and hummingbirds. [4]
The main cities in the Caribbean region are Barranquilla (1,033,951), which provides both a seaport and a major international airport, Cartagena (707,092), a seaport and an oil pipeline terminal, and Santa Marta (594,150), a seaport. [5]

Economics:
Colombia is primarily an agrarian nation, although it experienced rapid industrial growth in recent decades. [3&5]
While coffee is Colombia's leading agricultural product, the country's diverse climate and topography permits cultivation of a wide variety of other crops. In addition to coffee Colombia produces cacao beans, sugarcane, bananas, tobacco, cotton, and cut flowers. [3]
The coastal waters and many rivers and lakes of Colombia provide a variety of fish, notably trout, tarpon, sailfish, and tuna. The total catch in the early 1990s was about 108,700 metric tons annually; about one-quarter of which consisted of freshwater species of fish. [5]
The mineral resources of the country are varied and extensive. Colombia is the major world source of emeralds. Petroleum and gold are Colombia's chief mineral products. A number of other minerals are extracted, including silver, emeralds, platinum, copper, nickel, coal, and natural gas. Production of crude petroleum is centred in the Magdalena River valley, about 650 km from the Caribbean, and in the region between the Cordillera Oriental and Venezuela; it amounted to about 160.4 million barrels per year in the early 1990s. Much of Colombia's oil is shipped to Curaçao for refining. [3]
Colombia is one of the world's leading exporters of coal. Two-thirds of an annual production of 21.7 million metric tons comes from a single open-pit mine; the world's largest, on the Guajira Peninsula. (Northern part of the Caribbean region) [5]
The manufacturing industries account for about 21 percent of Colombia's yearly national output with cotton-spinning mills, foodstuffs, tobacco products, iron and steel, and transportation equipment. Chemical products are becoming increasingly important, and footwear, Panama hats, and glassware are made. [3]

As of 1989, Colombia had established 37 conservation units under the National Parks System; eight of these are located in the Caribbean region. According to CORPES, in 1992 there were 13 areas under some kind of protection status in the region. [5]

Identification and Assessment of Problems:

According to CORPES (1992), the major environmental problems of the Colombian Caribbean are pollution from industrial and domestic sources and degradation of the coastal areas. Poverty is a very serious issue in this area of Colombia. Although it has been estimated that 22,4 of total Colombian population lives below the poverty line, in the case of the Caribbean region, CORPES estimated that 38,4% of the population lives below the poverty line. It was estimated that 60% of the population is unable to satisfy its basic needs, in comparison to a 45% average for the whole country. [5]

It is important to note that 10% of the manufacturing industry of Colombia is located in Barranquilla and Cartagena and according to CORPES the most polluting ones, in order of priority are chemical, metallurgic, petrochemical, silica and limestone, food stuffs, tanning, wood transformation, cotton and textiles, radioactive substances, ozone depleting substances, and beverages. [5]

Cartagena Bay is the area most studied in the Colombian Caribbean coast. In the period 1983-1988 with UNEP's support several studies were carried out to identify the types and magnitude of land-based sources of pollution. In 1996 within the Global Environmental Facility project for most polluted bays in the Caribbean, CARDIQUE made an analysis of volumes and types of pollutants being discharged by the industry in Cartagena Bay. (See table 1). [2]

Table 1- Pollutants Load from Industrial Sources, Cartagena Bay

Organic matter (BOD)	6.24 Ton/d
Suspended solids	11.34 Ton/d
Oil and grease discharges	0.99Ton/d
Nutrient Discharges (TN)	2.10 Ton/d
Nutrient Discharges (TP)	0.16 Ton/d
Chromium	15.45 Kg/d
Phenols	68.80 Kg/d

Source: CARDIQUE (1998) [2]

Regarding sewage from domestic sources, CARDIQUE estimated that a total of 41,900 cubic meters per day are discharged to the bay. Total amount of pollutants is presented in table 2. [2]

It is important to note that the load of pollutants generated by the industry in Cartagena bay decreased substantially between 1995 and 1996, as a result of the Clean Production Agreement signed at the end of 1995. About 80% of the industries count with a sewage treatment plant in Cartagena bay. In the case of phenols, for example, the amount discharged in 1995 was 257.9 kg/d, which represented a reduction of 73.43% in one year. ECOPETROL, the Colombia's state-owned Oil Company was the largest contributor of pollutants in 1996 from the refining operation, despite a considerable improvement regarding suspended solids that showed a decrease of 88.88% and of BOD of 50.76% from the 1995 values. (CARDIQUE, 1998). (See Table 3). [2]

Table 2 – Pollutants Load from Domestic Sources in Cartagena Bay

Chloride	24.07 ton/d
Sodium	12.76 ton/d
Potassium	0.92 ton/d
Ammonia Nitrogen	2.27 ton/d
Nitrate	0.73 ton/d
Total Solids	76.91 ton/d
Total Suspended Solids (TSS)	7.75 ton/d
Total Dissolved Solids (TDS)	69.16 ton/d
Biological Oxygen Demand (BOD)	8.29ton/d
Chemical Oxygen Demand (COD)	14.82 ton/d
Detergents	0.045 ton/d
Oil and Greases	2.55 ton/d

Source: CARDIQUE (1998) [2]

Table 3 – Total Load of Pollutants 1995-1996

Parameter	1995 (kg/d)	1996 (kg/d)
Phenols	257.9	68.53
Biological Oxygen Demand (BOD)	14,404.48	6,322.22
Total Suspended Solids (TSS)	18,183.36	11,338.53
Chemical Oxygen Demand (COD)	25,164.45	16,338.75
Oil and Greases	7,145.70	1,046.01
Nutrient Discharges (TN)	18,054.39	2,375.19

Source: CARDIQUE (1998) [2]

Although sewage systems and solid waste management systems in Colombia do not cover much of the population the case of the human settlements located in the Caribbean coast is worse than the average in the rest of the country. According to CORPES (1992), 24% of the population of the region is connected to the sewer system. The solid waste situation is similar as only 60% of the population is covered but the refuse is dumped in landfills that are not properly managed and leaching of pollutants have been detected in a landfill in Barranquilla. CORPES estimated that the region generates about 1,203 tons/d of solid waste. [5]
Building of big infrastructure projects such as roads and oil and gas pipelines have had serious impacts on the coastal areas and in particular in coastal lagoons.

Emerging issues:
The port city of Barranquilla has commissioned the design of a maritime terminal in an attempt to enter the cruise trade. Cartagena was the city that received more tourists in 1996 and is also promoting the concept of becoming a home for cruise ships. [3]
Steag, Germany's largest operator of coal-fired powers plants, plans to build a $200 million bituminous coal-fired station in Colombia. If this is done in the Guajira Peninsula, nearby Cerrejon (world's largest open pit coal mine) extreme precautions should be taken as this is an arid area with a very vulnerable ecosystem. [3]

Priorities for Action:
A comprehensive coastal zone management plan defining areas to be protected and areas to be used for diverse economic activities and provision of raw materials and services appears to be the main priority.
Although the requirement of Environmental Impact Assessments has been in place since 1970, and a very comprehensive regulation was adopted recently, it is extremely important that the Government ensures that the recommendations contained therein are fully implemented and a very tight monitoring of obligations is performed on all development projects.
Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off. Establishment of a continuous monitoring system of the pollution status by agrochemicals of coastal and marine waters, sediments and organisms is a priority.
Building of adequate solid waste disposal facilities and improvement of the sewage system is a priority, as well as the implementation of a strategy to deal with hazardous wastes generated by heavy industry and the hospitals.
Implementation of the recommendations made by CARDIQUE is of paramount importance to ensure the improvement of the water quality of Cartagena Bay and its surroundings.
Adopting a Clean Production Agreement with the industrial sector in Barranquilla could contribute substantially to the improvement of the environmental quality of the area, as about 67.1 % of the regional industry is located in this city.

Measures taken:
On 29 September 1995 an agreement for clean production was signed between the Ministry of Environment, CARDIQUE (Corporación Autónoma Regional del Canal del Dique), DAMARENA and the Mamonal Foundation (73 industries located around Cartagena Bay). [2]
ECOPETROL improved the aeration system of the Skim Pond in 1996 to comply with CARDIQUE's requirement regarding its load of pollutants and is expected to invest $300 million in the next few years modernising its operation. [2]
The Inter-American Development Bank (IDB) has recently provided $ 10 million for a sewer system for Cartagena and the World Bank is negotiating a Cartagena water supply, sewerage and environmental clean up project. [6]

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] CARDIQUE (1998). Estudio de caso: Bahía de Cartagena, Colombia. Proyecto Regional de Planificación y Manejo de Bahías y Zonas Costeras fuertemente Contaminadas del Gran Caribe. Proyecto GEF/RLA/93/G41. Cartagena, Colombia.

[3] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[4] CORPES (1992). El Caribe Colombiano: realidad ambiental y desarrollo. Santa Marta, Colombia.

[5] INDERENA (1989). A Guide to the National Parks System of Colombia. Bogota, Colombia.

[6] Inter-American Development Bank (1998). Cartagena Sewer System Project. Washington, DC., USA.

[7] IUCN, (1993). Environmental Synopsis Colombia. IUCN, Gland, Switzerland.

Costa Rica

Population: 3,500,000 [3]

Natural Resource Base:

Located in southern Central America, bounded on the north by Nicaragua, on the east by the Caribbean Sea, on the south-east by Panama, and on the south-west and west by the Pacific Ocean. The total area of Costa Rica is 51,060 sq. Km of which about 28% have been designated national forest, park or reserve. [4]

Most of Costa Rica is rugged highlands, about 915m to 1830 m above sea level. Several mountain ranges extend nearly the entire length of the country. These include the Cordillera de Talamanca, Cordillera Central, and Cordillera de Guanacaste. The highest peaks are Chirripó Grande (3819 m) and the active volcano of Irazú (3432 m). A central plateau, the Meseta Central, is located between the ranges and contains the bulk of the population. The Caribbean coast is flat and approximately 212 Km long. The principal stream of Costa Rica is the San Juan River, which forms part of the country's boundary with Nicaragua to the north. [4]

The climate of Costa Rica ranges from tropical on the coastal plains to temperate in the interior highlands. Average annual temperatures range from 32° C on the coast to 17° C inland. A rainy season lasts from April or May to December. Annual precipitation in the country averages about 2540 mm. [4]

Good agricultural soils in Costa Rica are concentrated in the Meseta Central and in the river valleys. About one-third of the total land area is covered by forest, much of which is commercially productive. Fishing for tuna, sharks, and turtles is carried out along the coast. Waterpower is abundant and is used to generate electricity for industrial operations. [4]

Costa Rica's forests contain rich stands of balsa, mahogany, and cedar. More than 1000 species of orchids are found in Costa Rica. Wildlife is abundant and includes puma, jaguar, deer and monkeys. According to the World Conservation Monitoring Centre (WCMC) Costa Rica has 205 species of mammals, 850 of birds, 214 of reptiles and 162 amphibian and there are a total of 11,000 flowering plants, 1,100 ferns and 950 endemic species of higher plants. [7]

The capital is San Jose, with an estimated population in 1991 of 296,625. Important cities are Puerto Limón (population, 1991 estimate, 67,784), a trading centre and one of the country's principal ports; Puntarenas (92,360), a major Pacific seaport; and Alajuela (158,276), a centre for the production of coffee and sugar. [4]

Economics:

The agricultural sector contributed in 1996 $2,856.4 million while the industry, mining exploitation, and quarries generated $ 3,239 million, and the commerce $ 2,675 million. Other important sectors are transport, communications and financial services. [2]

98% of the fish catch originates from the Pacific Ocean, fleets are located in Guanacaste, Golfo de Nicoya y Golfito. The artisanal, semi-artisanal or advanced and industrial. Scale fish such as sea bass, cabrillas, snapper, mackerel, sole, barracudas, sharks and tuna fish are caught. The spine lobster (*Panulirus argus*) is more important in the Caribbean where is practically the only important resource, mainly in Barra del Colorado where there are about 67 fibre glass boats. There are oceanographic limitations, of water productivity and experience and capacity of the fleet that causes a low catch. [Fax comm., E. Cyrus].

About 10 percent of Costa Rica's land area is under cultivation. Apart from banana plantations, most of the agricultural landholdings are small. Coffee, one of the most valuable crops, is cultivated mainly in the central plateau. Bananas are raised in the tropical coastal regions on plantations. [3]

Gold and silver are mined in the western part of Costa Rica. Deposits of bauxite, manganese, nickel, mercury, and sulphur are largely unexploited. Newly discovered reserves of petroleum and natural gas are being exploited. Salt is produced from seawater. [3]

Assessment of the problem:

According to the report submitted by the Government of Costa Rica to UNCED (1992) the main problem of the marine and coastal areas is pollution by organic matter, bacterias, debris, agrochemicals and oil spills. In 1991 an inventory of land-based sources of pollution was performed in the Costa Rican Caribbean, using the methodology proposed by the World Health Organisation (WHO). (See Table 1) [6]

Table 1 – Sources of Liquid Waste, 1991 (ton/year)

Process	BOD	SS	Greases	N	P	Phenols	Sulphurs
Abattoirs	5,256	4,198	2,117	365	263		
Beverages	4	1.4					
Manufacture of Cardboard	599	1,200					
Refinery	496	171	21	482		6.8	3.2
Sewage	202	318		53	6.2		
Septic Tanks	328	761		157	19		
Total	6,889	6,651	2,138	1,057	288	6.8	3.2

Source: QTEC (1997)

The study performed in Puerto Limón within the UNDP/GEF (Q. TEC. 1997) stresses that the main pollution problems in this area are solid waste, domestic sewage, industrial effluents, oil pollution, agrochemicals and sedimentation. In the Limón area it was estimated that the solid waste generated by households is 22.4 ton/day of which only 11.8 ton/day are managed, while the industry generates 605 kg/day of which 302 kg are managed and the hospitals produce 41.4 kg. [6]

Another serious problem in the Caribbean region is a large load of sediments due to deforestation in the upper parts of the country. [6]

The use of agrochemicals such as copper, lindane, dieldrin and paraquat for the banana plantations, arsenic in the coffee areas and ametrine in the areas where sugar cane is planted is generalised. Although the use of some of these chemicals has been prohibited for several years, it is been proven that they can stay on the soils for about 20 years. In the OAS/UNEP report it is stated that in 1993 Costa Rica imported almost 5,000 tons of 30 different types of pesticides. [5]

Between 1987 and 1988 a study about pesticides was carried out, and in 12 water samples of 77, residues of organochlorine and organophosphate were found. The fungicide chlorothalonil was detected up to 11 ug/l. In fish samples the most common agrochemicals were DDT, aldrin, dieldrin, lindane, heptachlor, and hexa-chloro-benzene. Paraquat was detected in levels between 2 and 44 mg/kg in soils and sediments, in banana plantations. (Q.TEC. 1997) [6]

The ports of Puntarenas, Moín and Aleman, in Limón show serious pollution with bacteria. Puntarenas and Limon have been designated cholera prone areas. The maximum concentration of faecal coliforms on the beaches of Limón (1981-1995) was of 240,000/100 ml in Cienaguita. In the municipal beach a maximum of 24,000/100 ml was found in 1989 and in 1996 AyA found 35,100/100 ml, which exceeds the bathing standard. The figures for the municipal beach contributed by the Instituto Costarricense de Acueductos y Alcantarillados differ substantially from the above figures, giving a maximum of 11,000/100 ml in 1987 dropping to 430/100 ml in 1990. (Q.TEC, 1997). Table 2 shows average pollution in the rivers of the Limón area. [6]

Table 2– Average Water Quality in the Rivers of the Limón Area (1991)

River	SS (mg/l)	BOD (mg/l)	P (mg/l)	N (mg/l)	Faecal Coliforms (bact/100 ml)
La Estrella	356	3.4	0.17	0.74	2,400
Banano	2,085	5.0	0.04	0.82	9,300
Bananito	25	7.9	0.17	0.70	930
Limoncito	111	6.2	0.12	1.1	1.2×10^7
Moín	10	15	0.34	0.68	1,400
Reventazón	175	7.9	0.16	1.3	93,000
Pacuare	59	3	0.17	0.70	9,300
Tortuguero	20	3.9	0.04	0.70	900

Source: Q.TEC Soluciones Ambientales. (1997)

In the report to UNCED it is stated that there are no reliable data on types and amounts of pollution in the coastal areas. It further stresses that solid waste is also a serious problem in the whole country and only 46% of the refuse is disposed in authorised sites which do not count with minimal technical considerations. Regarding types, amounts and disposal techniques of hazardous waste generated in Costa Rica there is not much information. [4]

Table 3 shows levels of pollution in 1996. It is evident from tables 2 and 3 that the Limoncito River, the most important one in the region, is also the most polluted one.

Table 3– Average Water Quality in the Rivers of the Limón Area (1996)

River	SS (mg/l)	BOD (mg/l)	P (mg/l)	N (mg/l)	Faecal Coliforms (bact/100 ml)
Banano	177	6.4	0.08	4.7	930
Bananito	33	2.4	0.07	12	2,400
Limoncito	2	34	0.09	36	1×10^7
Moín	14	21	0.05	21	3,900

Source: Q.TEC Soluciones Ambientales. (1997)

Oil pollution is also a problem mainly in the area close to the refinery and north of the harbour, where the average amount of hydrocarbons is 22.1 ug/l and 11.6 ug/l, respectively. The average for the riverine waters in the Costa Rican Caribbean is 4.86 ug/l, although in the analysis carried out in the Moin river in 1997 the average concentration of hydrocarbons was 1.28 ug/l. [6]

Emerging issues:
The Government of Costa Rica is providing a set of impressive tax benefits to businesses related to tourism, therefore a considerable increase of this sector is expected in the next decade. [2]

Priorities for Action:
Comprehensive environmental legislation and national environmental policies have been adopted in recent years and the enforcement of these two seems to be the main priority. A comprehensive coastal zone management plan defining areas to be protected and areas to be used for diverse economic activities and provision of raw materials and services appears is an important priority. [4]
Environmental Impact Assessments are a requirement since 1995 and it is extremely important that the Government ensures that these are performed for all development projects and the recommendations contained therein are fully implemented.
Implementation of the recommendations made as a result of the study UNDP/GEF is of paramount importance to improve the quality of the coastal waters in Puerto Limón. Building of adequate waste disposal facilities and improvement of the sewage covering all urban and rural areas in the Caribbean coast, as well as the implementation of a strategy to deal with hazardous wastes generated in the country system is a priority.
The design and the implementation of a detailed and continuos monitoring programme is of paramount importance to assess the quality of the coastal waters.

Measures taken:
The Government and the IDB are negotiating a loan for a total of $25 million towards the conservation and management of natural resources, development of ecotourism and a related public awareness campaign. [2]
In October 1992 the Wildlife Conservation law was adopted. This law prohibits discharges of polluted effluents from any source into watercourses. In 1994 the Fisheries Institute of Costa Rica (INCOPESCA) passed the fisheries and aquaculture law through which use and management of all living marine resources is controlled. In 1995 a Decree was issued establishing water quality standards, monitoring and reporting mechanisms. That same year the general environmental law was adopted, including issues such as environmental impact assessments, hazardous wastes, and solid wastes and effluents management. [4] The biodiversity Law has been enacted as well as the necessary legislation. [Fax comm., E. Cyrus]
Costa Rica has had a successful experience with the coastal management plan of Gandoca Manzanillo. [Fax comm., E. Cyrus]
Six marine areas of multiple use have been created (AMUMs): North Caribbean, South Caribbean, North pacific, Golfo de Nicoya (Pacific ocean), South Pacific and Isla del Coco (Pacific Ocean). [Fax comm., E. Cyrus]
Some efforts have also been made regarding river basin management such as the Banano-Bananito, Sixaola. [Fax comm., E. Cyrus]
Costa Rica is a Party to the Biodiversity Convention, CITES and the Trans-zonal and highly migratory species Convention. [Fax comm., E. Cyrus]

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Banco Central de Costa Rica. Estadísticas económicas. San Jose (1997)

[3] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[4] Centro de Estudios Ambientales y Políticas (CEAP) & Fundación Neotropica (1991). Informe Nacional de Costa Rica para la Conferencia de las Naciones Unidas para el Medio Ambiente y el Desarrollo "ECO 92". San José, Costa Rica.

[5] OEA, PNUMA, Gobierno de Costa Rica & Gobierno de Nicaragua (1997). Estudio de Diagnóstico de la Cuenca del Río San Juan y Lineamientos del Plan de Acción. Washington, DC. , 1997.

[6] Q.TEC Soluciones Ambientales S.A. PNUD/FMAM- Proyecto Regional GEF/RLA/G41, Planificación y Manejo de Bahías y Zonas Fuertemente Contaminadas del Gran Caribe". San José, Costa Rica, 1997.

[7] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Cuba

Population: 11,000,000 [2]

Natural Resource Base:

Cuba is the largest island of the West Indies, south of Florida of the United States and east of the Yucatán Peninsula of Mexico. It forms, with various adjacent islands, the Republic of Cuba. Cuba commands the two entrances to the Gulf of Mexico—the Straits of Florida and the Yucatán Channel. On the east, the Windward Passage, a shipping route between the North Atlantic Ocean and the Caribbean Sea, separates Cuba from the island of Hispaniola. The United States maintains a naval base at Guantánamo Bay in the southeast. Havana is Cuba's capital and largest city. [4]

The island extends about 1225 km from Cabo de San Antonio to Cabo Maisí, the western and eastern extremities, respectively. The average width is about 80 km, with extremes ranging from 35 to 251 km. The total area is 114,524 sq. km including the area of the Isla de la Juventud and of other islands of the republic. [4]

About one-fourth of the surface of Cuba is mountainous or hilly, the remainder consisting of flat or rolling terrain. The mountainous areas are scattered throughout the island and do not stem from a central mass. The principal ranges are the Sierra de los Órganos, in the west; the Sierra de Trinidad, in the central part of the island; and the Sierra Maestra, in the southeast. The first two ranges are under 914 m in height; the Sierra Maestra, which includes the Sierra del Cobre and Macaca ranges, is the greatest in altitude, mass, and extent, and contains Pico Turquino (2000 m) the highest point in Cuba. Most of the soil of Cuba is relatively fertile. [4]

The coast of Cuba is extremely irregular and is indented by numerous gulfs and bays; the total length is about 4025 km. The island has a large number of excellent harbours, the majority of which are almost entirely landlocked. Notable harbours are those of Havana, Cárdenas, Bahía Honda, Matanzas, and Nuevitas, on the northern coast, and Guántanamo, Santiago de Cuba, Cienfuegos, and Trinidad, on the southern coast. [4]

The climate of Cuba is semitropical, the mean annual temperature being 25° C. Extremes of heat and relative humidity, which average 27.2° C and 80 percent, respectively, during the summer season. The annual rainfall averages about 1320 mm. More than 60 percent of the rain falls during the wet season, which extends from May to October. The island lies in a region occasionally traversed by violent tropical hurricanes during August to October. [4]

The land and climate of Cuba favour agriculture, and the country also has significant mineral reserves. Nickel, chrome, copper, iron, and manganese deposits are the most important. Sulphur, cobalt, pyrites, gypsum, asbestos, petroleum, salt, sand, clay, and limestone reserves are also exploited. All subsurface deposits are the property of the government. [4]

Cuba has a wide variety of tropical vegetation. Extensive tracts in the eastern portion of the island are heavily forested. The most predominant species of trees are palms, of which there are more than 30 types, including royal palms. Other indigenous flora is mahogany, ebony, lignum vitae, cottonwood, rosewood, cedar, majagua, granadilla, jaguery, tobacco, and citrus trees. [4]

According to the World Conservation Monitoring Centre (WCMC) Cuba has 31 species of mammals, 342 of birds, 102 of reptiles and 41 amphibian; there are a total of 6,004 flowering plants, 495 of ferns and 3,229 of endemic species of higher plants. [5]

Economics:

The economy of Cuba has traditionally been dependent on the growing of sugarcane (one of the world largest producers) and the production and export of refined sugar, molasses, and rum. [2]

A second crop of commercial importance is tobacco, grown especially in Pinar del Río Province. Among other important agricultural products are coffee, citrus fruit, pineapples, rice, cacao beans, bananas, corn, plantains, cotton, potatoes, tomatoes, and pimientos. Cattle, hogs, horses, poultry, sheep, and goats are also raised in significant numbers. [2]

The fishing industry traditionally comprised small independent operators banded into co-operatives. The government, however, has developed a large deep-sea fleet. [2]

Except for the small output of its hydroelectric facilities, thermal plants using petroleum products, coal, or sugarcane wastes generate the electricity of Cuba. In the late 1980s the country had an electricity-generating capacity of 3.9 million kilowatts, and annual production totalled 16.3 billion kilowatt-hours. A nuclear installation is being built near Cienfuegos. [2]

Assessment of the problem:

According to the study carried out by the Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1997), the major environmental problems confronting Havana Bay are nutrients, solids, oil pollution, heavy metals and bacterias. [3]

Oil pollution is considered one of the most serious marine environmental problems, although is evident from tables 1 and 2 that oil pollution has decreased substantially since 1981. Despite this decrease, the present values are much higher than the proposed CARIPOL standards. Several major spills have occurred in the Region and Cuba has also experienced pollution of its beaches and coral reefs through the routine release of oily waters of passing ships. (See tables 1 and 2) In table 3 there are some estimates of oil pollution in various parts of Cuba. [3]

Table 1 – Average Hydrocarbons in Surface Waters in Havana Bay

1981-1985	1986-1990	1990-1995	1996
3.35 mg/l	1.34 mg/l	1.31 mg/l	0.69 mg/l

Source: Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1997) [3]

Table 2 – Average Hydrocarbons in Sediments in Havana Bay

1986	1990	1994	1995	1996
3,948 ug/g	3,528 ug/g	990 ug/g	834 ug/g	994 ug/g

Source: Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1997) [3]

Table 3 – Average of hydrocarbons in surface waters and sediments

Ecosystem	Water (mg/l)	Sediments (ug/l)	Ecosystem Quality
Havana Bay	0.69	994	Very Polluted
Santiago del Estero Bay	0.31	864	Very Polluted
North Coast of Havana City	0.23	327	Polluted
Matanzas Bay	<0.05	175	Polluted
Nipe Bay	<0.05	104	Low Polluted
Varadero-Cardenas Area	<0.05	78	Not Polluted

Source: Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1997) [3]

In 1990 Betz stated that approximately 70% of the sewage in all areas in Cuba had some sort of treatment before discharge and that all solid wastes were disposed in landfill facilities. [1] Despite this, the study of the Centro de Ingeniería y Manejo Ambiental de Bahías y Costas states that the majority of the sewage is discharged into Havana Bay without previous treatment, which explains the high level of ammoniac nitrogen, nitrate, nitrites, phosphorus and faecal coliforms. According the study the concentration of nutrients is so high that can cause eutrophication of the bay. The amount of suspended solids has also increased since 1986 when it was about 160 mg/l to about 220 mg/l in 1996. (See Table 4) [3]

Table 4 – Average Concentration of Nitrogen, Phosphorus and Faecal Coliforms in Surface Waters in Havana Bay

Ammoniac N (umol/l)	Nitrates (umol/l)	Nitrites (umol/l)	Phosphorus (umol/l)	Suspended Solids (mg/l)	Faecal Coliforms (N.M.P./100ml) May 1996
11.7	2.78	1.07	4.7	224,77	$2{,}4 \times 10^6$

Source: Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1997) [3]

Concentration of heavy metals from domestic and industrial sources has increased in the last three years with the exception of Iron, Lead and Zinc, posing a serious risk to human health and living marine resources, as shown in table 5. [3]

Table 5 – Heavy Metals in Sediments in Havana Bay

Metal	1994	1995	1996
Co	<3 – 14	3.7 – 25	3.9 – 29
Cu	75 – 260	66 – 289	28 – 239
Fe	1.41 – 4.09	2.1 – 4.88	1.13 – 4.22
Mn	137 – 465	167 – 490	147 – 655
Ni	24 – 228	26 – 244	25 – 275
Pb	65 –334	11 – 405	21 – 377
Zn	189 – 858	96 – 969	64 – 959
Organic Matter *	15.1 – 25.6	16.6 – 24.7	8.7 – 22.2

*in percentage.

Source: Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1997) [3]

Emerging issues:

During 1996 the tourist industry grew by 50% and the nickel production was increased by 31%. In that same year Cuba's spiny lobster production represented almost 20% of the world total production. Shrimp production grew by 37% in 1996 and it is expected to grow an extra 50% in 1997. [2] A proposal to start international trade in sea turtles was submitted to the CITES Conference of the Parties which took place last year in Harare (Zimbawe), but it was not agreed by the necessary majority.

Priorities for Action:

Implementation of the recommendations made in 1997 by the Centro de Ingeniería y Manejo Ambiental de Bahías y Costas should be a top priority to decrease pollution in the Havana Bay. A comprehensive coastal zone management plan defining areas to be protected and areas to be used for diverse economic activities and provision of raw materials and services appears to an important priority.

Considering that the Cuban economy has expanded impressively during the last few years and that this trend will continue during the next decade or so, Environmental Impact Assessments should be undertaken for all development activities. Furthermore, it is extremely important that the Government ensures that the recommendations contained therein are fully implemented. Collection of up-dated information on the use, amounts and types of agrochemicals in sugarcane, tobacco and banana plantations is also of paramount importance. Building of adequate waste disposal facilities and improvement of the sewage system to cover 100% of the island population is a priority, as well as the implementation of a strategy to deal with hazardous wastes generated in the island. Design and implement a monitoring system of coastal waters in other areas of Cuba appears to be an important priority.

Measures taken:

No information available.

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] Centro de Ingeniería y Manejo Ambiental de Bahías y Costas (1997). Estudio de Caso: Bahía de la Habana – PNUD/FMAM Proyecto GEF/RLA/93/G41, Proyecto Regional de Planificación y Manejo de Bahías y Areas Costeras Fuertemente Contaminadas del Gran Caribe. La Habana, Cuba, 1997.

[4] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, Nov. 1994.

Dominica

Population: 73,500 [3]
Natural Resource Base:
Dominica is approximately midway between the islands of Guadeloupe (on the north) and Martinique (on the south). One of the Windward Islands, Dominica is about 47 km long and has an area of some 751 sq. km. [1 & 4]
Dominica is volcanic in origin and has a mountainous terrain, with several peaks rising above 1220 m; the highest point is Morne Diablotins (1447 m). The island has extensive rain forest, many rivers and waterfalls.
The climate is tropical with an average annual temperature of about 26.7° C. Dominica is one of the wettest islands of the Caribbean with an annual precipitation ranging from about 1,780-mm on the coast to up to 10,000 mm in the mountains. The island has many small rivers; Boiling Lake, from which sulphurous gases frequently arise, is located in the south. Luxuriant forests cover the mountains. Dominica is highly vulnerable to Hurricanes. [1]
Dominica's forests cover between 60 and 75% of the island. The island has two National Parks, and a substantial area of legally protected areas. [1]
According to the World Conservation Monitoring Centre (WCMC) Dominica has 12 species of mammals, 163 of birds, 14 of reptiles and 2 of amphibian and there are a total of 1,027 of flowering plants, 200 of ferns and 11 of higher plants. [2]

Economics:
Dominica's economy is mainly based on agriculture, 26% of its gross domestic product (GDP). Agroprocessing and manufacturing, and tourism also contribute to the GDP. Agricultural products include bananas which are the principal crop, citrus fruit (especially grapefruit and limes), coconuts, cocoa, coffee, cinnamon, vanilla beans, and vegetables. Pumice is quarried and exported. [3]
Manufacturing is limited to the processing of farm products. The main manufactures are fruit juices, alcoholic beverages, soap, and essential oils. [3]

Identification and Assessment of Problems:
According to the National Environmental Action Plan (NEAP, 1994), the agricultural and industrial expansion, agroprocessing and coastal zone development are putting immense pressure on the natural resources. Additionally, the capacity of the disposal practices for sewage and solid waste is not enough to deal with all the wastes generated by local residents. The facilities that exist are not sufficient in any way to prevent human hazards from pollution. [3] (See table 1).
During the period 1984-1987 there were several hundreds of cases of water borne diseases reported, such as typhoid fever (80), dysentery (19) and gastro-enteritis (1,094). [4]

Table - 1- Sewage Disposal Facilities Available in Dominica in 1987

Health District	Population	%PL	%ST	%CL	Total
Roseau	23,402	38	37	12	87
St. Joseph	6,026	10	26	7	43
Portsmouth	10,267	36	12	6	54
Marigot	9,487	57	11	1	69
Castle Bruce	4,343	67	8	N/A	75
La Plaine	4,392	68	14	1	83
Grand Bay	6,068	63	13	2	78

Key: PL= pit latrines, ST= septic tanks, CL= communal latrines
Source: Country Environmental Profile (1991) [4]

The expansion of the banana plantations sometimes occurs on land unsuitable for cultivation causing a serious erosion problem. According to Dominica's NEAP, 475,970 tons of pesticides were imported in 1992, and 650,000 tons were imported in 1989. [1 & 4](See Table 2).

Table - 2 - Dominican imports of selected pesticides in 1989

Pesticide	Volume
Round-Up	720 l
Reglone	48 l
Paraquat	119,825 l
Gramoxone	20,000 l
Benomyl	2,700 kg
Calixin	4,320 kg
Sigma	5,500 l
Primicid	26,300 l
Vydate	1,100 l
Furadan	100,000 kg
Mocap	58,320 kg
Nemacur	1,250 kg

Source: Country Environmental Profile (1991) [4]

The 1994 report mentions as well that there have been reports that the manufacturing industries discharge industrial wastes directly into the waters on and around the island. Table 3 shows estimated amounts of solid wastes generated by different sectors. [1]

Table - 3 - Generation and Disposal of Solid Waste

Type of Waste	Amount in 1992/1997/2003	Disposal Method
Municipal Waste	11,000/14,000/17,000 tons	Landfill
Ship-Generated Waste	104/208/312 tons	Landfill
Industrial Waste	2,068 tons	Not Available
Agricultural	Not Available	On Site

Source: Solid Waste Disposal in Dominica (CEHI-GTZ), July 1992 [1]

Dominica, as the majority of countries in the region counts with an extensive set of legal instruments. (See table 4)

Table – 4 - Principal Environmental Laws

Environmental Law	Date	Authority	Regulations
Town and Country Planning Act	1975	Physical planning and development control	None
Forest Ordinance	1959	Establish forest reserves and protected forest reserves for soil and water conservation	Forest reserve rules
Forestry and Wildlife Act	1976 1982 1990	Protect wildlife and manage forest habitat	Wildlife regulations
Fisheries Act	1987	Manage fisheries and marine reserves	Fisheries regulations
National Parks and	1975	Establish National Parks and protected	None

Protected Areas Act	1986 1990	areas	
Beach Control Act	1966 1990	Protect beaches, control sand mining	Beach control prohibition order
Water and Sewage Act	1989	Sewerage facilities and disposal Control water supply and prevent contamination of water sources	Water regulations
Public Health Act	1968	Maintain environmental health, control pollution and prevent contamination of water sources	None
Pesticides Control Act	1974 1987	Control importation and use of pesticides	Labelling, registration & licensing regulations
Litter Act	1990	Abate nuisances caused by litter	None

Source: National Environmental Action Plan (1994) [1]

Although Dominica has an extensive legislative framework, enforcement is a serious issue. Dominica recognises that several of these laws need to be modernised and that there is a need to articulate a comprehensive National environmental policy. [1]

In order of priority the problems Dominica is facing are reflected in table 5.

Table - 5 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Problem	Comments
Solid Waste Management	OECS Solid Waste Management Project, to be completed by 30.06.2000
Land Use Management	Soil erosion, serious problem
	High deforestation rates
Coastal Zone Management	Coastal Zone heavily populated
	Tourist Infrastructure Development
	Lack of Monitoring of Reefs
Water Pollution	No hard data. Last study 1984
	Domestic, Industrial, Agrochemicals
	Health impacts are evident
Forestry and Protected Areas	Agroforestry techniques are needed
	Protected Areas System is lacking
Natural Hazards	Hurricanes, earthquakes, volcanic eruptions, storms, floods and land slides
Institutions	Strengthening and co-ordination is required
Legislation	Out-dated. Not enforced

Source: NEAP 1994 [1]

Emerging issues:
In 1996 soap manufacturing registered a 32% increase and there was a dramatic increase of 41% in cruise ships arrivals. [3]

Priorities for Action:
Implementation of all the NEAP recommendations is extremely important. The main recommendations are: solid waste management plan; land-use management; coastal zone management; water pollution control; forestry and protected areas management; natural hazards emergency plan; development of a environmental management policy statement and the requirement of Environmental Impact Assessments (EIA); institutional strengthening and public awareness campaigns. All these recommendations have been translated into concrete projects that according to the timetable they must be in the implementation stage at present. [1]

Measures taken:
The Government of Dominica allocated 27% of its budget for the period 1993-1996 to projects that address environmental concerns such as water supply and sewerage systems. Additionally, Dominica is part of the World Bank financed initiative for the OECS Waste Management Project. (Per. Com. D. Hanrahan)
Dominica is participating in the OECS ENCORE programme funded by USAID for improving management of coastal zone resources through policy development, institutional building and public awareness. [1]
The Government is going to install a new water supply and sewerage system for the Roseau area with the support of the Canadian International Development Agency. The new system will not include a treatment facility but the discharge will be done through a coastal outfall. [1]
Several detailed projects have been drafted as part of the strategy to fully implement the priority actions mentioned-above. (See table 6)

Table – 6 – List of Projects

Project	Cost (US$)
Construction of a plant nursery	109,000
Establishment of Industrial Plantations	968,000
Multipurpose tree planting project	418,100
Watershed Rehabilitation and management	1,693,000
Preparation of forestry management plans	254,000
Wildlife farming	963,000
Agroforestry Development	381,620
Petite Savanne-Point Mulatre feeder road	953,000
Logging roads for Cottage industries	535,000
Establishment of Handicraft shop	754,000
Feasibility study on biomass production for fuelwood and charcoal	66,000
Upgrading and Management of Parks	3,273,500
Protection of mangroves and wetlands	323,000
Development of Environmental data base	271,000
Strengthening of the Wildlife Division	1,540,000
Environmental Legislation	20,000
Total	12,522,220

Source: NEAP (1996) [6]

References:

[1] Government of the Commonwealth of Dominica (1994). Dominica National Environmental Plan.

[2] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

[3] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.V.I.

[4] Caribbean Conservation Association. Dominica Environmental Country Profile. St. Michael, Barbados, 1991.

[5] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

Dominican Republic

Population: 8,076,000 [2]

Natural Resource Base:

Located in the West Indies, comprising the eastern two-thirds of the island of Hispaniola. The country is bounded on the north and on the south by the Caribbean Sea; on the east by the Mona Passage, which separates it from Puerto Rico and on the west by Haiti. The area is 48,734 sq km. A number of adjacent islands, among them Beata and Saona, are possessions of the Dominican Republic. Santo Domingo is the capital of the Dominican Republic as well as its largest city. [3& 6]

The Dominican Republic is a fertile, well-watered, mountainous country. Pico Duarte (3175 m) is the highest mountain in the country and in the West Indies. Between the Cordillera Central and the Cordillera Septentrional, a parallel range to the north, is the Cibao Valley, one of the most fertile and best-watered areas of the country. [3& 6]

The coastal plain in the southeast is another fertile region. The coastline of the Dominican Republic is about 1633 km in length, irregular and indented by many bays forming natural harbours, notably Ocoa Bay in the south and the Bay of Samaná in the north-east. [3& 6]

The climate is semitropical tempered by the prevailing easterly winds. Temperatures of more than 23° C are registered in the lowlands throughout the year. During the summer months temperatures range between 26.7° and 35° C in these regions. The highlands are considerably cooler. Annual precipitation averages about 1350 mm, but the mountainous areas of the north receive considerably more moisture. The wet season is from June to November. Tropical hurricanes occur occasionally. [3& 6]

The vegetation of the Dominican Republic is extremely varied and luxuriant. Among the species of indigenous trees are mahogany, rosewood, satinwood, cypress, pine, oak, and cacao. Many species of useful plants and fruits are common, including rice, tobacco, cotton, sugarcane, yam, banana, pineapple, mango, fig, grape, and breadfruit. [2]

The most noteworthy mammal among the indigenous animals is the agouti, a rodent. Wild dogs, hogs, and cattle are abundant, as are numerous reptiles, notably snakes, lizards, and caimans. Waterfowl and pigeons are common birds. [2& 3]

According to the World Conservation Monitoring Centre (WCMC) the Dominican Republic has 20 species of mammals, 254of birds, 105 of reptiles and 35 Amphibian and there are a total of 5,000 flowering plants, 650 ferns and 1,800 species of endemic higher plants. [7]

The Dominican Republic counts with 17 protected areas, which cover an area of 964,159 hectares. [6]

Economics:

The economy of the Dominican Republic is predominantly agricultural, and nearly half of the workforce is employed in farming. [2]

The principal cash crops of the Dominican Republic are raised on large plantations. Most farmers, however, engage in subsistence cultivation. Sugarcane is the main cash crop; other important crops are rice, bananas, coffee, cacao, and tobacco. Cattle, hogs, and poultry are raised primarily for local consumption. [2]

The fishing industry is underdeveloped, mainly because of a lack of deep-sea fishing equipment and refrigeration facilities. [2]

Sugar refining is a leading industrial activity in the Dominican Republic as well as textiles, cement, cigars, cigarettes, fertilisers, molasses, refined petroleum, and processed wheat and rice. Dominican Republic is the fifth world exporter of textiles. [2]

Mineral products in the early 1990s included ferronickel, gold, and silver. Dominican Republic is the seventh world exporter of nickel. [2]

Almost all the Dominican Republic's electricity is produced in thermal plants. Wood products cover more than 20% of the energy needs of the country. [2]

Tourism is a growing industry in the Dominican Republic and according to the National Report (1991), this activity has become the main cause of coastal degradation in the past few years. [2]

Assessment of the problem:

According to the Environmental Synopsis of the Dominican Republic (1993) the major environmental problems confronting Dominican Republic, is lack of environmental legislation, habitat degradation and deforestation. An assessment carried out in 1980 stated that only 14% of the country's area was covered by forest. Continued deforestation and present agricultural practices are causing soil erosion and a serious sedimentation problem in rivers and coastal waters. [6]

Pollution from domestic sewage is a serious problem as only 27% of the population is connected to a sewage system. The major cause of mortality is gastro-enteritis and there are plentiful cases of water borne diseases. Other sources of marine pollution are industries and agriculture. Sewage is normally discharged into the sea without treatment. [6]
Solid waste is a major problem in Dominican Republic, as owing to the lack of proper collection and disposal systems, the refuse is left anywhere. [6]
During 1996 the liquid waste of more than 2 million tourists was added to the domestic sewage. [6]
Numerous wetlands have disappeared in the last few years owing to the disposal of agricultural and industrial waste. Sand and salt mining have also contributed to wetland degradation. Mangrove cutting and shrimp aquaculture are creating additional burdens on these fragile ecosystems. [5]
The national parks are not properly managed due to lack of financial resources and adequate institutional arrangements. [6]
The marine and coastal habitats are being degraded also due to tourist development, coconut plantations and livestock development, fishing, mangrove destruction and coral and shells collection. [6]
Atmospheric pollution is recognised as a problem in the Dominican Republic mainly with cement particles, dust, suspended solids, and sulphurous gases. [6]
Oil pollution is also a problem and three oil spills have taken place in the area. Because of its location, the Dominican Republic is prone to be affected by oil pollution from passing ships. [3&6]

Emerging issues:
The Dominican Republic has been promoting industrial development in the Free Trade Zones (35), in which the companies qualify for a 100% exemption of all kinds of taxes, duties and charges affecting production and trade. The amount of companies located in these zones almost doubled between 1996 and 1997. It was announced in 1997 that six new industrial parks are going to be opened in the near future. [2]
There are plans to invest $1-2 billion dollars in the Sans Souci area to remodel the cruise ship quay and build three new hotels. [2]

Priorities for Action:
Legislation and institutional strengthening seems to be the main priority. The Environmental problems are of such magnitude that a comprehensive National Environmental Action Plan (NEAP) should be prepared as soon as possible. Coastal zone management and environmental impact assessments should be covered by the NEAP. The Government should consider the possibility of requesting the IDB or the World Bank for some assistance to undertake this initiative. Building of adequate waste disposal facilities and improvement of the sewage system is a priority. All new industrial and tourist developments should not be authorised unless there are effective ways to deal with the waste problem, including hazardous wastes generated by these activities. Collection of up-dated information on the use, amounts and types of agrochemicals is also of paramount importance to avoid pollution by run-off.

Measures taken:
The Government and the IDB agreed upon a consolidation of water and sanitation reform project for a total of $65 million, and through this project it is expected that this programme will provide solutions to the sanitation and sewage management problems at different levels. The loan is expected to be approved by October 1998. [4]
The Government and the IDB are also negotiating a loan of $85 million for a project to rehabilitate and improve the ports system in Dominican Republic. Through this project it is expected that some measures be taken to control marine pollution. Before this project is initiated an EIA will be carried out. [5]

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] Government of the Dominican Republic (1991). Informe Nacional para la Conferencia Mundial de las Naciones Unidas sobre Medio Ambiente y Desarrollo, Brasil, 1992. Santo Domingo, República Dominicana.
[4] Inter-American Development Bank (1997). Consolidation of Water and Sanitation Reform. Washington, DC.
[5] Inter-American Development Bank (1995). Rehabilitación y Mejoramiento del Sistema Portuario. Washington, DC.
[6] IUCN, (1993). Perfil Ambiental República Dominicana. IUCN, Gland, Switzerland.
[7] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, Nov. 1994.

Grenada

Population: 98,600 [3]
Natural Resource Base:
Grenada comprises the island of Grenada, Carriacou and Petit Martinique together with some small islands, islets and rocks. The country has a total area of 344 sq. km; Grenada Island has an area of 312 sq. km. The capital, largest town, and principal port is St. George.
Grenada is of volcanic origin and is mountainous. The highest peak is Mount Saint Catherine 838-m. The valleys between the mountains are picturesque and fertile, and many contain swift-flowing streams. The island also has hot springs, several mountain lakes, and excellent beaches.
The climate is humid tropical, with an average annual temperature of 28° C along the coast. Annual rainfall is 1524 mm on the coast; a rainy season lasts from June to December.
Forests in the interior contain teak and mahogany trees.
The three nearshore tropical marine ecosystems habitats of critical importance in Grenada are mangroves, coral reefs and seagrass beds. [2]
According to the World Conservation Monitoring Centre (WCMC), Grenada has 15 species of mammals, 150 of birds, 16 of reptiles and 3 of amphibian and there are a total of 919 of flowering plants, 148 of ferns and 4 of higher plants. [5]

Economics:
Agriculture dominates the economy, and landholdings are generally small. The principal export crops are citrus fruits, cacao, nutmeg, bananas, and mace. Other crops include coconuts, cotton, cloves, and cinnamon. Tourism is also important to the economy. [3]

Identification and Assessment of Problems:
In the Grenada Environmental Profile it was estimated that in 1991 with a population of 89,000 people, 32,485 tonnes of solid waste were generated annually in Grenada. [2] The present local population will be generating around 36,000 tons of solid waste. Solid waste has been identified in the NEAP as the main environmental problem. There are three designated waste disposal sites serving only towns and adjacent populations. The Government encourages the rest of the people to use individual household disposal pits for non-biodegradable waste and to make compost with the rest. [4]
According to Grenada's NEAP other major environmental problems are water supply and liquid waste management, land and coastal use practices, erosion, and marine pollution. [4]
St. George is served by a collection system but there is no treatment of the effluent that used to be discharged through an outfall that broke in 1955 after hurricane Janet. Septic tanks, pit latrines and soak away pits are the most common methods of sewage disposal in Grenada. With USAID funds the Grand Anse sewerage system was built in 1994. Grand Anse Bay is the heaviest polluted water mass in Grenada. The main problems are discharge from abattoirs, industrial waste, eroded silt, grey waste, raw sewerage from outfalls and yachts, hillside runoffs from housing developments and agrochemicals. [4]
Table 1 shows in order of priority the main environmental problems of Grenada, as identified by the Government. [2]

Table – 1 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Issue	Comments
Solid Waste Management	Inadequate disposal in Grenadines
	Ineffective legislation and inadequate financial resources
	Disposal in wetlands and improperly manage landfills
Water Supply and Liquid Waste	60% of population uses private supply
	Fertilisers from watersheds are promoting growth of algae in slow sand filters
	Septic tanks and soak away pits central Sewer collection system and pit latrines are standard methods
	Untreated effluent is discharge into the sea

Land Use Management	Agricultural lands have been transformed into human settlements and commercial developments
	Inappropriate land use practices
Coastal Zone Management	Water pollution, destruction of mangrove swamps and sand mining are destroying living marine resources.
	Siltation is seriously affecting coral reefs
Land –based Water Pollution	Abattoirs; industrial waste; eroded silt; grey water; raw sewerage from outfalls and yachts; hillside run-offs from housing developments; residue from agrochemicals; leaches from refuse dumps and raw sewage; disposal of marine waste into the sea; siting waste disposal sites in mangrove swamps; and other types of waste carried out the sea by flooding
Forestry and Protected Areas	Top soil erosion; deforestation; destruction of habitats and reduction of water levels in watersheds
Natural and Man-made Hazards	Hurricanes; storm surge, earthquakes, landslides and rockfalls, floods and volcanic eruptions

Source. NEAP 1994 [4]

Oil pollution is considered a serious marine environmental problem particularly in St. George's harbour. Many spills were noticed during the preparation of Environmental Profile (1991). Grenada has also experienced frequent pollution of its beaches and coral reefs through the routine release of oily waters of passing ships.[2]
In 1988 a total of 224,488 pounds of biocides were imported in Grenada. Highly toxic chemicals on the list included Furadan and Gramoxone, which with baygon and Bop make for 67% of imported biocides. The organochlorine insecticides such as DDT, Heptachlor and Chlordane were still used to some extent in Grenada. It is important to note that Grenada imports the lowest amount of biocides of any of the Windward Islands. (See tables 2 and 3). [2]

Table - 2 – Biocides imported into Grenada during 1988 in quantities exceeding 1,000 kg.

Biocide	Quantity (kg)
Baygon Spray	10,865
Benlate	1,383
Bop Insecticide	21,957
Calixin	2,950
Cooper Flykiller	1,476
Furadan	16,050
Gramoxone	19,095
Malathion	1,122
Rounup Herbicide	2,199
Sevin 85% Sprayable	6,522
Shelltox Insecticide	2,089
Tilt	1,250

Source: Country Environmental Profile (1991) [2]

Table - 3 – Pesticide Imports in the OECS countries in 1988

Country	Pesticide Imports	No. of USEPA restricted
St. Lucia	759,182 lb.	13
Grenada	224,488 lb.	20
St. Vincent	906,697 lb.	10
Dominica	2,345,712 lb.* or 847,076**	11

*Based on Pesticide Control Board ** Based on Dominica Banana Market Co.
Source: Country Environmental Profile (1991)[2]

Emerging issues:
A $75 million hotel and golf course project promoted by the Ritz Carlton is going to be built near St. George. Additionally an international yachting centre for $130 million including a marina, villas, condominiums and world-class entertainment centre is going to be built in the very near future. [3]

Priorities for Action:
Within the NEAP a complete and extensive list of priority actions have been proposed for all the environmental problems identified in the above section. Their implementation is the main priority. (See table 4).

Table – 4- Main Priority Actions

Implement OECS Solid Waste Management Programme
Construct a Sanitary Landfill
Install port reception facilities
Continue Monitoring water quality
Introduce a comprehensive metering system
Increase water storage capacity
Install sewerage system in Grenville and Gouyave
Prepare a five year water supply and liquid waste management plan
Improve inter-departmental co-ordination
Increase community participation and awareness
Complete the physical/land use plan
Introduce draft planning legislation
Seek approval for physical development plan
Extend Monitoring of coastal pollution and intensify the Monitoring using CEHI resources
Assess the size and composition of marine stock
Establish guidelines and regulations for pesticide use
Introduce proper waste disposal systems throughout the country
Implement a land use and integrated watershed management project
Implement a forestry management and institutional strengthening project
Develop the National Parks system
Initiate a natural hazards management plan
Introduce new legislation to provide sound basis for environmental management and pollution control
Strengthen public awareness programmes

Source: NEAP 1994 [4]

A comprehensive coastal zone management plan defining areas to be protected and areas to be used for diverse economic activities and provision of raw materials and services appears to be, as well as including the requirement of Environmental Impact Assessments for development projects are very important.
Considering the location of Grenada, an oil pollution contingency plan should be drafted.

Measures taken:
Grenada is part of the OECS/World Bank initiative for solid waste disposal. The drafting of the National Land Use Policy was initiated in 1994. [4]
Several detailed projects have been drafted as part of the strategy to fully implement the actions mentioned-above. (See Table 5)

Table – 5 – List of Projects

Project	Cost (US$)
Land use and integrated watershed management	1,487,970
Forest management and institutional strengthening	1,444,063
Development of National Parks	196,402
Perseverance sanitary landfill	1,095,000
Total needed	4,223,435
Capacity Building	Funding approved by Organisation of Eastern Caribbean States (OECS)

Source: NEAP (1994) [4]

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Conservation Association. Grenada Environmental Country Profile. St. Michael, Grenada, 1991.

[3] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[4] Government of Grenada (1994). Grenada National Environmental Plan.

[5] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Guadeloupe (France)

Population: 422,000 [2]

Natural Resource Base:

Guadeloupe is a group of islands in the eastern Caribbean Sea. The two principal islands—separated by the Salée River, a narrow arm of the Caribbean Sea—are Basse-Terre on the west and Grande-Terre on the east. Nearby island dependencies are Marie-Galante, La Désirade, and Les Saintes; the other dependencies, Saint-Barthélemy and Saint Martin, are located about 250 km to the northwest. Basse-Terre is the most mountainous of the islands and contains the highest point, Soufrière (1484 m) an active volcano. [2]

The climate of the islands, though hot and humid, is tempered by the surrounding waters; the mean annual temperature is 25° C. Annual average rainfall is 982 cm. Guadeloupe suffered severe damages caused by hurricanes Luis and Marilyn in 1996. [2]

According to the World Conservation Monitoring Centre (WCMC), Guadeloupe has 11 species of mammals, 134 of birds, 20 of reptiles and 5 of amphibians and there are a total of 261 of flowering plants. [3]

Economics:

Tourism and agriculture are the primary industries. Major exports are sugar, bananas, and rum. About 18 percent of the total land area is under cultivation. Guadeloupe imports most of its consumer goods and foodstuffs. [2]

Assessment of the problem:

No information available. [1]

Emerging issues:

No information available.

Priorities for Action:

No information available.

Measures taken:

The "Contrat de Plan Etat-Region 1994-1999" is a multi-year project which has four major components: social affairs, economics, spatial development and ecology. The fourth component provides measures to fight pollution, improve water policies, protect natural ecosystems and develop new energy sources. [2]

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Guatemala

Population: 10,929,000[1]

Natural Resource Base:

Guatemala is the most western of the Central American states, bounded on the west and north by Mexico, on the east by Belize and the Caribbean Sea, on the southeast by Honduras and El Salvador, and on the south by the Pacific Ocean. Its total area of 108,889 sq. km makes it the third largest nation in the region, after Nicaragua and Honduras. At its widest points, the republic stretches about 430 km east to west and 450 km north to south. [2]

About two-thirds of the country's total land area is mountainous. The rugged terrain provided refuge that allowed the indigenous peoples to survive the Spanish conquest in the 16th century, while the fertile valleys eventually produced fine coffee and other crops that dominated the nation's economy. Frequent volcanic eruptions, earthquakes, and torrential rains have often brought disaster to the country and made building and maintaining roads and railways very difficult. [2]

Two mountain chains traverse Guatemala from west to east, dividing the country into three major regions: the western highlands, where the mountains are located; the Pacific coast, south of the mountains; and the Petén region, north of the mountains. These areas vary in climate, elevation, and landscape, providing dramatic contrasts between dense tropical lowlands and highland peaks and valleys. [2]

The northern chain of mountains begins near the Mexican border with the Cuchumatanes range, then stretches east through the Chuacús and Chamá mountains and slopes down to the Santa Cruz and Minas mountains near the Caribbean Sea. A deep rift separates the northern and southern mountains, where the Motagua River and its tributaries flow from the highlands into the Caribbean. [2]

To the north of the western highlands is the sparsely populated Petén, which includes about a third of the nation's territory. This lowland region is composed of rolling limestone plateaus covered with dense tropical rain forest, swamps, and grasslands, dotted with ruins of ancient Maya cities and temples. [2]

A narrow, fertile plain of volcanic soil stretches along the pacific coast. Once covered with tropical vegetation and grasslands, this area is now developed into plantations where sugar, rubber trees, and cattle are raised. [2&3]

Guatemala has 400 km of coastline, but lacks a natural deepwater port on the Pacific. Guatemala claims territorial waters extending out 12 nautical miles plus an exclusive economic zone of 200 nautical miles offshore. Hurricanes and tropical storms sometimes batter the coastal regions. [2&3]

The principal rivers of Guatemala are the Motagua, Usumacinta, Dulce, Polochic, and Sarstún. The Motagua drains and divides the highlands and is navigable in its lower reaches, where it forms the boundary with Honduras before it empties into the Caribbean Sea. The Usumacinta, navigable for 480 km, winds through the northern lowlands, forming part of the boundary between the Petén and Mexico, and then meanders across the Mexican State of Tabasco. The Chixoy, a tributary of the Usumacinta, and the Polochic drain the central Verapaz region. The Dulce, a short but navigable river, provides a scenic connection between Lake Izabal and El Golfete Lake, then empties into the Bay of Amatique on the Caribbean coast at Livingston. The Sarstún forms part of the boundary between Guatemala and Belize. Many shorter, fast-running rivers flow from the highlands into the Pacific, providing power for hydroelectric plants. [2&3]

Lake Izabal, near the Caribbean ports, is Guatemala's largest lake, covering about 800 sq. km. In the north is Lake Petén Itzá, around which are many Maya archaeological ruins and exotic birds. The major town of the Petén region, Flores, is built on an island in the lake, on the site of an ancient Maya city. [3]

The climate of Guatemala varies according to altitude, from hot coastal plains to cold mountain heights. Most of the population lives between 900 and 2400 m above sea level, where there are warm days and cool nights with average annual temperatures of about 20° C. The coastal regions are hot and humid, with average annual temperatures of about 28° C. There is a rainy season, from May through October. Yet May is the hottest month, with average lows of 16° C and highs of 29° C; the coldest month is December, when low temperatures average 12° C and highs are 23° C. During the dry season, especially from February to May, the air is often filled with dust. Rainfall in the tropical northern region averages between about 1500 and 2500 mm annually; Guatemala City, in the southern highlands, receives about 1320 mm annually. [2]

Most plants typical of tropical areas are found in the Guatemalan lowlands. In the mountain regions oak trees predominate on lower slopes, giving way to pine forests above 2100 m. Orchids and other brilliant flowers grow abundantly throughout the country. [3]

Deer, monkeys, and piglike mammals called peccaries are common in the sparsely populated lowlands. Other wild animals—including jaguar, tapir, and puma—are found in smaller numbers, and crocodiles inhabit some rivers. Bird life is extremely rich, but the brightly coloured quetzal, Guatemala's national bird, is rare. [3]

The government has established several national parks and recreational areas to preserve plant and animal life. Among these are Mario Dary Rivera Park in the Baja Verapaz, dedicated to preservation of the quetzal, and the Chocón Machacas reservation near Livingston, on the Caribbean coast, designated for the preservation of the manatee and the mangroves. Efforts are also being made to save the elusive waterfowl known as the Atitlán grebe, which lives on Lake Atitlán. [3]
Guatemala's primary natural resource is the rich soil of its highland valleys and coastal plains, but it also has some petroleum, as well as nickel, lead, zinc, iron, and small quantities of gold, silver, and jade. Only 16 % of the land is suitable for farming, with another 12 % used for grazing. Forests and woodlands cover 40 %, offering valuable timber, fine woods and other products for both domestic use and export. The remaining 32 % of the country includes urban areas and rugged terrain, desert, and lowland areas that have become exhausted or are otherwise unsuitable for agriculture or grazing. [3]
According to WCMC Guatemala has 250 species of mammals, 669 of birds, 231 of reptiles and 99 Amphibian and there is a total of 8,000 flowering plants, 652 of ferns and 1,171 of endemic species of higher plants. [6]

Economics:
Guatemala's economy traditionally has been based on exports of coffee, bananas, sugar, and other tropical crops. [1]
Agriculture in 1995 accounted for 24 % of the GDP, 58 % of the labour force, and 57 % of Guatemala's exports. Coffee has been Guatemala's most important export for more than a century, and, despite considerable diversification, in 1995 it still accounted for 28 % of Guatemala's exports. Sugar has been rising in importance, accounting for 12 % of exports in 1995. Bananas remain important, and are grown in the tropical lowlands mainly by foreign corporations—including Chiquita (formerly United Fruit and United Brands), Fyffes, Dole, and Del Monte. [2]
Since the 1970s Guatemala has been the leading exporter of cardamom, a spice popular in Arab countries. Fresh fruits, flowers, seeds, and vegetables account for another 5 % of exports. Guatemala no longer exports cotton, which until recently was a major export. [2]
Export agriculture has absorbed much of Guatemala's limited arable land, so that food production has suffered. Guatemala more than doubled its food imports between 1987 and 1995. Corn remains the principal crop for domestic consumption, but significant amounts of rice, beans, sorghum, potatoes, soybeans, and other fruits and vegetables, as well as livestock, are also raised. [3]
Guatemala's large forests, estimated at 3.6 million hectares in 1992, have been declining at the rate of about 90,000 hectares annually, as trees are cut for firewood and construction timber. Some valuable stands of mahogany and cedar remain. Guatemala is the second largest supplier of ornamental plants to Europe. [2]
The commercial shrimp and fish industries have grown in the 1990s, accounting for about 1 % of exports in 1995. Domestic seafood consumption is small. [2]
Small quantities of antimony, barites, feldspar, gypsum, marble, limestone, silica, and gravel are mined, but petroleum is the major mineral resource of Guatemala. Most Guatemalan crude oil is used for asphalt and other derivatives. Production rose from 1.5 million barrels in 1990 to 3.4 million barrels by 1995. Guatemala has produced about 8 million cubic meters of natural gas annually since 1989. [2]
In 1995 manufactured products accounted for 14 % of the GDP, slightly down from a high of nearly 17 % in 1980. Recently, assembly plants of clothing and textiles have become an important part of the manufacturing sector, mostly for export to the United States. Leading manufactures include processed food, cosmetics, pharmaceuticals, chemicals, glassware, paper, and furniture. [2]
Guatemala uses less energy per person (210 kilowatt-hours of electricity) than any other country in the Western Hemisphere except Haiti. Although Guatemala's rapid-flowing mountain streams provide potential for hydroelectric plants, only 37 % of the population has access to electricity, and in some areas up to 86 % of the residents lack electric power. Even in Guatemala City there are sometimes electrical shortages. About 35 % of Guatemala's fuel needs are met by petroleum, most of it imported; wood fuel supplies 59 % of the domestic energy used. [2]

Assessment of the problem:
More than 80 % of Guatemalans live below the poverty level. According to 1987 statistics, the top 10 % of the population received 44 % of the income, and the bottom 10 % received 0.9 %. Poverty affects both urban and rural Guatemalans, but rural residents, including most of the Maya population, generally live under harsher conditions. More than 70 % of rural residents are classified as living in extreme poverty compared to 36 % of urban inhabitants. In the 1990s, about 60 % of Guatemalans have access to drinking water and sanitation, but figures are lower for rural areas. [3]

About 54 % of the population has access to health care, but the majority of doctors are around Guatemala City. Malnutrition affects about 60 % of young children, and the infant mortality rate is high. [3]
Según el índice de pobreza humana (IDH) del Programa de Naciones Unidas para el Desarrollo (PNUD), Guatemala ocupó el lugar número 46 de los más pobres de 78 países analizados. [5] En la tabla 1 se muestran algunos indicadores sociales para seis de los países más pobres de la región de acuerdo con el índice pobreza del PNUD.

Table –1 - Indicadores Sociales del PNUD (%)

Indicador	Jamaica (12)	R. Dominicana (20)	Honduras (25)	Nicaragua (34)	Guatemala (46)	Haití (61)
Población que no vivirá más de 40 años	4,3	10,2	10,8	13,6	14,5	27,1
Tasa de analfabetismo adulto	15,6	18,5	28	34,7	44,3	55,9
Población sin acceso a agua potable	14	35	13	47	36	72
Población sin acceso a servicios de salud	10	22	31	17	43	40
Niños menores de 5 años de peso insuficiente	10	10	18	25	27	28
Indice de pobreza (%)	12,1	18,3	22	27,2	35,5	46,2

Fuente: Informe sobre Desarrollo Humano 1997 [5]

Aunque no hay datos concretos sobre los problemas ambientales más serios que enfrenta Guatemala, es claro que la contaminación por aguas servidas, y residuos líquidos y sólidos de la industria y la agricultura son un riesgo importante para la salud de los ecosistemas. En orden de prioridad los problemas ambientales más serios de Guatemala están listados en la table 2. [4]

Table – 2 – Environmental Problems

Problem	Comments
Erosión de Suelos	Malas prácticas de uso del suelo
	Causa sedimentación y colmatación de cuerpos de agua
Deforestación	Cuencas altas de los ríos para producción de leña y expansión de la frontera agrícola
Manejo de Parques Nacionales	Inadecuado; proceso de colonización y de expansión de la frontera agrícola dentro de las reservas
Contaminación de Aguas	Cuencas de los ríos y aguas costeras, proveniente de aguas domésticas, industriales, mineras y agrícolas
Disposición de Basuras y Residuos Sólidos	Totalmente inadecuado
Contaminación del Aire	Ciudad de Guatemala
	Quema de Basura; residuos industriales

Fuente: Monografía Ambiental (1993) [4]

Although there is no specific information on impacts, the report submitted to UNCED states that pollution from sewage, industry and agriculture as well as solid waste are a major problem.

Oil pollution is also a problem and some compensation was paid to the Government for an oil spill caused in the Amatique bay.

Emerging issues:

In 1997 the Korean President agreed to lend Guatemala $32 million for rural development and environmental projects. [1]

Priorities for Action:

It is evident that there is not much information on the status of marine pollution or contribution of land-based sources to coastal waters. Guatemala needs substantial support from the international community to deal with its poverty problem and at the same time initiate comprehensive environmental programmes.

An inventory of types and amounts of industrial pollutants and agrochemicals being used appears to be an important measure to take. Management of the solid and liquid waste is also an important priority.

Measures taken:

No available information.

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] The Government of Guatemala, (1991). The Guatemala National Report to the Conference on Environment and Development.

[4] World Conservation Monitoring Centre. Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Guyana

Population: 98,600 [1]

Natural Resource Base:

Guyana is located in South America, bounded on the east by the Caribbean Sea, on the north by Suriname, on the south by Brazil, and on the west by Brazil and Venezuela. Guyana has an area of 214,969 sq. km; its coastline is about 435 km long. [3]

Guyana can be divided into three major geographical regions. A belt of alluvial soil, varying in width from about 8 to 65 km and mostly below sea level extends along the coast and is protected by a system of dams and dikes. To the south lies the dense forest area that makes up about 80% of the country. The forests extend into an interior highland region with a maximum elevation, atop Mount Roraima, of 2772 m. Beyond the forest lies a region of savannah. [4]

Guyana is one of only 13 countries in the world that still retain the tropical forest virtually intact. In 1989 the Government designated 360,000 ha. for conservation purposes. [4]

Guyana has a tropical climate, with little seasonal temperature change. The annual rainfall on the coast is about 1525 to 2030 mm. The savannah region receives some 1525-mm of rain annually, mainly from April to September. [3]

The important mineral deposits of Guyana include bauxite, manganese, gold, diamonds, and kaolin. Some petroleum is located offshore. [3]

The plants and trees of Guyana are noted for their great size; the giant water lily is common. The dense forests contain excellent woods, such as greenheart and mora, for use in the lumber industry. The animal life is varied and includes deer, anteater, and two species of monkey. Among the birds are manakins, sugarbirds, and cotingas; the diversity of brilliantly coloured birds and insects is considerable. [3&4]

Guyana has only one legally established protected area "The Kaieteur National Park", but it does not have a management plan or the minimum infrastructure to manage it in an efficient way. [4]

According to the World Conservation Monitoring Centre (WCMC), Guyana has 193 species of mammals, 737 of birds, 2 of endemic reptiles and 10 of endemic amphibians and about 6,000 species of flowering plants and 407 of ferns. [5]

Economics:

Agriculture accounts for about 25% of the gross domestic product (GDP) and employs about one-third of the labour force. Sugar and its by-products and rice account for most of the agricultural exports. Coconuts, coffee, cacao, citrus fruit, corn, manioc, and other tropical fruit and vegetables are grown primarily for home consumption. Large areas of rough pasture exist in the interior savannahs. Substantial numbers of cattle, hogs, sheep, and chickens are raised. [1&4]

Cultivation is confined almost entirely to the narrow coastal strip of rich, alluvial soil. Agricultural expansion requires heavy expenditures for protection against flooding and for drainage and irrigation, because part of the strip is below the high-tide mark of the sea and rivers and because of the heavy seasonal rainfall. [4]

In the late 1980s about 125,000 m^3 of wood were harvested annually from Guyana's extensive forests. The forestry sector contributes about 2% of the GDP. Almost all of the harvest was made up of hardwoods, used mainly in construction and furniture making and as fuel. [3&4]

Fishing is concentrated along the Atlantic coast. Shrimp are a valuable product. [4]

Guyana is a major producer of bauxite; about 1.3 million metric tons were mined annually in the late 1980s. Manganese, gold, and diamonds are also produced. [1]

Manufacturing in Guyana is limited to processing bauxite and to production of foodstuffs, beverages, construction materials, clothing, soap, and cigarettes. [1]

Identification and Assessment of Problems:

According to the National Environmental Action Plan (1994), the most serious environmental problem of Guyana is that most of the population and the physical assets of the country are concentrated in a relatively small area of the coastal zone, where flooding is frequent. [4] Table 1 shows major environmental problems. (See Table 1)

Poverty is a serious problem and mortality statistics reveal high levels of environmental related diseases such as cholera, filaria, dengue, malaria, tuberculosis, gastro-enteritis, typhoid, hepatitis and even cancer. According to the NEAP, Guyana has the lowest per capita income of the Western Hemisphere ($330). [4]

The problems faced by the Guyanese coastal areas are very diverse and of serious implications from the human health and environmental points of view. About 90% of the population live in the coastal areas, and agriculture that generates 25% of the GDP is all carried out in the coastal areas. Guyana's industry is also located in Georgetown and the coast. [4]

There is no reliable data regarding amounts of waste generated by the industry, although with the number and types of industry a table of potential pollutants has been prepared. (See Table 2). [4]

Table – 1 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Problem	Causes/Consequences
Coastal Erosion and Flooding	Sea defences system has not been maintained; coastal erosion takes place at rapid rate; mangroves are destroyed for fuelwood and tanning; sea level rise.
Integrated Coastal Zone Management	Dispersion of responsibilities, lack of basic data
Waste Management and Pollution Control	Impacts on public health and hazards to coastal areas from domestic, industrial, agriculture, mining and ships; lack of hard data.
Watersheds Mismanagement	Deforestation for fuelwood and expansion of agriculture and siltation; water shortages.
Logging	There is no quantification of the impacts; Greenheart is being over-harvested-extraction 1 m^3 /ha/yr., growth rate = 0.13m^3 /ha/yr.; habitat destruction; increased turbidity in rivers; increased charges of Biological Oxygen Demand (BOD); soil erosion
Air Pollution	There is no quantification of the problem, but there is evidence that the mining industry is generating large amounts of particulate matter; lung diseases in the area have been reported; old open pit mines have not been rehabilitated; land degradation by acidification, removal of soils and solid waste are serious; groundwater pollution is presumed as well as surface waters; cyanide and mercury are released by small-scale mining.
Public Health Impacts	Air and water monitoring is a key issue

Source: NEAP (1994) [4]

As there are not many cruise ships visiting Guyana there is no a problem with ship generated waste. The waste is removed in bags from the few ships that arrive in the port and trucked to the Georgetown disposal site. [4]
The NEAP stated that coastal erosion which is taking place at a very fast pace and flooding are serious problems. Solid and liquid wastes from domestic sources are the two major causes of pollution. The common practice is to dump solid waste in nearby public areas and vacant lots. Georgetown, which in 1994 generated 50 tons of waste per day, (18,250 tons/yr.) had only an incinerator that worked only at 10% capacity and according to the study made, it would be too expensive to repair. The sewerage system in Georgetown was discharging 3,9 million gallons per day of untreated sewage into the Demerara River in 1994. The rest of the country is served by septic tanks and latrines that do not comply with minimal technical specifications and in the flooding period's overflow and cause contamination of surface waters. Table 3 shows common enteric diseases in Guyana. [4]

Table 2- Sources of Industrial Waste in Guyana

Industry	Number	Potential Pollutants
Sawmills	66	BOD, dust
Food Processing	47	BOD, phosphates, solids, dust, pathogens
Detergents, Soaps	9	BOD, phosphates, caustics
Metal working/Foundry	8	Heavy metals, solids
Sugar Refinery	7	BOD, solids, caustics, phosphates
Chemical, Pharmaceutical	6	Alkalis, acids, phosphates, solids
Distilleries/Breweries	5	BOD, phosphates, thermal

Plastics	4	CFCs, solids

Source: NEAP (1994)[4]

Table 3 – Enteric Diseases in Guyana

Transmission	Diseases
Water-borne	Cholera, dysentery, gastro-enteritis, and typhoid
Food-borne	Dysentery, gastro-enteritis, and hepatitis
Soil-borne	Hookworm

Source: National Environmental Action Plan (1994) [4]

Agricultural chemicals are also of serious concern but there is no reliable data regarding the magnitude of the problem. [4]
Mining activities contribute 8% of the GDP and are normally undertaken close to major rivers. A great deal of particulate matter is released from the bauxite calcining burners. There is evidence that in Linden there are cases of lung diseases and asthma. There is no information regarding the seriousness of the effects of mining on water resources; however, there is evidence that small-scale miners use mercury in gold mining. [1 & 4]

Emerging issues:
In 1993 the World Bank stated that with some improvements in public infrastructure, Guyana could be attractive to substantial foreign investment. [4]

Priorities for Action:
The main priority at this stage is to secure the financial resources to carry out all the 40 specific recommendations for actions made in the NEAP. In my view, although all recommendations are important, particular attention should be given to the drafting of new environmental legislation and the preparation of the comprehensive integrated coastal zone management plan. [4]
Building of adequate solid and liquid waste disposal and treatment facilities is a top priority.
Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off as well as monitoring of pollutants generated by the mining industry.
Explore the establishment of innovative financial mechanisms to support the management of protected areas is very important.
Public awareness campaigns are basic to get community involvement in the assessment of the problems and their solutions.

Measures taken:
With the support of the World Bank, Guyana carried out its NEAP (1994) which is expected to assist in the eradication of pollution and reduction of environmental problems. [4]
With World Bank funds, the Government is implementing a project to strengthen institutions and human resources, as well as to rehabilitate water and sewerage facilities. [4]
With the Inter-American Development Bank (IDB), Guyana is undertaking an Urban Rehabilitation project to carry out basic studies of potable water, sewerage and drainage needs of Georgetown. [2]
With the support from the IDB, the Caribbean Development Bank (CDB) and the European Union (EU) two thirds of the sea defences needed are going to be rebuilt. [4]
With the assistance of Germany, the Government is investigating the cause of water shortages from the Canje, Berbice and Tapcuma rivers in order to improve the management of the watersheds. [4]
With the support of the Canadian Development Agency (CIDA) and Germany, a reforestation project in watersheds is being undertaken, in particular in the Demerara watershed, which is the most important. [4]
The World Wild Life Fund (WWF), the EU and Germany have agreed to support the design of a protected areas system for Guyana. The Kaieteur National Park will be expanding to include the entire upper watershed of the Potaro River. [4]
The Government has agreed that the World Bank performs an environmental audit of the LINMINE bauxite project, as well as the feasibility study. [4]

References:

[1] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[2] Inter-American Development Bank (1996). Guyana, Environmental Management Programme. Washington, DC.

[3] Government of Guyana (1992). Development Trends and Environmental Impacts in Guyana. Country report to UNCED. Georgetown, Guyana.

[4] Government of Guyana (1994). National Environmental Action Plan. Georgetown, Guyana.

[5] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Haiti

Population: 7,329,000 [1]

Natural Resource Base:

Haiti occupies the western third of the island of Hispaniola, which it shares with the Dominican Republic. Nearly 85 percent of the terrain is mountainous. Haiti's main cities have an average temperature of 21-32 °C. There is high humidity in the coastal areas and there are some semiarid zones. [1]

According to the World Conservation Monitoring Centre (WCMC), Haiti has 3 species of mammals, 220 of birds, 102 of reptiles and 46 of endemic amphibians and about 4,685 species of flowering plants, 550 of ferns and 1,623 of endemic higher plants. [3]

Economics:

Other than sugar refining and textile production, there is little industry. The manufacturing industry contributes 15% of GDP and employs only 5.7% of the population. [1]

Most of the population is employed in subsistence agriculture and farming. Major export crops include coffee, sugar cane, cocoa, mangoes and sisal. The agriculture sector contributes with 27% of GDP and accounts for 63% of employment. [1]

Haiti has some deposits of marble and calcium carbonate. [1]

Identification and Assessment of Problems:

The extensive cutting of trees and shrubs for firewood and charcoal, Haiti's primary fuel sources, have devastated Haiti's forests. Less than 2 percent of the country remains forested. Cutting of the remaining trees is most severe in the impoverished rural areas. [2]

Expansion of the agricultural lands into inappropriate slopes is causing serious erosion and deforestation problems. Subsistence agriculture is focusing on crops like cereal and corn, therefore coffee and cocoa trees are not planted anymore. Exacerbating the condition are cultivation techniques that disregard soil conservation. [2]

Although groundwater is plentiful in Haiti, safe water is scarce. Sewage systems and sewage treatment are non existent. Outside the capital city of Port-au-Prince, less than 40 percent of the population has access to a safe water supply. As a result, waterborne diseases are widespread. [2]

Poverty is a serious problem and mortality statistics reveal high levels of environmental related diseases such as cholera, filaria, dengue, malaria, tuberculosis, gastro-enteritis, typhoid, and hepatitis. [2] Haiti has the second lowest per capita income of the Western Hemisphere after Guyana ($373). Some authors state that Haiti has the lowest per capita income. (See Guyana Profile)

The problems faced by the Haitian coastal areas are very diverse and of serious implications from the human health and environmental points of view. [2]

There is no reliable data regarding either industrial or agricultural waste. [2]

Emerging issues:

The major international donors pledged $900 million to support Haiti's emergency recovery needs and $600 million had already been disbursed by the end of 1995. [1]

Under the Lome IV Convention the European Union has allocated ECU 148 million to be spent between 1995-2000 on road reconstruction, land reform and irrigation, infrastructural rehabilitation, food security, electricity supply and health. [1]

The Inter-American Development Bank and the Government of Haiti are negotiating a project on intensification of agriculture for $70 million that includes physical infrastructure development, production inputs and reforestation. [1]

Priorities for Action:

Taking into account that there is a very close relationship between poverty and environment degradation, the main priority is that the international community continues supporting Haiti's economic growth making sure that the environmental dimension is fully included in the development plan.

Building of adequate solid and liquid waste disposal and treatment facilities is a top priority.

Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off as well as monitoring of pollutants generated by the mining industry.

Measures taken:
At present there are multiple projects being negotiated with the Inter-American Development Bank (IDB) but they are in an early stage of development. (Personal communication, A. Montalvo)

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] World Resources Institute (1993). Haiti. Pub Houghton Mifflin Co. 1993.
[4] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Honduras

Population: 5,800,000 [2]

Natural Resource Base:

Honduras is located in Central America, bounded on the north and east by the Caribbean Sea, on the south by Nicaragua, on the south-west by the Pacific Ocean and El Salvador, and on the west by Guatemala. Honduras is one of the largest Central American republics, with an area of 111,888 sq. km. The capital and largest city is Tegucigalpa. [3]

La Ceiba (82,900) and Puerto Cortés (33,200) are among the leading Caribbean ports. [3]

The climate of Honduras is tropical, but it varies according to altitude. The mean annual temperature in the interior is about 21° C. The low-lying coastal regions, however, are warmer, and show high humidity. The average annual temperature is 26.7° C. The dry season prevails from November to May; the average annual rainfall ranges from 1016 mm in some mountain valleys to 2540 mm along the northern coast. [3]

Honduras is a plateau, consisting of broad, fertile plains broken by deep valleys, and traversed by mountain ranges in a north-western to south-western direction. The mountains, which are volcanic in origin, rise to maximum elevations of more than 2800m. There are two coastal strips, one extending about 640 km along the Caribbean Sea and the other 64 km on the Pacific Ocean. Most of the country's rivers drain to the Caribbean Sea. Navigable Atlantic rivers include the Ulúa, which drains approximately one-third of the country, and the Coco. [3 & 5]

Forests cover about 31 percent of the land and fertile pasturelands provide the basis for increasingly productive dairy farming and livestock raising. Forests of oak and pine cover the cooler highlands, and savannah grasses cover the drier parts of Honduras. Mangrove and palms are found in the coastal regions. [3 & 5]

Valuable mineral deposits, such as lead and zinc, are also present. [3]

There is high biodiversity in Honduras. Bear, deer, monkey, wolf, and coyote are numerous. The cat family includes jaguar, puma and ocelot. A wide variety of reptiles exists, and marine and bird life abound. [3 & 5]

According to the World Conservation Monitoring Centre (WCMC) Honduras has 173 species of mammals, 684 of birds, 152 of reptiles and 56 of amphibian species and about 5,000 of flowering plants, 650 of ferns and 148 of endemic species of higher plants. [6]

Economics:

Agriculture is the largest sector of the economy. About 16 percent of the total land area of Honduras is arable, most of it on the coastal plains. The leading cash crops are coffee, bananas and plantains. Other important crops include sugarcane and palm oil. [2]

The principal food crops are corn, dry beans, and rice. Citrus fruit and pineapples are also grown. [2]

The livestock population in the late 1980s numbered some 2.3 million cattle and 734,000 pigs. Chickens are raised for local consumption. [2]

Forestry is an important industry in Honduras. Valuable woods include pine, mahogany, ebony, walnut, and rosewood. [2]

The annual fish catch of 20,989 metric tons is primarily shellfish. [2]

Deposits of silver, zinc, and lead are exploited in Honduras. Other resources, largely untouched, include iron ore, coal, copper, and antimony. [2]

In the manufacturing industry products such as cement, cotton and sugar are produced in quantities large enough for export. Textiles, detergents, chemicals, light metals, and food products are manufactured primarily for local consumption. The chief industrial areas are located near the capital and the cities of San Pedro Sula and the free port of Puerto Cortés. [2]

Assessment of the problem:

According to the Honduras Environmental Profile (1989), there is a very serious pollution problem in the country; however, there is no hard data or monitoring that allows for the quantification of contamination from different sources. Atmospheric pollution is produced by the industry, in particular, coffee, soap and detergents, sawmills, pulp and paper, cement, sugar, tanning and brick production. [5]

Agricultural chemicals are also of serious concern but there is no reliable data regarding the magnitude of the problem. There is evidence of soil pollution with heavy metals due to the extensive use of agrochemicals, such as DDT, BHC, Lindane, Dieldrin, Mirex, and Chlordane. In Honduras, as in other Central American countries there is an excessive use of biocides, partly because of lack of public awareness within the farmer communities. In 1986 a total of 1,726,350 kg of insecticides and nematocides were imported into Honduras, as well as 1,186,630 kg of herbicides. (See table 1). [5]

Table 1 – Imported Herbicides in 1986

Product	Kg
Gramoxone	257,060
2,4-D-6 Amina	237,846
Paraquat	160,762
Gesapax	75,911
Round up	76,889
Unspecified	115,927
Others	265,235
Total	**1,186,630**

Source: Environmental Profile (1989)

Industrial pollution was also stressed as a serious threat to the watercourses as in 1989 very few industries were treating their liquid, solid or atmospheric waste. In the Cortés Province, by the Caribbean Sea, 46% of the industry is located. [5]
Mining effluents have also caused environmental hazards in Honduras. In Lake Yojoa they have had episodes of fish deaths caused by excessive levels of cyanides. [5]
Poverty is a serious problem and mortality statistics reveal high levels of environmental related diseases such as cholera, filaria, dengue, malaria, tuberculosis, gastro-enteritis, typhoid, hepatitis and even cancer. [5]
The problems faced by the Hondurans coastal areas are very diverse and of serious implications from the human health and environmental points of view. [5]
Solid and liquid wastes from domestic sources are two major causes of pollution. Normally 60% of the urban population is covered by the collection system and there is no system in place for the rural areas. In 1989 it was estimated that 64% of the total solid waste generated in Honduras (923 tons/day) was handled by individuals as they considered appropriate. There are some landfills in several cities but they do not comply with minimum technical requirements causing leaching of pollutants into the groundwater. The common practice is to dump solid waste in nearby public areas and vacant lots. [5]

The domestic liquid waste presents a similar situation to the solid wastes. 61% of the urban population is covered by a sewer system and in the rural areas only 7.8%. The rest of the country is served by septic tanks and latrines that do not comply with minimal technical specifications and in the flooding periods overflow and cause contamination of surface waters. The 1989 profile reported that there was only one treatment plant in the country that was handling the load generated by a settlement of 15,000 people. [5]
There is a problem with disposal of hazardous waste from hospitals, which are disposed together with domestic waste in the existing landfills. [5]
The Honduran coral reefs, which are considered some of the most beautiful of the Caribbean region, have been seriously affected by water pollution from domestic and industrial sources. [5]

Emerging issues:
During 1997, the Presidents of Honduras and Nicaragua signed a "Declaration for the Development of an Interoceanic Corridor of Cargo" between Puerto Cortés, Honduras and Puerto de Corinto, in Nicaragua, which may create new jobs and needs for extra public services. [2]
In 1996 there was an increase of 22.4% of private investment focused on expansion of the agriculture sector, commercial construction and acquisition of machinery. [2]
Revenues from tourism increased in 1996 by 14.4% and it was expected to grow by a further 16% in 1997. The Tela Bay Ecotourism project was expected to be initiated in 1997 with the building of eight hotels along the beachfront. [2]

Priorities for Action:
The environmental problems of Honduras are complex and of considerable magnitude. Puerto Cortés and Ceiba are populated towns that urgently need adequate solid and liquid waste disposal and treatment facilities for domestic and industrial waste. New developments require comprehensive environmental impact assessments and monitoring of the compliance of the recommendations is of paramount importance.

Collection of up-dated information on the use, amounts and types of agrochemicals is also of paramount importance to avoid pollution by run-off and threats to human health. Monitoring of pollutants generated by the mining and manufacturing industries and the hospitals is also important.
Preparation of a comprehensive integrated coastal zone management plan is top priority.

Measures taken:
With the support of the Inter-American Development Bank, Honduras is carrying out an environmental management project of the Bay Islands for a total of $19.1 million. Through this project it is expected to contribute to adequate environmental management, improve sanitation practices, strengthen institutions and design a tariff system that will allow the recovery of the investment. [4]
From personal communication with Government officials I am aware that the World Bank has also been very active supporting the Government of Honduras on strengthening its environmental institutions but I was unable to locate precise information on the project (s).

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] "Honduras," Microsoft Encarta 98 Encyclopaedia. 1993-1997 Microsoft Corporation.
[4] Inter-American Development Bank (1994). Bay Islands, Environmental Management Programme. Washington, DC.
[5] Government of Honduras (1989). Perfil Ambiental de Honduras, Tegucigalpa, Honduras.
[6] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Jamaica

Population: 2,574,000 [1]

Natural Resource Base:

Jamaica is located south of Cuba. Jamaica has an area of 10,991 sq. Km. The coastline is about 800km long. Kingston is the capital city.

Jamaica is a mountainous country, except for the lowland coastal area. The principal range is the Blue Mountains with a maximum elevation, atop Blue Mountain Peak, of 2256 m.

The climate is tropical in the coastal areas with little seasonal temperature change. The average temperature in the lowlands is 27 °C and 22 ° C in the mountains. Annual rainfall on the coast is about 818 mm and in the mountains can be more than 5080 mm. The island is susceptible to hurricanes mainly from June to November.

The important mineral deposits of Jamaica include bauxite, gypsum, lead and salt.

Jamaica ranks fifth among the world's islands for endemic plant species. Almost 800 species of plants are not found anywhere else. [5] The Jamaican forests contain excellent woods, such as cedar, mahoe, mahogany, logwood, rosewood, ebony, palmetto palm, coconut palm and pimento. Among the birds there are parrots, hummingbirds, and cuckoos.

The main marine ecosystems are coral reefs, mangrove swamps and seagrass beds. Marine mammals of interest include about 100 manatees (*Trichechus manatus*) and bottlenose dolphins (*Tursiops truncatus*) The Jamaican Iguana (*Cyclura lophoma*) that was thought to be extinct was re-discovered in 1990. [5]

Marine resources in Jamaica have been badly impacted during hurricane seasons in 1961, 1980 and 1988. Nevertheless, human activities represent the major threat to the survival of these ecosystems. [5 & 6]

According to the World Conservation Monitoring Centre (WCMC), Jamaica has 24 species of mammals, 262 of birds, 36 of reptiles and 21 of amphibians and about 2,746 species of flowering plants, 558 of ferns and 923 of endemic higher plants. [8]

Economics:

Agriculture accounted for 8.4% of the GDP in 1996 and the labour force employed was 206,000. Sugar and its by-products and rice account for most of the agricultural exports. Coconuts, coffee, cacao, citrus fruit, corn, manioc, and other tropical fruit and vegetables are grown primarily for home consumption. Large areas of rough pasture exist in the interior savannahs. Substantial numbers of cattle, hogs, sheep, and chickens are raised. [1]

Manufacturing, mining and construction sectors contributed about 38% of GDP in 1992, and services contributed 6.2%. In Jamaica processing of bauxite and production of alumina play an important role generating foreign exchange. The contribution by mining to GDP from 1990 to1996 was 9% and the mining sector employed a labour force of about 6,000 persons. Jamaica is the third largest producer of bauxite after Australia and Guinea. [1]

Tourism is also an important activity. 1,820,627 people visited Jamaica in 1996 and 33% of the work force is employed by an activity related to tourism. [1] The total number of visitor arrivals increased for 1997 to approximately 1,903,893.

The Kingston oil refinery production meets half of the national needs. [1]

Identification and Assessment of Problems:

According to the National Environmental Action Plan (1995), watershed degradation, deforestation, land degradation in the hills, pollution of surface, ground and sea water, and developments on the lowlands are the major environmental problems of Jamaica. Table 1 lists the main environmental problems of Jamaica.

Table - 1 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Issue	Causes/Consequences
Deforestation	A rate of 3%/yr. Slash- and-burn cultivation and charcoal burning Serious impacts on soil degradation; water siltation and sedimentation; loss of habitats
Water Pollution	Surface, ground and sea waters; health risks Industries; agriculture; mining; watershed degradation; poor sewage system

Watershed Degradation	Poor land use practices Short water supply; land degradation and loss of top soil; sedimentation; impacts on coral reefs and seagrass beds; flooding
Unplanned Human Settlements	Shortage of water and basic services; health risks; solid waste disposal; sewage
Reef Degradation	Water pollution in particular nutrients and sediments; explosives; souvenir collecting; ship anchors; hurricanes and tropical storms
Beach Erosion	Sand mining; coral reef destruction; mangrove cutting
Air Pollution	Main urban centres Refineries; power station; chemical processing facilities, cement plant; bauxite mining and processing; sugar production, other industrial activities; motor vehicles and traffic congestion.
Industry	Non compliance with effluent and emission standards; solid waste dispose in streams and sinkholes

Sources: Environmental Synopsis (1993) & NEAP (1995) [5 & 6]

According to the NEAP, 19 of the 26 newly defined watersheds have been declared critical owing to the degree of degradation. The forest cover has been cleared to replace it with coffee, or to produce yam sticks, charcoal, fence posts and timber. The impact in the coastal areas, and particularly in the coral reefs is very serious due to siltation. Also the clearing of the slopes for cultivation has caused accelerated erosion of the soils. [6]
Solid and liquid wastes from domestic, ship-generated, industrial and agricultural sources are the two major causes of pollution. It has been estimated that the solid waste disposal in Jamaica would be about US$ 50/ton, [6] for a daily production of 8,657 tonnes, the collection and disposal will have an estimated cost of US$ 432,850 per day. The loads and ways of disposal of solid waste are summarised in Table 2.

Table 2 – Generated and Disposal of Solid Waste

Type of waste	Amount generated	Disposal methods
Municipal	2775 ton/day	Dump sites
Ship-generated	5310 ton/day	National dump sites
Industrial	572 tons/day	Dump sites/on site solid waste landfills
Agricultural	No data available	On-site and some reuse in feeds and fertilisers

Source: Inter-American Development Bank (IDB) [6]

The NEAP states that 50% of the waste is generated in the Kingston Metropolitan Area, causing a serious pollution problem to Kingston Harbour. The dumpsites have a high potential to pollute soils, water and air. Only 60% of all generated waste is collected, although in some urban areas there is evidence that only 40% is collected. The individuals and small private contractors dump the waste in public areas, vacant lots and drains. [6] The Government is focusing on the rehabilitation of the Kingston Harbour.
Ship-generated waste is a growing problem and some measures will have to be taken soon. [6]
The national sewage generation was estimated in 455 million litres per day, of which only 25% is collected and treated. The use of septic tanks and latrines that do not comply with minimal technical specifications are of common use to dispose the rest of the sewage. [6]
Waste generated by hospitals, tyres and hazardous wastes are also a source of concern in Jamaica. The incinerators in hospitals are working very poorly and the waste is still unsafe after burning. Tyres and hazardous wastes are disposed in dumping sites creating a major health risk. It has been estimated that there are 122 companies that generate hazardous waste in Jamaica, and at present they are expected to store their waste. [6]

Air pollution in the major urban centres is another cause of concern to the Government of Jamaica. The main origins of these emissions are oil refineries, power stations, and chemical processing facilities, Kingston cement plant, as well as the bauxite processing and the sugar production.
The marine resources of Jamaica are considered to be the most over-fished in the English speaking Caribbean by CARICOM. The use of dynamite, gill nets and traps has had a serious adverse impact in the fisheries.
Mangrove swamps have been decimated for firewood and yamsticks and beaches have been seriously affected by sand mining.
Jamaica has an extensive legal framework. (See table 3) [6]

Table – 3- Principal Environmental Laws

Environmental Law	Authority
Natural Resources Conservation Act	To protect and manage natural resources and control pollution
Watersheds protection Act	Watersheds protection
Public Health Act	Environmental Health; waste management; pollution control
Clean Air Act	Control of air pollution
Forest Act	Declaration and Management of forest reserves
Jamaica National Heritage Trust	Preservation and management of historical sites, buildings and artefacts
Fishing industry Act	Development and management of fisheries
Morant and Pedro Cays Act	To protect the cays from unauthorised exploitation of species
Water Act	To establish board and water courts
Underground water Act	To protect underground resources
Beach control Act	Control of sand removal from beaches
Wildlife Protection Act	Control hunting of Wildlife
Marine Park regulations	To establish national parks and protect their resources
Mining Act	Control of mining
Petroleum Act	Control of petroleum as a hazardous substance
Quarries control Act	Control of quarrying activities
Town and country planning Act	Physical planning and building control
Land utilisation Act	Land use planning and development control
Local improvements Act	Amelioration of poor infrastructure amenities in communities
Urban Development Corporation Act	Urban physical planning and development
Pesticides Act	Control of importation, use and disposal of pesticides
Litter Act	Control of litter in public places
Harbours Act	Control of harbour pollution (oil spills)
Shipping Act	Control of shipping

Source: NEAP (1995) [6]

From the above table, and taking into account all the environmental problems identified in this section, it is evident that Jamaica has a major enforcement problem, or the legislation is outdated.

Emerging issues:
Feasibility studies were completed in 1996 for a caustic chemical plant and an alumina refinery and a $14 million limestone mining and burnt lime plant was to start being constructed by the end of 1997. [1]
Several relatively big tourist complexes are going to be built in Kingston, Montego Bay, Negril, Ocho Rios and Port Antonio. [1]
A $180 million Information park is going to be built at Portmore Centre, in an effort to convert Jamaica in an important information technology centre in the Region. [1]

Priorities for Action:
As identified in the NEAP immediate actions need to be taken regarding land use management; human settlements; forestry, agriculture and watershed management; waste management; air, land and water pollution; marine living resources; national parks, protected areas and wildlife; legislation; institutions; and, public awareness. Therefore, the main priority at this stage is to secure the financial resources to carry out all the recommendations made in the NEAP. Of particular interest are actions pertaining to Education and Training. Public education is vital for the success of programmes. Coastal Zone Management training is needed as there is not enough expertise available in this area. Oil pollution equipment and training need to be updated as well as the National Contingency Plan. The Coastal Environment Index Mapping exercise on sensitive areas needs to be completed. Legislation for mandatory garbage separation, collection and disposal also needs to be implemented.
The new projects mentioned in the emerging issues section should be subject to detailed environmental impact assessments, including a careful analysis of needs for public services and waste management facilities.
Create a mechanism to apply the "polluter pays" principal throughout the country for solid and liquid waste from all sources is an important priority.

Measures taken:
With the support of the World Bank, Jamaica carried out its NEAP (1995) which is expected to assist in the eradication of pollution and reduction of major environmental problems. [6]
With United Nations Development Programme (UNDP) funds, the Government is implementing a project to strengthen institutions and human resources that will assist in creating capacities for watershed management. With the IDB, Jamaica undertook in 1991 a feasibility study for the reforestation of six watersheds and negotiations are underway for a project of $12 million for a watershed management programme, as well as a project on land administration and management programme for $25 million. [3, 4&6]
With the Canadian International Development Agency's (CIDA) financial support Jamaica has carried out a first phase of a reforestation project and it is expecting to receive funds for a second phase. The Dutch and the European Union have also provided funds for projects related to agro-forestry and watershed management. [6]
With UNDP, UNEP and USAID funds there is a programme to clean up the Kingston harbour and establishing a sewage collection system and treatment facility. The European Union is financing two projects for disposal and treatment of sewage in Ocho Rios and Negril. With the IDB a project is under negotiation to carry out a solid waste management programme for $40 million. [6]
With the support of Sweden, the Government of Jamaica is undertaking a project on integrated coastal zone management. [6] There is an initiative to develop a "National Strategy and Action Plan to Preserve Jamaica's Biodiversity". A system for designating protected areas has been developed for ensuring biodiversity maintenance, which is under the Natural Resources Conservation Authority. Two national parks have been established and seven other protected areas are under study. This will ensure that 25% of the island's land mass is protected by the next century. The Natural Resources Conservation Authority has also developed a Permit and Licensing System which requires the application for, and issuing of a permit before certain development projects can be undertaken. The Natural Resources Conservation Authority has, in addition, taken steps to integrate conservation projects in new resort development. A project has been developed to assist hotels in establishing Environmental Management Systems (EMS) under the ISO 14000 Standards.
Other initiatives being taken to protect the coastal zone from environmental degradation include:

- revision of the Coastal Development Order for the parish of St. Ann;
- formulation of an Integrated Development Plan for the city of Montego Bay;
- an Environmental Protection Plan for the Negril Area and its environs;
- the development of a comprehensive Coastal Zone Management Plan; and
- the development of a Tourism Master Plan.

The Government of Jamaica in an effort to rehabilitate degraded watersheds has developed projects involving fuelwood plantations, reforestation and agro-forestry. The Government has developed a National Settlement Strategy in an effort to rationalise the spatial distribution of human settlements across the island.

As a first step to implement the NEAP, the Government of Jamaica drafted specific projects related to the above-mentioned problems (See table 4).

Table – 4 - List of projects

Project	Cost
National Land Resource Data Base	Unknown
Management of Public Lands for Fuelwood Production	Unknown
Development of a Coastal Zone Management Plan	US$ 1,000,000
A national water quality assessment programme	J$2,225,00 + US$ 150,000

Source: NEAP (1995) [6]

In the NEAP status report (1996) it is evident that the Government of Jamaica initiated the implementation of several of the recommendations contained in the NEAP (1995)[7]

References:

[1] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[2] Inter-American Development Bank (1996). Jamaica, Solid Waste Management Programme. Washington, DC. USA.

[3] Inter-American Development Bank (1997). Jamaica, Land Administration and Management Programme. Washington, DC. USA.

[4] Inter-American Development Bank (1997). Jamaica, Watershed Management Programme. Washington, DC. USA.

[5] IUCN – The World Conservation Union (1993). Environmental Synopsis, Jamaica. Gland, Switzerland.

[6] Government of Jamaica (1995). National Environmental Action Plan. Kingston, Jamaica.

[7] Government of Jamaica (1996). Status Report, National Environmental Action Plan. Kingston, Jamaica.

[8] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Martinique (France)

Population: 392,100 [2]

Natural Resource Base:

Martinique is located in the eastern Caribbean, off the north-western coast of South America. One of the Windward Islands, Martinique is largely of volcanic origin and essentially mountainous. The island has an area of 1102 sq. km. [3]

Fort de France (101,540) is the capital and chief seaport. Other important towns are Le Lamentin (30,596) and Sainte Marie (19,760). [3]

According to the World Conservation Monitoring Centre (WCMC), Martinique has 9 species of mammals, 131 of birds, 9 of reptiles and 1 of amphibian and about 259 species of ferns and 30 of endemic higher plants. [4]

Economics:

Martinique's economy is based largely on agriculture, and about 18 percent of the island is cultivable. Agriculture generates 8% of the gross domestic product (GDP). Bananas are the principal agricultural product follow by pineapple, other fruits, sugarcane, vanilla, and tobacco. Refined petroleum products, rum, sugar, cement, and processed food are major manufactures. Tourism and fishing are also important to the economy. In the early 1990s Martinique's imports cost about $1.7 billion and its exports earned approximately $211 million. Principal trading partners were France and Guadeloupe. [2]

Identification and Assessment of Problems:

According to Betz (1990) the liquid waste originated by the agriculture industry was pre-treated in compliance with the law before discharging it into the watercourses. Sewage was also treated in detoxification facilities but there were plans to develop an integrated waste management system. [1]

Betz also reported that solid waste was disposed on a landfill. [1]

Emerging issues:

France provides tax incentives for tourism and industrial initiatives for investors who want to develop enterprises in Martinique. [2]

The oil refinery was recently expanded. [2]

Priorities for Action:

The available information is not sufficient to make specific recommendations.

Measures taken:

No information available.

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] "Martinique," Microsoft Encarta 98 Encyclopedia. 1993-1997 Microsoft Corporation.

[4] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Mexico

Population: 92,250,000 [2]

Natural Resource Base:

Mexico is located in North America, bounded on the east by the Caribbean Sea, on the north by the United States of America, on the south by Guatemala, and on the west by the Pacific Ocean. Mexico has an area of 1,958,201 sq. km. The capital is Mexico city where 10% of the population live. [5]

The Caribbean Sea borders six Mexican States. In the north-eastern corner of Mexico, south of the United States and North of Veracruz, Tamaulipas State is located (2,526,387). Most of Tamaulipas is a lowland coastal plain, but the south-central region forms part of the Sierra Madre. Much of the arable land needs to be irrigated but the lowlands are very fertile. The majority of the State is semi-arid with high temperatures and little rainfall. The area is 79, 829 sq. Km. The coastal area is largely unpopulated. [5]

South of Tamaulipas the state of Veracruz is situated (6,228,000). The climate and topography of Veracruz range from a hot and flat coastal region to extremely cold and high peaks, Pico de Orizaba, (5610) the highest in Mexico and the Cofre de Perote (4250). The area of the state is 72,000 sq. km. A large river that originates in the Valley of Mexico flows eastward across Veracruz until it enters the Gulf of Mexico at Tampico. Mexico's main port city is Veracruz, located in the state of the same name. [5]

Tabasco state, (1,748,664) south-east of Veracruz, is mainly a rural state and the site of one of Mexico's largest oil fields. The climate is hot and humid, with temperatures ranging from 20° to 40°C. The area of the state is 24,661 sq. km. Alluvial floodplain, rivers, lagoons and marshlands cover most of the state. There are areas of dense forest with animals such as jaguar, deer, and alligator. [5]

Campeche is situated in the Yucatan Peninsula in south-eastern Mexico. The climate is semi humid to humid with a dry winter season. Tropical forest covers more than half of the states' territory. Campeche covers an area of 51,833 sq. km. The majority of the state' population live on the coastal area (642,082). [5]

Yucatan state located in south-eastern Mexico, north and north-east of Campeche, it has an essentially flat topography and is made of limestone cover with a shallow layer of top soil, which limits substantially its fertility. The climate is humid and rainy in the south and hot and dry in the north. The state covers an area of 39,340 sq. km. and it has a population estimated on 1,555,733. Hurricane Gilbert seriously damaged the Yucatan Peninsula in 1988. [5]

Quintana Roo (703,442) is located in the Yucatan Peninsula, and has similar characteristics to Yucatan state. The thin soils and the semiarid climate produce a forest that includes large stands of mahogany but impairs agricultural crops. The area of the state is 50,350 sq. km. [5]

According to World Conservation Monitoring Centre (WCMC), Mexico has 450 species of mammals, 1,026 of birds, 687 of reptiles and 285 of Amphibian species and about 25,000 flowering plants, 1000 ferns and 12,500 of endemic species of higher plants. [6]

Economics:

Agriculture accounts for about 10 % of the gross domestic product and employs about one-third of the labour force. [2]

Tamaulipas has some of the most important gas fields in Mexico and several petroleum refineries and petrochemical plants are located in Tampico, which is the most influential commercial centre and a seaport. [5]

Veracruz is a leading agricultural state producing maize, beans, sugarcane, coffee, rice, honey, fruit, cattle and pigs. The state also has an important fishing industry and is the location of the Poza Rica fields and refinery. [5]

Tabasco is not a very developed state, but it is a major source of crude oil and gas. In 1995 25 % of the crude oil produced in Mexico came from Cinco Presidentes oil field in Tabasco. Production of sugarcane, bananas and corn is also important. Fishing and cattle ranching is common in the state. [5]

Campeche has an impressive fleet of fishing vessels for fish and shrimp. The shrimp and prawn production is one of the highest Mexico. Production of rice, honey and sugarcane is also important. In 1995 Campeche produced 25 % of the natural gas produced in the country. [5]

Yucatan's economy depends on tourism, light manufacturing, and agricultural products such as cattle, poultry and honey. Fishing is also important. [5]

Quintana Roo's economy depends basically on tourism, as Cancun and Cozumel have become two of the most attractive international destinations in Mexico. [5]

Assessment of the problem:

According to Meyer-Arendt (1993) coastal erosion in Yucatan is a very serious problem. [4]

No information available about pollution problems or sanitation systems in the Caribbean coast of Mexico. It is evident from the main economic activities carried out in the area that oil pollution must be a problem. At the same time if we take into account that about 10.9 people live in the Caribbean coast of Mexico and that some of the states are considered to be less developed than other parts of Mexico, solid and liquid waste might be a serious problem.

Emerging issues:
No information available

Priorities for Action:
In 1993 Meyer recommended the preparation of a comprehensive integrated coastal zone management plan for the Yucatan Peninsula to try and find solutions to the serious coastal erosion problem. [4]
Collection of up-dated information on the use, amounts and types of agrochemicals is also of paramount importance to avoid pollution by run-off as well as monitoring of pollutants generated by the oil and petrochemical industries.

Measures taken:
With the Inter-American Development Bank (IDB), Mexico is undertaking a $600 million rural areas sanitation project to carry out institutional and community development, and build the necessary infrastructure. [3]

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] Inter-American Development Bank. Apoyo a la Modernización del Sector Agua y Saneamiento en Zonas Rurales. Washington, DC., USA, 1998.
[4] Meyer-Arendt, Klaus. Shoreline Changes along the North Yucatan Coast. Coastal Zone'93. Published by the American Society of civil Engineers, New York, New York, 1993.
[5] "Mexico," Microsoft Encarta 98 Encyclopedia. 1993-1997 Microsoft Corporation.
[6] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Montserrat (United Kingdom)

Population: 5,800 [1]

Natural Resource Base:

Montserrat is one of the Leeward Islands of the Lesser Antilles, Southwest of Antigua and Northwest of Guadeloupe. It is a small island of 102 sq. km, mountainous and volcanic. The capital Montserrat is the major urban centre. Since mid 1995, many people have fled the island due to the threat of a violent eruption of the Soufrière Hills volcano. Antigua and Barbuda reported that it had received about 3,000 evacuees and some other residents have relocated in the United States and the United Kingdom.[2]

The climate is tropical with little seasonal variation. The average annual temperature is 28°C.

According to the World Conservation Monitoring Centre (WCMC), Montserrat has 193 species of mammals, 737 of birds, 2 of endemic reptiles and 10 of endemic amphibians and about 20,000 species of flowering plants, 1,059 of ferns and 8,000 of endemic higher plants. [3]

Economics:

The economy of Montserrat has almost come to a halt. Since the threat of a volcanic eruption started tourism has decreased by 51%. Agriculture accounted for 4.5% of the gross domestic product (GDP) in 1996, as farmers went ahead planting taking the risk of loosing everything. [1]

Major construction activities that were under way in 1996 were halted. [1]

Identification and Assessment of Problems:

According to the National Environmental Action Plan (1994), the most serious environmental problems of Montserrat are improper land-use practices, mismanagement of watersheds, solid waste disposal, municipal sewage, hazardous waste disposal, sand mining, exploitation of marine resources, siltation of coastal wetlands and lack of appropriate legislation. [2]

The Government is in charge of collecting 87% of the municipal waste of the island and a private contractor the remainder. Collection is irregular and solid wastes are scattered along the roadsides. Sewage is disposed through septic tanks. Medical waste along with other hazardous waste is disposed in a public landfill. [2]

Emerging issues:

Last September the British Government announced that a 5-year development plan was going to be prepared. [1]

Priorities for Action:

Under the present circumstances it is difficult to make recommendations regarding priority actions. The NEAP contained very important recommendations regarding land use planning, watershed management, and waste management, management of coastal resources and conservation of the natural and cultural heritage. [2]. If circumstances change the implementation of these actions would still be a main priority.

Measures taken:

With the support of the World Bank and the United Nations Development Programme, Montserrat carried out its NEAP (1994) which was expected to assist in the improvement of the quality of the environment in the island. [2]

References:

[1] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[2] Government of Montserrat (1994). National Environmental Action Plan. Montserrat.

[3] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Netherlands Antilles (The Netherlands)

Population: 209,721 [1]

Natural Resource Base:

Netherlands Antilles comprises two island groups, the Netherlands Leeward and the Netherlands Windward Islands, in the Caribbean Sea. The former group, consisting of Curaçao and Bonaire is situated Northwest of Caracas, Venezuela. The area of the Netherlands Leeward Islands is 800 sq. km. The Netherlands Windward Islands consist of the southern part of St. Maarten and all of Saint Eustatius and Saba, covering a total area of about 68 sq. km. These islands are situated at the northern end of the Lesser Antilles chain, to the Southeast of Puerto Rico. The capital and largest city is Willemstad (125,000). [3]

The topography varies from low hilly terrain in Curaçao, Bonaire, St. Eustatius and St. Maarten, to an extinct volcano in Saba, rising up to 1000mt above sea level. [3]

The climate is mild tropical, with an average temperature in Bonaire and Curaçao of 28°C and for the other islands 27°C. [3]

According to the World Conservation Monitoring Centre (WCMC), the Netherlands Antilles has 252 species of birds, 18 of reptiles and 2 of amphibians. [4]

Economics:

The most important activities of the Netherlands Antilles are refining petroleum and transhipment, tourism and offshore finance. Large refining facilities are located on the island of Curaçao and transhipment takes place in Bonaire, Curaçao and St. Eustatius. Petroleum and petroleum products accounted for about 53 percent of the annual value of imports and 86% of exports. Financial services constituted 22.9% of GDP and transport and communication 13.3%. [2]

Identification and Assessment of Problems:

Curaçao hosts about 69% of the population, while St. Maarten hosts 24%. According to the report prepared by Buth and Ras in 1992, only 38% of the sewage generated in Curaçao (equivalent to 55,000 people) is connected to a sewerage system and from it 75 % was treated in 1992, while the rest of the sewage was discharged untreated. The estimated pollution load was 3,055 t/yr. of BOD_5, Suspended Solids was 880 t/yr., Oil was 1,050 t/yr., Nitrogen was 330 t/yr. and Phosphorus was 1.6 t/yr. 91 % of the BOD_5 load was originated from the oil refinery, 6 % from other industries and 3 % from domestic sewage. [1]

The report further states that in general the impact of land-based sources of marine pollution in Saba, Bonaire and St. Eustatius is considered minimal, although the presence of oil terminals in the two latter ones occasionally causes accidental spills and leakages. [1]

In Bonaire leakage or discharge of sewage seriously threatens the marine environment.

In St. Eustatius erosion is increasing, causing not only a problem in land, but in the marine environment.

Emerging issues:

No information available.

Priorities for Action:

Immediate action to control leakage and discharge of sewage into Bonaire's coastal areas.

Measures taken:

Bonaire is now planning the construction of a sewerage and treatment plant in order to combat degradation of the reefs, however, funding is only partly committed..[2]

In Curaçao the execution of Kuststrook Marie Pompoen - reconstruction and construction of a sewerage system and a treatment plant - at the east side of Willemstad will be finished by the summer of 1999. There are also a few projects planned within the framework of the refineries up grading, which will decrease impacts on the environment. [2]

It is planned to undertake a project about legislation for discharges in the year 2000. This legislation will propose measures and standards, taking into account such aspects as the geology of the area, availability of a sewerage system in the vicinity and location with respect to the marine environment. [2]

References:

[1] Buth, L. & Ras J. 1992, Inventory of the Land-based Sources of Marine Pollution. Curaçao, Netherlands Antilles.

[2] Government of the Netherlands Antilles, Fax communication of 23.12.98.

[3] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[4] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Nicaragua

Population: 4,500,000 [1]

Natural Resource Base:

Nicaragua located in Central America, bounded on the east by the Caribbean Sea, on the north by Honduras, on the south by Costa Rica, and on the west by the Pacific Sea. Nicaragua has an area of 129,494 sq. km; its coastline is about 435 km long. [3]

Nicaragua is the largest country and the most urban nation in Central America, with nearly two-thirds of its population living in or around cities. Managua, the capital, had an estimated population of more than 1.5 million in 1992 and could approach 2 million by the end of the century. It is by far the largest city and the centre for government, communications, and industry. Managua is prone to earthquakes, which destroyed it in 1931 and again in 1972. [3]

Nicaragua can be divided into three major geographical regions. In the Pacific and Caribbean coasts there are tropical lowlands and in the centre there is a cooler highland plateau. Nicaragua is traversed by several mountain ranges and there are peaks higher than 2100 m. Nicaragua's Caribbean lowlands are very sparsely settled, while the population is quite dense in the Pacific coast region, where most of the cities are located. Although half of the territory is in the Mosquito Coast that extends about 70 km inland from the Caribbean, only 1.43 % of the population lives in this area (64,350). [3]

Tropical rain forest covers a large part of the Caribbean lowland area which is virtually intact. In 1989 the Government designated 360,000 ha. for conservation purposes. [3]

Nicaragua has a tropical climate with average temperatures changing with altitude. The coastal areas have an average temperature of 27 degrees Celsius and in the highlands the average temperature varies between 16 and 27 degrees Celsius. The annual rainfall on the Caribbean coast is about 2500 mm. The Pacific region and the central highlands receive some 1000 to 1800 mm of rain annually, mainly from May to November. [3]

The important mineral deposits of Nicaragua include gold, silver and copper. The abundant volcanoes provide for a good source of geothermal energy. [3]

Nicaragua has broadleaf trees such as oak and cedar, which are common in the highlands. The excellent hardwoods like mahogany have been cut. The animal life is varied and includes small deer, puma, sloths, wild pigs, and several species of monkey. Among the birds there are parrots and hummingbirds. [3]

According to World Conservation Monitoring Centre (WCMC) Nicaragua has 200 species of mammals, 750 of birds, 161 of reptiles and 59 of amphibian species and about 7,000 flowering plants, 576 ferns and 40 of endemic species of higher plants. [4]

Economics:

Agriculture accounts for about 30% of the gross domestic product (GDP). Coffee accounts for most of the agricultural exports. Sesame, banana, sugar, meat, tobacco, rice, sorghum, cacao, cotton and corn are also produced. Large areas of rough pasture exist in the interior savannahs. Substantial numbers of cattle, hogs, sheep, and chickens are raised. [2]

Fishing is concentrated along the Caribbean coast. Shrimp are a valuable product mainly produced through farming on the Pacific coast. [2]

Manufacturing contributes about 16 % of the GDP. Major industries include cement, agrochemicals, oil products, metal processing, foodstuffs, beverages, sugar and coffee processing, clothing, and cigarettes. [2]

Nicaragua is making an effort to promote tourism and in 1995 received 270,000 visitors. [2]

Major ports are Corinto and Puerto Sandino on the Pacific coast and Bluefields and Puerto Cabezas on the Caribbean. [3]

Assessment of the problem:

According to the National Environmental Action Plan (NEAP,1994), the most serious environmental problems of Nicaragua are deforestation, soil erosion and water pollution. [3]

Poverty is a serious problem and mortality statistics reveal high levels of environmental related diseases such as cholera, filaria, dengue, malaria, tuberculosis, gastro-enteritis, typhoid, hepatitis and even cancer. Nicaragua is one of the three poorest nations in the Western Hemisphere, with a per capita income of $420. [3]

The NEAP stated liquid wastes from domestic sources are a major cause of pollution. In Nicaragua as a whole 19% of the urban population has access to a sewage system. In the Caribbean region nobody has access to such a system. Septic tanks and latrines that do not comply serve the rest of the country with minimal technical specifications. There

is very little hard data of water quality, but there is evidence of serious pollution with industrial waste and pesticides. Mining also has caused pollution with heavy metals. [3]
According to the NEAP only 49% of the solid waste is collected. The gross estimate is that in 1992 the households produced 352,955 tons of solid waste in Nicaragua, and industry, hospitals, etc generated 81,489 tons. In the 143 municipalities of the country only 43 % has a collection system in place and the final disposal is made in sites of which 87% do not have an official authorisation. [3]
Although Nicaragua has very rich soils, their degradation is taking place at a very fast pace. Erosion is a problem of considerable magnitude. Watershed mismanagement has had serious impacts on water availability and siltation. [3]
There is no reliable data regarding industrial waste and there is no problem with ship generated waste as there are no cruise ships visiting Nicaragua. [3]
Agricultural chemicals are also of serious concern but there is no reliable data regarding the magnitude of the problem. Some agrochemicals are produced in Nicaragua and there is evidence that serious pollution was caused by the discharge of toxic substance from one of the factories into a nearby lake. [3]
Charcoal contributes 57% of the total amount of energy consumed in Nicaragua with a detrimental effect on the forest. [3]
Bluefields (36,000) is the largest city on the Caribbean coast. This city does not count with a sewer system; therefore individuals dispose their sewage through septic tanks and latrines. The solid waste problem is very serious, as the common practice is to dump solid waste in nearby public areas and vacant lots, only about 44 % is collected. The study carried out with UNDP/GEF funds in the coastal lagoon of Bluefields concluded that the industrial waste is not considerable at present and that the major problem is the solid waste that are disposed around the lagoon. Some hydrocarbons were found but in low concentration. (See table 1). [2]

Table 1 – Hydrocarbons in Sediments and Surface Waters in Bluefields (1995)

Lagoon (ug/l)	Sediments (ug/g)	Sediments - Harbour Area (ug/g)
26.6	28.55	247

Source: Centro de Ingeniería y Manejo Ambiental de Bahías (1996) [2]
It was estimated through this study that Bluefields generates 22.4 tons/day of solid waste and that 73% is organic matter and 21% plastics. Average amounts of heavy metals in 1994 and 1995 are shown in table 2. [2]

Table 2 – Average Amounts of Heavy Metals in Sediments in Bluefields

Year	Org. Matter ug/l	Co ug/l	Cu ug/l	Fe %	Mn ug/l	Ni ug/l	Pb ug/l	Zn ug/l
1994	16.95	21	53	5.96	826	14	19	117
1995	14.3	21	54	6.33	670	19	18	111

Source: Centro de Ingeniería y Manejo Ambiental de Bahías (1996) [2]
The study carried out with UNDP/GEF funds in the coastal lagoon of Bluefields concluded that pesticides are an issue of concern in the lagoon. (See table 3) [2]

Table 3 – Organochlorine Pesticides in Water and Sediments (1995)

	Lindane	Heptachlor	Aldrin	Dieldrin	DDT
Water (ng/l)	1.9	10.1	4.5	6.85	21.25
Sediments (ng/g)	1.8	3.9	0.8	6.4	8.8

Source: Centro de Ingeniería y Manejo Ambiental de Bahías (1996) [2]

Emerging issues:
The Government of Nicaragua is working very hard to accelerate the economic growth of the country and the quality of life of the people. This will bring new threats to the environment if it is not done in an environmentally sound manner. [1]

Priorities for Action:
The Caribbean coast is not under a lot of human pressure in Nicaragua and it seems that at this stage the Government could take all necessary measures to make sure that the area develops in a sustainable manner. The main priority at this stage is to build adequate solid and liquid waste disposal and treatment facilities.
A coastal zone management plan as has been drafted for Bluefields should be extended to the rest of the Caribbean coast. The implementation of the recommendations made in the final report of the UNDP/GEF project is of paramount importance to control marine pollution. [2]

Measures taken:
With the support of the World Bank, Nicaragua carried out its NEAP (1994) which is expected to assist in the eradication of pollution and reduction of soil erosion. [3]
With UNDP/GEF funds, the Government is implementing a project to draft a management plan for the Bluefields lagoon and propose a management plan for solid waste. [2]

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] Centro de Ingeniería y Manejo Ambiental de Bahías. Final reports-Nicaragua case study, UNDP/GEF Project on Planning and Management of Heavily Contaminated Bays and Coastal Areas in the Wider Caribbean. Havana, Cuba, 1996.
[4] Government of Nicaragua (1994). National Environmental Action Plan. Managua, Nicaragua.
[5] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Panama

Population: 2,680,000 [2]

Natural Resource Base:

Panama is located in Central America, on the narrow strip of land that connects North and South America. The country is bounded on the north by the Caribbean Sea, on the east by Colombia, on the south by the Pacific Ocean and on the west by Costa Rica. At its widest point it stretches 650 km from west to east, but at its narrowest, near the roughly north-south route of the Panama Canal, it measures only 48 km. It has an area of 77,082 sq. km. [3]

Panama has a hot and humid tropical climate, with temperatures changing according to altitude. Prevailing winds carry moisture from the Caribbean Sea to the northern coast, making it wetter than the Pacific side. The northern slopes of the mountains receive an average of 2970 mm of rain a year. Pacific winds bring drier air to the southern coast, which receives up to 1650 mm a year. Panama lies outside the paths of Caribbean and Eastern Pacific hurricanes. The average temperatures in coastal areas are 23° to 27° C; in higher elevations they average about 19° C. [3]

The largest cities are Panama City (458,490), and its suburb of San Miguelito (282,420). Together with nearby Tocumen, Arraiján, and La Chorrera, they form a metropolitan area of nearly 1 million people. Other major cities are Colón located on the Caribbean coast (54,654) and David (65,763); each is part of a metropolitan area of more than 100,000 people. Other regional cities include Santiago, Penonomé, and Chitré. [3]

The central region, known as the transit zone, consists of narrow coastal plains and a mountainous middle section. Half of Panama's people, 90 % of its industry, its largest cities, and its major transportation routes are located in this area. [3]

Panama is crossed by mountain ranges, covered with large areas of rain forest, and bounded by two long coastlines studded with islands and bays. In the west, the mountain range is called the Cordillera Central, the Serranía de Tabasará has an average height of about 1500 m. The highest point in the country, the Barú volcano (3475 m), is located in this range. The mountains in the country's eastern half are divided between the Serranía de San Blas and the Serranía del Darién, with an average altitude of about 900 m. [3]

Bocas del Toro in the Northwest of Panama (Caribbean Sea) is a mountainous and densely forested region. [3]

In the Southwest, the province of Chiriquí has mountain slopes covered with rich volcanic soils and it produces strawberries, coffee, and other temperate crops. On its Pacific coast there are extensive banana plantations. [3]

Eastern Panama contains the country's most extensive and dense rain forests and is very lightly populated. [3]

Both of Panama's coasts are indented with many lagoons, bays, and gulfs, including the Gulf of Panama on the Pacific side. Major Pacific islands include Coiba Island, used as a penitentiary, and the Pearl Islands, in the Gulf of Panama, which are being developed for tourism and fishing. The San Blas Islands are coral atolls inappropriate for development. [3]

Panama has several important rivers. The Chagres drains a watershed of 326,000 hectares north of Panama City and flows into the Caribbean just west of Colón. [3]

Panama's and Colombia's Darién jungle is the largest tropical rain forest in the western hemisphere outside the Amazon Basin. The entire north coast of Panama is densely forested and contains more than 2000 species of tropical plants. This habitat also supports a wide array of animals common to Central and South America, including ocelots, sloths, armadillos, pumas, anteaters, spider and howler monkeys, deer, alligators, crocodiles, and many snakes. It has one of the most diverse populations of birds in the world, ranging from colourful tropical species to long-distance migrating birds. Due to its unique location, Panama has several animal species found nowhere else, such as the golden tree frog and the giant tree sloth. In populated areas, however, most of the native animals have been hunted or driven out. [3]

Panama has manganese and iron-ore deposits, the world's ninth largest reserves of copper ore, and working gold mines. Its rich fish catch in the Pacific (especially for prawn and shrimp) is being supplemented with shrimp farming in ponds. [3]

According to the World Conservation Monitoring Centre (WCMC), Panama has 218 species of mammals, 929 of birds, 226 of reptiles and 164 of amphibian species and about 9,000 flowering plants, 900 ferns and 1,222 of endemic species of higher plants. [4]

The Chagres National Park and Forest Reserve were established to protect the fragile lands near the headwaters of the river. Another conservation effort, Soberanía National Park, encompasses 22,000 hectares of forested land along the east bank of the Panama Canal. [3]

Economics:
In the 1990s commerce, finance, and business contributed about 72 % of Panama's GDP. [3]
The Panama Canal contributes about 10 % of the nation's GDP. Business related to the Canal play a major role in this sector. International banking, maritime services, manufacturing, and shipping combined provide more jobs and tax revenue than the Canal. [3]
A major factor in Panama's industry and foreign commerce is the Colón Free Zone, an international trade facility that allows businesses to operate without paying import duties or taxes. Established in 1948 near the northern terminus of the canal, this zone is the largest of its kind in the western hemisphere and second only to Hong Kong in the world. In 1995 its 1600 businesses generated $11 billion in sales and employed 14,000 people. Companies in the zone import raw materials and other components for manufacturing, or operate warehouses that break down large shipments from Asia and distribute them to nations bordering the Caribbean Sea. In the 1990s the free zone doubled its area and has benefited from new container ports at Manzanillo and Coco Solo. [2 & 3]
Agriculture employs 20% of the Panamanian labour force and generates about 7% of the GDP. The only export products are bananas, coffee, and sugar. Among the more important products for local consumption are fruit, corn, rice, timber, some vegetables, and livestock. About 9 % of the land is suitable for farming, with another 20 % used for grazing. [2]
Panama's fishing fleet works the rich grounds in the Pacific Ocean, using refrigerated ships. Shrimp and prawn represented Panama's second most important export product in 1996. [2]
The Darién area produces a large amount of mahogany for export, and teak is grown in plantations in other regions. [2]
Manufacturing, amounting to 9 % of GDP, is mostly light and destined for construction and domestic markets. Products include fabricated metal, petroleum products, building materials, cement, chemicals, paper and paper products, household consumer goods, processed food and beverages, furniture, and clothing. Virtually all the products manufactured in the Colón Free Zone are exported. [3]
Panama has a small mining industry, which contributes only 0.2 % to GDP and employs about 2000 people. Activities include some gold and silver mining, and quarrying. It exports some refined petroleum products. [3]
Hydroelectric power is generated from dams on Lake Bayano, Lake Alajuela, and a few smaller dams, and supplies about 70 % of Panama's energy requirements. The remainder is generated from imported petroleum. [3]
The Panama Canal is the major tourist attraction within Panama, and about 250,000 visitors travel through the canal every year in cruise ships. However, very few set foot in Panama itself. Traditional tourism has never been a large industry. [3]

Assessment of the problem:
Deforestation, soil erosion, siltation and watershed mismanagement seem to be the most serious problems facing Panama. [3]
Long-term environmental hazards are expected from disposal of hazardous materials and unexploded ammunition on U.S. military bases in areas formerly controlled by the United States as part of the Panama Canal Zone. [3]
As in the rest of Central America pesticide use is very common but there is no hard data regarding the magnitude of the problem. [1]
According to Betz (1990) sewage is discharged directly into the sea and solid waste is disposed in landfills. [1]
The main human settlement in the Caribbean is Colón and it is assumed that industrial wastes are generated in this area. [2]
In 1990 CONAMA reported to be carrying out monitoring of the Colon Bay but the results of this monitoring were not available in the information search carried out.[1]

Emerging issues:
No information available.

Priorities for Action:
The main priority at this stage is to build adequate solid and liquid waste disposal and treatment facilities.
Collection of up-dated information on the use, amounts and types of agrochemicals is also of paramount importance to avoid pollution by run-off. Monitoring of pollutants generated by the manufacturing industry in Colón is an important priority.
Drafting of an integrated coastal zone management plan for the Caribbean region is a top priority as well as establishing a water quality-monitoring programme.

The new mining and tourist developments should undertake a detailed Environmental Impact Assessment before receiving authorisation to initiate construction.

Measures taken:
No information available

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] "Panama," Microsoft Encarta 98 Encyclopaedia. 1993-1997 Microsoft Corporation.
[4] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Puerto Rico (U.S.A.)

Population: 3,733,000 [1]

Natural Resource Base:

Puerto Rico is bordered on the north by the Caribbean Sea, on the east by the Virgin Passage, on the south by the Caribbean Sea, and on the west by the Mona Passage. Puerto Rico has an area of 9,194 sq. km; its coastline is about 501 km long. [2]

Puerto Rico is a mountainous country with an east to west mountain range that extends almost the entire length of the island. On the northern and southern part of the island lie the coastal plains. [2]

Puerto Rico has a tropical climate, with little seasonal temperature change. The annual average temperature is 27°C in San Juan, the capital city. The annual rainfall is about 1500 mm. The savannah region receives some 1525-mm of rain annually, mainly from April to September. Puerto Rico is a hurricane prone island. [2]

The important mineral deposits of Puerto Rico include limestone, glass sand, clay, copper, cobalt, chromium, nickel, iron ore, and peat. [2]

The tropical rain forest in the northeastern part of the country contains tree ferns, orchids and mahogany trees. There also kapok trees, poincianas, breadfruit and coconut palms. [2]

According to the World Conservation Monitoring Centre (WCMC), Puerto Rico has 16 species of mammals, 239 of birds, 46 of reptiles and 19 of amphibians and about 2,128 species of flowering plants, 364 of ferns and 235 of endemic higher plants. [3]

Economics:

Manufacturing in Puerto Rico generates 41.4 % of the gross domestic product (GDP). Production of foodstuffs, beverages, construction materials, clothing, chemicals, electric and electronic products, and cigarettes are major activities in Puerto Rico. [1]

Tourism accounts for 6.3 % of the GDP. In 1996 the island received about 4.1 million tourists. [1]

Agriculture accounts 33% of the labour force. Coffee accounts for most of the agricultural exports. Coconuts, vegetables, bananas, pineapples, tobacco, sugar and its by-products and rice are other agricultural products. Large areas of rough pasture exist in the interior savannahs. Cattle and chickens are also an important source of income. [1]

Puerto Rico produces construction materials such as cement, sand and gravel. Clay, graphite, lime and salt are also produced. [1]

Identification and Assessment of Problems:

No information available.

Emerging issues:

San Juan is the largest home port for cruise ships in the Caribbean and the second in the world. The Government is expecting that the contribution of tourism to the GDP will be doubled in the next few years. [1]

Priorities for Action:

New tourist developments should be subject to detailed environmental impact assessments.

Measures taken:

No information available

References:

[1] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[2] "Puerto Rico", Microsoft Encarta 98 Encyclopedia. 1993-1997 Microsoft Corporation.

[3] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

St. Kitts and Nevis

Population: 44,000 [1]

Natural Resource Base:

The Federation of St. Kitts and Nevis comprises two Leeward Island, Southeast of Puerto Rico. A volcanic mountain range traverses St. Kitts and the highest peak is Mount Liamuga (1315m) and Nevis is also of volcanic origin. The area of the country is about 269 sq. Km. Basseterre is the capital city (18,500). About 37% of the island is covered with forest. [2&3]

Nevis has four wetlands. Mangroves, salt ponds and marine seagrass beds are afforded general protection. [2&3]

The climate is tropical with an average annual temperature of 27 degrees Celsius. [1]

St Kitts and Nevis have several important ecosystems such as coral reefs, wetlands and tropical forest. [2&3]

According to World Conservation Monitoring Centre (WCMC), St. Kitts and Nevis has 7 species of mammals, 99 of birds, 10 of reptiles and 1 of amphibians and about 533 species of flowering plants, 126 of ferns and 1 of endemic higher plants. [4]

St. Kitts and Nevis have established two national parks but it is in the process of considering the creation of some additional ones. [3]

Economics:

Tourism is a developing sector, which accounted for 10% of the gross domestic product (GDP) in 1992. In 1996 the number of visitors declined by 14%, as a result of a 30% decline of cruise ships arriving in the islands. [1]

Sugar and its by-products account for most of the agricultural exports. Other agricultural products include white potatoes, onions, cabbages, melons, tomatoes, carrots, cucumbers, sweet peppers, asparagus, pineapples and papayas. Revitalisation of the livestock sector is a priority, in particular of cattle, pigs, sheep, and chickens. Agriculture accounted for 8% of the GDP in 1992. The islands have about 22,000 acres of arable land, of which 13,000 are cultivated. [1]

Manufacturing in St. Kitts and Nevis is limited to refining sugar, producing foodstuffs, beverages, electronic components, clothing, and furniture and contributes with 9% of GDP. [3]

Identification and Assessment Problems:

According to the National Environmental Action Plan (1994), the single most serious environmental problem of St. Kitts and Nevis is solid waste. [1]

The second most serious problem is sewage and chemical disposal from industrial sources. The NEAP states that 80% of marine pollution is due to land-based sources of pollution which are mainly municipal waste, industrial and agricultural waste. [1]

Beach erosion, sand mining and loss of habitats are issues of great concern in St. Kitts and Nevis. [1]

Table 1 – Main Environmental Problems

Problem	Cause/Consequences
Solid waste disposal	Lack of technical and financial resources to dispose in an adequate manner Municipal waste; ship generated wastes; industrial wastes, including hazardous waste; and agricultural wastes mainly from sugarcane
Coastal and Marine Pollution	80% of pollution is generated by land-based sources, mainly the sugar factory, the brewery, the hospital, and the Gardens Housing project
Beach Erosion	Sand mining; coastal developments; destruction of mangroves and coral reefs
Loss of habitats and biodiversity	Destruction of mangroves and coral reefs with excessive nutrients and sediments; destruction of habitats; decrease of turtle populations and other species; use of mangrove swamps as solid waste dumps
Deforestation	Fuel wood and charcoal
Poor land use practices	Degradation of watersheds; lack of land use plans
Protected Areas	Lack of a parks and protected areas system

Natural hazards	Hurricanes and tropical storms; droughts, floods and earthquakes Exacerbated by dumping of wastes in river beds; road construction; filling of salt ponds
Lack of adequate legal instruments	EIA as a requirement; updating of regulations
Lack of institutions and human resources	Capacity building

Source: NEAP (1994) [3]

Table 1 lists main environmental problems as seen by the government of St. Kitts and Nevis. [3]
St. Kitts and Nevis have a legal framework, although it is a bit outdated. For certain issues and is lacking precise regulations to implement the Acts. [3] (See table 2)

Table – 2 – Principal environmental laws

Environmental Law	Date	Regulations
National Conservation and Environmental Protection Act	1987	In preparation
Fisheries Act	1984	Fisheries regulations
Watercourses Act	1949	Watercourse regulations
Public Health Act	1969	Public health regulations
Pesticides Act	1973	Labelling, storage regulations
Litter Act	1989	In preparation
Town and country planning act	1949	Drafted
Land development Act	1960 1988	None
south-east peninsula land Development Conservation Act	1986	Land use management plan
Frigate Bay development corporation act	1972	None

Source: NEAP (1994) [3]

Emerging issues:
A seaport is being developed in Nevis, as well as a tourism complex. [1]

Priorities for Action:
The main priority at this stage is to secure the financial resources to carry out all the recommendations made in the NEAP. There are specific recommendations regarding human resource development; legal instruments and institutions; solid waste management; coastal and marine pollution; beach erosion; biodiversity and wildlife; forestry; land use planning; national parks and cultural heritage; natural and environmental hazards; and public awareness. [3]
In my view, although all recommendations are important, particular attention should be given to the preparation of a comprehensive integrated coastal zone management plan and to the completion of the legal framework for environmental management.
Building of adequate solid and liquid waste disposal and treatment facilities is a top priority.

Measures taken:
With the support of the World Bank, St. Kitts and Nevis carried out its NEAP (1994) which is expected to assist in the eradication of pollution and reduction of erosion on the coastal area.
With World Bank/Global Environment Facility/Caribbean Development Bank funds, the Government is participating in the OECS Waste Management Project that will rationalise the country's waste collection system as well as the waste disposal. The Government developed a National Solid Waste Management Plan that they expected to put in place after 1994. [3]
Land use planning has been introduced as part of the World Bank project on Agricultural Development Support. [3]

The Government has drafted a set of project outlines to implement the recommendations of the NEAP. [3] (See table 3)

Table – 2- List of projects

Project	Cost (US$ million)
OECS Waste Management	6.2
Liquid waste management	15
Integrated Coastal zone Management Programme	2.7
Forestry management	6.7
Protected area system plan	3.2
Environmental and Tourism awareness programme	0.225
Wingfield National Park	0.076
Marine park study	0.072
Total	**34.173**

Source: NEAP (1994) [3]

References:

[1] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[2] Caribbean Conservation Association (1991), St. Kitts and Nevis Environmental Profile. St. Michael, Barbados.

[3] Government of St. Kitts and Nevis (1994). National Environmental Action Plan. Baseterre, St. Kitts and Nevis.

[4] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

St. Lucia

Population: 147,179 [2]
Natural Resource Base:
Saint Lucia is located in the Southeastern Caribbean, between Martinique on the north and Saint Vincent on the south. Saint Lucia has an area of 616 sq. km. Castries is the capital city (53,000). [1]
Saint Lucia is of volcanic origin and it is traversed from northeast to southwest by a mountain range whose highest peak is Mount Gimie (950m). In the south, the Soufrière crater offers a source of geothermal energy. [1]
Saint Lucia has a tropical climate, with an average annual temperature of 27° C and relative humidity of 75%. The average annual rainfall on the coast is less than 2032 mm and more than 3048 mm in the mountains. 80% of the country has slopes greater than 10 degrees, and almost half of the population lives with slopes in excess of 20%. Rainfall is the primary source of fresh water in St. Lucia. It was estimated in 1987 that with a population of 140,000 people the total consumption of was 29 megalitres per day assuming a consumption of 200/lt/per capita/ per day [1].
There are seven major watersheds in St. Lucia with a total area of 2037 ha. It is important to note; however, that within a seven-year period, six studies were carried out in St. Lucia regarding water supply and hydrology. The findings are very confusing as it is difficult to conclude whether there are 28, 31, 37 or 47 watersheds in the country, and it is not possible to have any certainty of the coverage of these watersheds. [1]
Only 11% of the area is covered with primary forest and 48.6% with secondary forest. Mangroves cover about 0.1% of the area. The animal life is varied and includes pigmy gecko (*Sphaerodactylus microlepis*), boas (*Boa constrictor orophius*), four endangered species of marine turtles, greenback (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelis imbricata*) and olive ridley (*Lepidochelys olivacea*), and one vulnerable species, the loggerhead (*Caretta caretta*), iguanas (*Iguana iguana*), agoutis (*Dasyprocta aguti*), and opossum (*Didelphis marsupialis insularis*). Among the birds are St. Lucia parrot (*Amazona versicolor*), St. Lucia Black Finch (*Melannospiza richardsoni*), St. Lucia Oriole (*Icterus laudabilis*) and Semper's Warbler (*Luecopeza semperi*). St. Lucia Parrot and Semper's Warbler are endangered, and it is possible that the latter is extinct as it was last seen in mid 1970s. [1]
The main marine and coastal ecosystems are coral reefs, mangrove swamps and seagrass beds. In 1986, 19 sites were declared marine reserves. [1]
According to the World Conservation Monitoring Centre (WCMC), Saint Lucia has 9 species of mammals, 169 of birds, 17 of reptiles and 2 of amphibians and about 909 species of flowering plants, 119 of ferns and 11 of endemic higher plants. [4]

Economics:
Agriculture accounted for about 11.4 % of the gross domestic product (GDP) in 1996 and about 30,000 jobs. Bananas account for most of the agricultural exports. Other products include coconuts and mangoes. [2]
Tourism is another important economic activity that employed 11,000 people during 1996 and contributed 11.7% to the GDP. The average number of visitors per year until 1993 was 300,000 but this number has increased steadily during the last few years. [2]
Manufacturing in Saint Lucia is limited to production of foodstuffs, beverages, electrical goods, textiles, tobacco and basic chemicals. [2]

Identification and Assessment of Problems:
According to the St. Lucia's Environmental Profile (1991), although there is not much hard data on the state of pollution, there is evidence of marine pollution by bacteria, pesticides, sewage, solid waste and petroleum. Other problems affecting the coastal areas are coastal erosion, sand mining and dredging, overfishing and natural disasters. [2]
Sewage is generally discharged into the sea without prior treatment with the exception of the Rodney Bay where sewage is treated and then discharged through a marine outfall. Some other tourist areas have their own package treatment plants, but there is no detailed information on their performance. Archer made the only estimates of solid and industrial wastes in the Island in 1984. [2]
Oil pollution is a daily threat with the tanker traffic and the Hess Oil storage terminal at Grand Cul de Sac Bay. [2]
Deforestation has been serious in St. Lucia. Before 1950 the cultivation of sugar cane required clearing of forested areas and after that, the banana cultivation expanded also to forestlands. In 1984 the United Nations Development Programme (UNDP) and the World Bank estimated that 80,000 m-tons of fuelwood were consumed per year. In 1981 it was estimated that 88% of households in St. Lucia use charcoal and firewood as fuel sources. As in the case of

watersheds mentioned above, regarding fuelwood there are also several studies carried out with the support of different international organisations that give different estimates. [2]
According to the National Environmental Action Plan (1994), one of the most serious environmental problems of Saint Lucia is solid waste management. The collection system is not very reliable and people dispose the garbage along the roadside, rivers, swamps, etc. The normal disposal system is open dumping with occasional burning. There are several waste disposal sites in operation but the Government is trying to create a sanitary landfill. [3]
The agriculture-related industry also discharges into the sea fair amounts of solid waste. [3] The solid waste generated by the cruise ships is a major problem if we take into account that St. Lucia received 218,777 cruise ship passengers in 1996, which is more than the total population of the island. [2]
The NEAP states that coastal erosion is taking place at a very fast pace due mainly to sand mining and dredging. [3]
Agricultural chemicals are also of serious concern but there is no reliable data regarding the magnitude of the problem. [3]

Table – 1 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Problem	Cause/Consequence
Solid waste ➢ **Domestic** ➢ **Agriculture** ➢ **Industry** ➢ **Ship generated**	Lack of reliable collection system and equipment failure; lack of adequate maintenance of equipment; lack of adequate legislation, effluent standards and guidelines for industry; lack of public awareness; lack of a disposal system for ship generated waste; lack of co-ordination between responsible institutions; lack of funding No recycling; lack of space to place a suitable sanitary landfill; illegal disposal into gullies, rivers, along the roadside, near shore and mangroves Health risks; contamination of aquifers; air pollution through burning of solid waste from open dumps
Water pollution ➢ **Domestic** ➢ **Hotels** ➢ **Marinas** ➢ **Agriculture**	Lack of adequate legislation or enforcement of existing; co-ordination between institutions, duplication of efforts; no hard data; poor collection and treatment systems by the hotels Sewage from leaching and direct discharges; agricultural pollution: indiscriminate use of pesticides and solid matter particularly during rainy season Impact on beaches, seagrass beds and coral reefs; tourism industry; human health
Coastal Degradation	Destruction of corals reefs by sediments and other pollutants; coastal developments Damage to dune belts and cliff faces; destruction of vegetation and wildlife habitats; coastal erosion
Degradation of watersheds	Poor land use practices; deforestation; road building; lack of resources; lack of a national water conservation plan; lack of public awareness; lack of legislation; expansion of banana plantations; housing developments Increased surface runoff; reduction of water percolating in aquifers; soil erosion; sedimentation
Deforestation and habitat loss	Shallow soils; deforestation; mechanisation; crop diversification Sedimentation

Source: Environmental Profile [1] and NEAP 1994 [3]

Table 1 presents a summary of major problems affecting the marine, coastal and freshwater environments in St. Lucia, according to the NEAP and the Environmental Profile. [1&4]

Emerging issues:
During 1997 the Caribbean Development Bank provided $955,000 to partly finance a Rural Enterprise Development Project that will promote diversification in agriculture production. [3]

Priorities for Action:
In 1991 the Environmental Profile stated that monitoring of loss of habitats, reefs and coastal fisheries, status of turtles nesting and nesting beaches, over fishing, water pollution, in particular bacteria, nitrates, phosphates, heavy metals, pesticides and petroleum, and soil erosion and sediment loads were a top priority. [1]
The main priority at this stage is to secure the financial resources to carry out all the recommendations made in the NEAP. [3] In my view, although all recommendations are important, particular attention should be given to the solid waste management problem by designing and building of adequate solid waste management systemsand amend and enforce the existing legislation. Liquid waste disposal facilities and treatment systems are also a top priority.
Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off as well as monitoring of pollutants in water courses and soils.

Measures taken:
Saint Lucia carried out its NEAP in 1994 in order to fulfil its commitment at UNCED of implementing Agenda 21. [3]
A forest management plan was drafted with the support of the Canadian International Development Agency (CIDA). [1]
With World Bank/Global Environment Facility/Caribbean Development Bank funds, the Government is participating in the OECS Waste Management Project that will rationalise the country's waste collection system as well as the waste disposal. [3]
The draft of the Land Development Control Act included EIA as a requirement for development projects. *(There is no information on whether the draft has been adopted already)*
St. Lucia is participating in the OECS Environmental and Coastal Resources (ENCORE) programme funded by USAID for improving management of coastal zone resources through policy development, institutional building and public awareness. [3]
St. Lucia has adopted various environmental laws, which if enforced, will contribute substantially to the improvement of the major problems affecting the marine, coastal and freshwater environments in St. Lucia. Issues such as environmental impact assessments and coastal zone management do not seem to be covered by existing legislation. See Annex 1. [3]
Within the NEAP, the Government identified 6 priority projects. (See table 2) [3]

Box 1: Priority Projects

- Coastal Conservation
- St. Lucia Solid Waste Management Project
- Water and Sewerage Authority (WASA) Capital Work Programme
- Greater Castries Area Sewage System
- Environmental Education – Deforestation
- System of Parks and Protected Areas

References:
[1] Caribbean Conservation Association (1991), St. Lucia Environmental Profile. St. Michael, Barbados.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] Government of Saint Lucia (1994). National Environmental Action Plan. Castries, Saint Lucia.
[4] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Annex 1 - Environmental Laws

Environmental Law	Date	Issue
Agriculture Small Tenancy	1983	Regulations requiring sound soil and water conservation practices on small land holdings
Air and Seaport Act	1981	Development and management of the nations air and seaports
Beach Protection Act	1967	Regulation of sand mining
Crown Lands Ordinance	1946	Establishes the Crown Land Committee to allocate/use of Crown lands
Employers Occupational Health and safety act	1985	Provides inspection of food handling premises
Fisheries act	1984	Management of fisheries and marine reserves
Forest, Soil and Water Conservation Ordinance	1946	Management of forest; establishment of forest reserves and protected forest; and, soil and water conservation programmes to protect forested areas
Housing and Urban Development Corporation Act	1971	Planning and development of housing projects
Land Development Act	1971	Regulates land use planning and development control
Litter Act	1983	Control of litter in public or private places
Merchant Shipping Act	1981	Introduces the Law of England with regard to Merchant Shipping
National Development Corporation Act	1971	Promotes economic growth and industrial development
St. Lucia National Trust Act	1975	Regulates preservation of buildings, objects and areas of natural or scenic importance
Pesticides Control Act	1975	Regulates import, use, labelling and storage of pesticides
Public Health Act	1975	Regulates oversight for sewage, industrial and solid waste disposal
Plant Protection Act	1988	Regulates control of pests and diseases and prevents introduction of exotic species
Radioactive Minerals Act	1957	Authorises exploration and mining
Rodney Bay Development Act	1970	Authorises land improvements works
Slum clearance and housing Ordinance	1946	Regulates management of slum areas
Timber Industry Development Act	1984	Development and promotion of timber industry
Tourist industry Development Act	1981	Promotion and development of tourist industry
Town and country planning Ordinance	1946	Physical planning and building control
Water and Sewerage Authority Act	1984	Regulates water supply, sewerage management and protection of surface waters
Wildlife Protection act	1980	Provides for conservation of wildlife, wildlife reserves and enforcement of hunting regulations

Source: NEAP 1994 [3]

St. Vincent and the Grenadines

Population: 110,724 [1]

Natural Resource Base:

St. Vincent and the Grenadines are part of the Windward Islands; they lie south of St. Lucia and north of Grenada. The total area is 388 sq. Km. The capital city is Kingstown (15,670). [2]

St. Vincent is of volcanic origin and it is traversed from north to south by a forested mountain range whose highest peak is La Soufrière (1234) an active volcano that has erupted three times since 1821. [2]

St. Vincent and the Grenadines has a tropical climate with an average annual temperature of 24 degrees Celsius. The annual rainfall on the coast is about 1524 mm to 3810 mm in the mountains. [2]

According to the World Conservation Monitoring Centre (WCMC), St. Vincent and the Grenadines has 8 species of mammals, 129 of birds, 16 of reptiles and 3 of endemic amphibian and about 1,000 species of flowering plants and 165 of ferns and 9 of endemic higher plants. [3]

Economics:

Agriculture is the main economic activity, it accounts for almost 20% of to the gross domestic product (GDP). Bananas account for most of the agricultural exports. Other important crops are rice, mangoes, arrowroot, nutmeg, mace and coconuts. [1 & 2]

Tourism is another important activity that makes substantial contributions to the GDP. Manufacturing is limited to cement furniture, flour, and refined sugar. [1]

Identification and Assessment of Problems:

According to the Environmental Profile (1991), the most serious environmental problem of St. Vincent and the Grenadines is the collection and disposal of solid waste. The collection system is not very reliable and people dispose the garbage along the roadside, rivers, swamps, etc. The normal disposal system is open dumping with occasional burning. There is only one official waste disposal site in St. Vincent, which is adjacent to the airport. There are other dumps in the larger towns and the rural areas are left to individual initiative. [2]

Although there is no hard data on the loads of pollutants, there is evidence of marine pollution by bacteria, pesticides, sewage and oil. Other problems affecting the coastal areas are coastal erosion, sand mining and dredging, overfishing and natural disasters. [2]

Sewage is generally discharged into the sea without prior treatment. The only area covered with a sewer system is downtown King. This system was designed in 1956 and partly built in 1974. Raw sewage is discharged in Kingstown Harbour. Sewage pollution from yachts and boats is very serious in several bays and is considered to be the cause of reef decline in the Grenadines. [2]

Oil pollution is a daily threat with the tanker traffic and the St. Vincent terminal. The terminal has no equipment available to deal with an emergency and there is no system to collect or dispose waste oil. [2]

The agriculture-related industry is related to serious environmental issues such as mismanagement of watersheds; environmentally unsound agricultural practices; and, agrochemical pollution. The agriculture processing also generates a fair amount of solid waste. [2]

Although watersheds are basic as water reservoirs for agriculture and domestic purposes, much of their vegetation has been replaced by crops that do not have as deep roots as trees. Soil erosion is leading to loss of fertility and sedimentation of the catchment areas and dams. The farmers have therefore to increase the use of fertilisers, increasing the cost of farming and generating a load of nutrients that washes way from the agricultural lands to the water sources downstream. [2]

Table 1 – Imported Biocides in 1988

Biocide	Quantity (lbs.)
Diazinon	1,891
Benomyl	5,626
Calixin	11,220
Furadan	121,000
(Gramoxone) Paraquat	91,963
Mocap	684,200
Sevin	2,030
Tilt	3,643
Vydate	40,643
Total	962,216

Source: De Georges, 1989 [2]

The Environmental Profile states that coastal erosion is taking place at a very fast pace and that some research should be done to identify the causes and propose some mitigation measures. [2]
Agricultural chemicals are also of serious concern but there is no reliable data regarding the magnitude of the problem. In 1989 a list of imported biocides was published based on replies received from some of the importers of agrochemicals. The major importer did not reply to the information request so the data obtained do not reflect the reality in 1988. [2] (See table 1)
In order of priority the problems faced by St. Vincent and the Grenadines, based on the 1991 profile are listed in table 2.

Table – 2 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Issue	Cause/Consequence
Extensive use of pesticides	Lack of regulations; no hard data; no sampling capabilities; lack of public awareness
Illegal activities in water catchment areas, forest and marine reserves	Existing legislation is ignored; management plans are needed
	Deforestation; pollution with agrochemicals and erosion are common; sedimentation
Sand mining and coastal erosion	Existing legislation is not enforced; lack of public awareness; destruction of coral reefs; construction of coastal infrastructure
Solid waste management	There are no proper disposal systems; there are no technical appropriate disposal sites
Liquid waste management	There are only two municipal sewerage systems in the country
	Rivers and coastal areas are polluted with excreta posing a risk to human health and biodiversity; coral reefs affected by nutrients and sediments
Coastal developments	Lack of Environmental Impact Assessments; lack of regulations; lack of monitoring and enforcement
Oil and hazardous materials spills	Lack of contingency plans

Source: Country Profile (1991) [2]

Emerging issues:
In 1996 Yacht passengers increased by almost 57%. In 1997 a group of Kuwaiti and Dutch investors started the construction of a $16 million cruise facility in Kingstown. [1]

Priorities for Action:
The main priority at this stage is to secure the financial resources to carry out all the recommendations made in the Environmental Profile (1991).[2] In my view, although all recommendations are important, particular attention should be given to the drafting of new legislation, preparation of the comprehensive integrated coastal zone management plan and an oil contingency plan are a top priority.
Building of adequate solid and liquid waste disposal and treatment facilities is a top priority.
Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off as well as monitoring of pollutants generated by the industry.

Measures taken:
No information available

References:
[1] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[2] Caribbean Conservation Association (1991), St. Vincent and the Grenadines, Country Environmental Profile. St. Michael, Barbados.
[3] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

Suriname

Population: 411,555 [1]

Natural Resource Base:

Suriname located in South America, bounded on the north by the Caribbean Sea, on the east by French Guiana (France), on the south by Brazil, and on the west by Guyana. Suriname has an area of 164,000 sq. km. The capital city is Paramaribo (180,000), largest city and seaport. [2]

Suriname can be divided into three major geographical regions. A swampy coastal plain ranging up to 80 km in width, a central plateau region containing savannahs, tracts of dunes and forested areas and to the south a densely forested mountainous area. [4]

Suriname has a tropical climate, with annual temperatures between 22.8 degrees C and 32.2 degrees C. The annual rainfall on the coast is about 2032mm and 1524mm in the inland areas. [4]

The important mineral deposits of Suriname include bauxite, granite, gold, and kaolin. Some petroleum is located offshore. The World Bank ranked Suriname number 17 in a list of the 172 wealthiest countries of the world. [2]

Suriname has one of the largest unspoiled areas of rainforest in the Western Hemisphere The dense forests contain excellent woods, such as greenheart and mora, for use in the lumber industry. The animal life is varied and includes deer, anteater, and two species of monkey. Among the birds are manakins, sugarbirds, and cotingas; the diversity of brilliantly coloured birds and insects is considerable. [4]

There are four national reserves in Suriname covering the four estuaries in the country. The ecosystems of saline and brackish wetlands cover an area of about 3,250 km^2 and there is a wide belt of black mangrove (*Aviccenia nitida*) along the coast, and a belt of red mangrove (*Rhizophora mangle*) along the rivers mouths. Some of these swampy areas were converted into cotton, coffee, cacao and sugarcane plantations, and recently large-scale projects such as rice; animal husbandry and aquaculture have taken over. [2]

According to the World Conservation Monitoring Centre (WCMC), Suriname has 180 species of mammals, 673 of birds, 151 of reptiles and 95 of amphibians and about 4,700 species of flowering plants and 315 of ferns. [3]

Economics:

Rice accounts for most of the agricultural exports and provides 12,000 jobs. Bananas, soybean, African oilpalm, vegetables and fruits are also grown. Large areas of rough pasture exist in the interior savannahs. Substantial numbers of cattle, hogs, sheep, and chickens are raised. [2]

Prawns are a valuable product whose production has been decreasing probably due to overfishing by Korean, Japanese, Surinamese, Panamanian, Venezuelan and American fishing boats. In 1988, 2,690 tons were brought ashore. [2]

Suriname is a major producer of bauxite; about 5,000 tons are produced daily. Oil production and gold extraction is increasing. The crude oil extraction was about 6,800 barrels per day in 1995. Mercury is used in gold mining by porknokers (small miners). [2]

Manufacturing in Suriname is limited to processing bauxite and crude oil. At the Suralco plant 3.3 million metric tons of bauxite are refined to 1.6 metric tons of alumina per year. [2] There is a small production of beverages, construction materials, clothing, soap, and cigarettes for local consumption. [1]

In the early 80's timber production was about 300,000 m^3/yr. The present production does not exceed 200,000m^3/yr. contributing with about 2% of the gross domestic product (GDP) per year.

The tourist industry is a developing sector. [1]

Identification and Assessment of Problems:

According to the National Environmental Action Plan (1994), the most serious environmental problem of Suriname is that 90 % of the inhabitants live immediately south of the estuarine area of which 65% in and around Paramaribo and another 25% along the east west road between Guyana and French Guiana (France). [2]

The NEAP stated that coastal erosion is taking place at a very fast pace. Solid and liquid wastes from domestic sources are the two major causes of pollution. Solid waste is normally disposed at the Charlesburg site in the north part of Paramaribo, but due to the mismanagement of the site, instead of being an efficient landfill nowadays this place is used as a dump with serious health hazards. [2]

Most buildings in Paramaribo have their own septic tank and the effluent is disposed into sewers and open canals. The system does not work and there is overflowing of septic tanks causing water pollution. In rural areas septic tanks and latrines that do not comply with minimal technical specifications are of common use. [2]

There is no reliable data regarding industrial and mining waste. [2]

Agricultural chemicals are also of serious concern and it has been estimated that an average amount used per year is 471 m-tonnes in a total area of 75,000ha. Episodes of acute intoxication of fish, birds and wild animals have been reported. [2]

A great deal of particulate matter is released from the bauxite calcining burners. During the refining process of bauxite 1.3 million mt of bauxite residue (caustic red mud) is disposed in the bauxite residue lakes. Since the refinery entered in operation 250 ha. of red mud lakes have been abandoned. During the rainy season the lakes overflow, and the caustic liquor contaminates swamps and rivers. There is no information regarding the seriousness of the effects of mining on water resources. In 1992, 8,000 m of alumina was lost as dust and during loading. [2]

Due to water pollution, water borne diseases have affected Surinamese children in the past. Between 1988 and 1990 the diarrhoeal mortality rate for children under 1 year of age was 5.7 per 1000, and for children between 1 and 4, the rate was 23.3 children per 1000. [2]

Table 1 presents major problems affecting the marine, coastal and freshwater environments of Suriname according to the NEAP [2].

Table – 1 – Major Problems Affecting the Marine, Coastal and Freshwater Environments

Problem	Cause/Consequence
Coastal zone accretion, erosion, subsidence and siltation	Mangrove forest conversion into shrimp and fish ponds Hydrological changes due to construction of dams and roads, withdrawal of water for irrigation and drainage diversions
Pesticides and fertilisers	471 m-tonnes of pesticides were imported in 1993 for 74,000 ha. (157 ton/ha.); Aerial spraying is common for rice and bananas; existing regulation is ineffective; lack of resources and manpower; lack of public awareness; lack of monitoring programmes Acute intoxication of fish, birds and wild animals is common; 1 ha. Of red mangrove is killed by 1.6 kg of the herbicide 2,4-d used for rice plantations; no hard data of impacts on the flora and freshwater ecosystems; bioaccumulation may have an impact on human health
Urban pollution	Lack of proper infrastructure; lack of adequate legislation; lack of funding; lack of public awareness; lack of monitoring programmes Illegal dumping and burning of solid waste is common practice; present landfill is an in sanitary open dumping system filled with water; sewage is disposed into septic tanks which are emptied periodically and the contents is discharged into the suriname river; the majority of the sewer systems drain into the suriname river; air pollution is caused by energy generation, wastes burning, small industries and motor vehicles
Mining and mining industry	Lack of adequate legislation; lack of Environmental Impact Assessment (EIA); lack of land reclamation plans; lack of public awareness (small miners); lack of appropriate technologies Deforestation and sedimentation; land degradation and erosion; destruction of marshes and agricultural lands; noise, vibration and dust; degradation of habitats and wildlife Leachate from abandoned mine pits filled with groundwater: dissolved aluminium and heavy metals; 250 ha. of abandoned red mud lakes (caustic liquor); no information available on ground water pollution; pollution of the Suriname river; 1,100 m/yr. of spent potlinings (hazardous waste) were dumped in the red mud lakes until 1992; 1.2 million tons/yr. of carbon dioxide (CO_2); 14,000 m-tons/yr. of sulphur dioxide (SO_2); unknown amounts of mercury and polycyclic aromatic hydrocarbons are released Disturbance of rural and tribal communities

Depletion of forest stocks	Lack of generalised EIA; lack of a forestry action plan; Lack of research on impacts and sustainability; lack of strong institutions and trained human resources Erosion; land degradation; habitat destruction and wildlife depletion; water pollution; loss of cultural heritage
Decrease of Biodiversity	Habitat destruction

Source: NEAP 1994 [2]

Emerging issues:
With the financial support of the European Investment Fund and the (International Fund for Agriculture Development (IFAD) a project was carried out to rehabilitate the infrastructure for producing rice and bananas. The production of bananas might be doubled in 1998. [2]
Suriname has been under negotiations with some Asian timber companies over concessions and exploitation licenses started. It is expected that this sector of the economy will develop substantially in the forthcoming years. [2]
The Government is actively encouraging foreign investors to reach joint-venture agreements to invest in mine development and processing mills. [2]

Priorities for Action:
The main priority at this stage is to secure the financial resources to carry out all the recommendations made in the NEAP. [2] In my view, although all recommendations are important, particular attention should be given to the drafting of new legislation and preparation of the comprehensive integrated coastal zone management plan.
Building of adequate solid and liquid waste disposal and treatment facilities is a top priority.
Monitoring of pollutants generated by the mining industry is a key issue. Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off and contamination of watercourses.

Measures taken:
With the support of the Organisation of American States (OAS), Suriname carried out its NEAP (1994) which is expected to assist in the eradication of pollution and reduction of environmental degradation. [2]
The University is opening a pesticides laboratory to carry out the monitoring of agrochemicals. [2]
An environmental impact assessment (EIA) was performed for the oil refinery that was being built in 1994 along the Suriname River and that was expected to start operations in 1997. [2]
Since 1990 some abandoned mud lakes have been rehabilitated and new environmentally sound techniques to store bauxite are being studied. Since 1993 spent potlinings are buried in seal waste landfills. [2]
The Government has been requesting EIAs as part of the agreements with foreign investors.
UNEP provided funds in 1995 for the design of a coastal zone management plan for the north Commewijne/Marowijne coastal area. [2]
Suriname has adopted various environmental laws. See table 2. [2]

Table – 2 - Environmental Laws

Environmental Law	Date	Issue
Bill on Water Management	1983	Creates Water Authority
Decree for the State Oil Company	1980 1981 1985	Regulate oil exploration and exploitation
Drilling Act	1952	Regulates mining but does not include environmental considerations
Fish Protection Act	1961 1963 1978 1980	Regulates freshwater fisheries

Forest Management	1992	Regulates concessions
Game Act	1971 1980 1994	Provides protection to wildlife
General Water Management Act	1932 1962 1984	Establishes polders for the "polder board"
Hinderance Act	1939 1944 1972	Prevents damage by new undertakings
Mining Act	1986	Regulates concessions after 1986
Nature Conservation Act	1954	Protects Wildlife
Pesticides Act	1972	Regulates import, handling and use
Petroleum Act	1932 1953 1968	Regulates permits and concessions
Planning Act	1973	Regulates regional and national planning
Safety Act	1947 1969 1970	Protects life and health of labourers
Sea-Fishery Law	1980 1989	Regulates sea-fisheries
Timber Ordinance	1947 1949 1952	Establishes the Forest Service

Source: NEAP 1994 [2]

It is evident from the previous table that the existing legislation is far from sufficient to be able to control degradation of the environment and assist the country in achieving sustainable use of its resources.

References:

[1] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[2] Government of Suriname (1994). National Environmental Action Plan. Georgetown, Suriname.

[3] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

[4] "Suriname" *Microsoft Encarta 98 Encyclopedia* 1993-1997 Microsoft Corporation

Trinidad and Tobago

Population: 1,320,000 [3]

Natural Resource Base:

Trinidad and Tobago is 10 km off the Venezuelan coast, is north of and opposite the mouth of the Orinoco River and is separated from South America by the Golf of Paria. Trinidad and Tobago has an area of 5,130-sq. km. [3]

The northern coast of Trinidad is rocky and thickly forested, the southern coast is steep, and the eastern coast is exposed to heavy surf. The highest peak in Trinidad is 940 m. Tobago is of volcanic origin and the highest peak is 550m. The capital city is Port of Spain (58,400) and other major cities are San Fernando (30,100) and Arima (29,000). [2]

Trinidad and Tobago has a tropical climate, with little seasonal temperature change. The temperature ranges from 29°C to 32°C. The annual rainfall is about 1014 mm. [3]

The islands have a high diversity of terrestrial and marine flora and fauna, including extensive coral reefs. 60% of its land is either forest or swamp, and it has been successfully managing a forestry reserve since 1927. The country has 13 wildlife sanctuaries. [6]

According to the World Conservation Monitoring Centre (WCMC), Trinidad and Tobago has 100 species of mammals, 433 of birds, 70 of reptiles and 26 of amphibians and about 1,982 species of flowering plants, 277 of ferns and 236 of endemic higher plants. [5]

Economics:

Hydrocarbons generate about 20% of the gross domestic product (GDP) and 75% of the foreign exchange. [3]

Manufacturing contributes with 10% of the GDP in Trinidad and Tobago. In addition to the energy related industries there are steel and iron carbide plants. Also production of yachts, sport fishing boats, fishing trawlers, power catamarans, kayaks and pirogues are exported from Trinidad. [3]

Agriculture employs about 10% of the labour force. Sugar and its by-products account for most of the agricultural exports. Coconuts, coffee, cacao, citrus fruit, tonka beans, rubber trees, and other tropical fruit and vegetables are also cultivated. [3]

Identification and Assessment of Problems:

According to the World Resources Institute, deforestation, expansion of the agriculture sector into slopes while residential, commercial and industrial developments take over the good arable land, has generated serious land degradation and soil erosion. [6]

Water pollution both in land and in the marine and coastal areas due to runoff and sediments, agrochemicals, industrial waste and sewage constitute a growing concern. Oil is also a major problem and tar balls often foul the island's beaches. [6]

Tourism has impacted the islands through untreated sewage, degradation of coral reefs by boat anchors and divers, and overfishing of shellfish. [6]

Although no hard data on Trinidad and Tobago' status of pollution from land-based sources was found during this research, there is no doubt that the Institute of Marine Affairs in Trinidad must have a lot of useful information on the subject.

According to Betz (1990), 16 % of the population is connected to sewers, 33 % is covered through septic tanks and about 50% of the population uses cess pits and pit privies. Pollution from industry, agriculture and municipal wastes appear to be serious. [1]

Emerging issues:

Four international consortiums and more than six multinationals are at present exploring for gas and petroleum in Trinidad and there expectations that by the year 2,000 the extraction of these two products will increase substantially. [3]

With the tax incentives the Government is providing it is expected that in the near future manufacturing will be making a major contribution to the GDP. [3]

Tourism will be promoted in particular in Tobago and the Charaguaramas Peninsula in Trinidad. [3]

Priorities for Action:

The main priority is to build adequate solid and liquid waste disposal and treatment facilities.

Collection of up-dated information on the use and types of agrochemicals is also of paramount importance to avoid pollution by run-off as well as monitoring of pollutants generated by the manufacturing and oil industry.

Integrated Coastal Zone Management (CZM) is a priority for Trinidad and Tobago. Lewsey (1991) states that the approach used in Trinidad to carry out CZM is sectorial, which does not allow for solving cross-sectorial issues or conflict use management. [4]

Measures taken:
With the support of the Inter-American Development Bank, Trinidad and Tobago are carrying out a short-term support programme for tourism for $ 10 million.

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Bertrand, D., et. al. Coastlines of Trinidad and Tobago, A Coastal Stability Perspective. Coastlines of the Caribbean. Coastal Zone 91'. Published by the American Society of Civil Engineers, New York, New York, 1991.
[3] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[4] Lewsey, Clement. Evaluating the Efficacy of CZM in the Eastern Caribbean. Coastlines of the Caribbean. Coastal Zone 91'. Published by the American Society of Civil Engineers, New York, New York, 1991.
[5] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.
[6] World Resources Institute. Trinidad and Tobago. Washington, DC., USA, 1993.

Turks and Caicos (United Kingdom)

Population: 14,800 [2]

Natural Resource Base:

Turks and Caicos Islands are located southeast of the Bahamas. The Turks Islands comprise six uninhabited cays, two inhabited islands (Grand Turk and Salt Cay), and a large number of small rocky islands. The Caicos Islands comprise six principal islands, including Grand Caicos (24.3 sq. km), the largest in the dependency, and a number of islets. Total area, 430-sq. km. [3]

The mean annual temperature is 29.4° C. Despite frequent hurricanes, the rainfall averages only 711 mm annually. [3]

According to the World Conservation Monitoring Centre (WCMC), Turks and Caicos has 175 species of birds, 12 of reptiles and about 440 of flowering plants, 7 of ferns and 9 of endemic higher plants. [4]

Economics:

The chief exports are crayfish, fish meat, and conch. [2] From the 899,517-kg of conch meat exported to the United States in 1994, Turks and Caicos produced 297,240 kg. In 1993 the total conch meat exported by Turks and Caicos was 329,940 kg, with a wholesale value of US$ 10/kg. [5]

Agriculture is very small. Turks and Caicos is home to the world's only commercial conch farm raising domestic conch for export, and some other experimental farms have been developed to produce tilapia for export. [2]

Tourism is important and in 1997 they were expecting 100,000 visitors. [2]

Identification and Assessment of Problems:

According to Betz (1990) there are no major pollution problems in Turks and Caicos. The large majority of sewage and solid waste is disposed in an appropriate manner and Environmental Impact Assessments (EIA) are a requirement for development projects. [1]

Emerging issues:

A major port facility will be established on east Caicos and several international resorts are carrying out considerable expansion projects. [2]

Priorities for Action:

The main priority at this stage is to prepare a comprehensive integrated coastal zone management plan and to build adequate solid and liquid waste disposal and treatment facilities that will cover 100% of the population and the visitors.

Monitoring of the implementation of the recommendations of the EIA is an important priority.

Measures taken:

No information available

References:

[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.

[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.

[3] "Turks and Caicos Islands," Microsoft Encarta 98 Encyclopaedia. 1993-1997 Microsoft Corporation.

[4] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.

[5] Mulliken, Teresa A. Status of the Queen Conch Fishery in the Caribbean. TRAFFIC Bulletin Vol. 16 No. 1 (1996)

Venezuela

Population: 22,315,597 [2]

Natural Resources:

Venezuela is located in South America, bounded on the north by the Caribbean Sea, on the east by Guyana, on the South by Brazil, and on the west and south west by Colombia. Venezuela has an area of 912,050 km and its coastline is about 2800 km long. [3]

Venezuela can be divided in four major geographical regions. The Llanos region in the border with Colombia is a tropical grassland in the north central region. The Guiana highlands in the southeast and the south, reaching an altitude of 2700 m above sea level, extend from the Delta of the Orinoco River into Brazil and Guyana. In the northeast and north are the Venezuelan highlands, which reach their higher altitude in Pico Bolivar (5007m). Angel Falls, which is the world's highest waterfall, is in the eastern part of the highlands. The Maracaibo lowlands are near the northwestern coast. [3]

Venezuela has a tropical climate in the lowlands and the Llanos, with average temperatures of 13°C to 26°C in Caracas, and 23° to 24°C in Maracaibo. [3]

The important mineral deposits of Venezuela include petroleum, natural gas, bauxite, copper, iron ore, gold, lead, diamonds, and zinc. [3]

Forest of varied species including palms, mangoes and brazilwood covers nearly 40% of Venezuela. The animal life is varied and includes jaguars, deer, anteaters, bears, ocelots, armadillos and monkeys. Among the birds there are flamingos, herons, ibis, and guacharos. Reptiles include crocodiles and snakes. [3]

According to World Conservation Monitoring Centre (WCMC), Venezuela has 305 species of mammals, 1296 of birds, 259 of reptiles and 199 of amphibians. There area about 20000 species of flowering plants, 1059 of ferns and 8000 of endemic higher plants. [4]

Economics:

The oil industry generates 25% of the gross domestic product (GDP) and 75 % of Venezuela's foreign exchange earnings. Petrochemicals are also exported. Much of Venezuela's oil is exported to the Netherlands Antilles for refining. Venezuela is the 7th largest world producer of crude oil. Bauxite, gold, silver, platinum, coal, salt, copper, tin, asbestos, phosphates, titanium, mica and diamonds are also produced. [2]

Agriculture accounts for about 6 % of the gross domestic product and employs 10 % of the labour force. Sugar and its by-products account for most of the agricultural exports. Bananas, maize, rice, sorghum, plantains, oranges, cassava and coffee are produced in substantial quantities. Considerable numbers of cattle, hogs, sheep, and chickens are raised in the Llanos. [2]

Manufacturing in Venezuela includes processing of hydrocarbons and production of steel, aluminium, fertilisers, cement, tires, motor vehicles, foodstuffs, beverages, clothing, and wood items. [2]

Tourism is also an important activity. During 1996 Venezuela received more than 800,000 tourists. [2]

Assessment of the problem:

According to the Betz (1990) report the use of pesticides and fertilisers is of serious concern and they have caused contamination in the coastal areas. Venezuela has established water quality standards and through this instrument they can make the industry take necessary measures to control pollution. Although there is no classification of the waste discharged directly into the sea or rivers, they have an inventory of industries discharging toxic and hazardous wastes in general. [1]

Solid and liquid wastes from domestic sources are two major causes of pollution and there is a limited number of collection and disposal systems. [1]

Emerging issues:

In 1996 a memorandum was signed with the Inter-American Development Bank (IDB) for $1 billion in funding support for projects related to the social sector and infrastructure in the energy and transportation sectors. [2]

Priorities for Action:

Environmental Impact Assessments should be undertaken for all new projects and their recommendations should be implemented carefully.

Building of adequate solid and liquid waste disposal and treatment facilities is a top priority.

Collection of up-dated information on the use, amounts and types of agrochemicals is also of paramount importance to avoid pollution by run-off. Monitoring of pollutants generated by the mining and oil industries is a top priority.

Measures taken:
There are two projects under execution with IDB funds. A programme of support for the modernisation and rehabilitation of the water supply and sanitation system and a watershed conservation and management programme, each of them for $10 million.

References:
[1] Betz, Karen E. A Report on Land-based Sources of Marine Pollution in the Caribbean. Environmental Protection Agency, 1990.
[2] Caribbean Latin American Action. 1998, Caribbean Basin Profile. Caribbean Publishing Co Ltd., Grand Cayman Islands, B.W.I.
[3] "Venezuela" Microsoft Encarta 98 Encyclopedia. 1993-1997 Microsoft Corporation.
[4] World Conservation Monitoring Centre (WCMC). Biodiversity Data Sourcebook. World Conservation Press, November 1994.