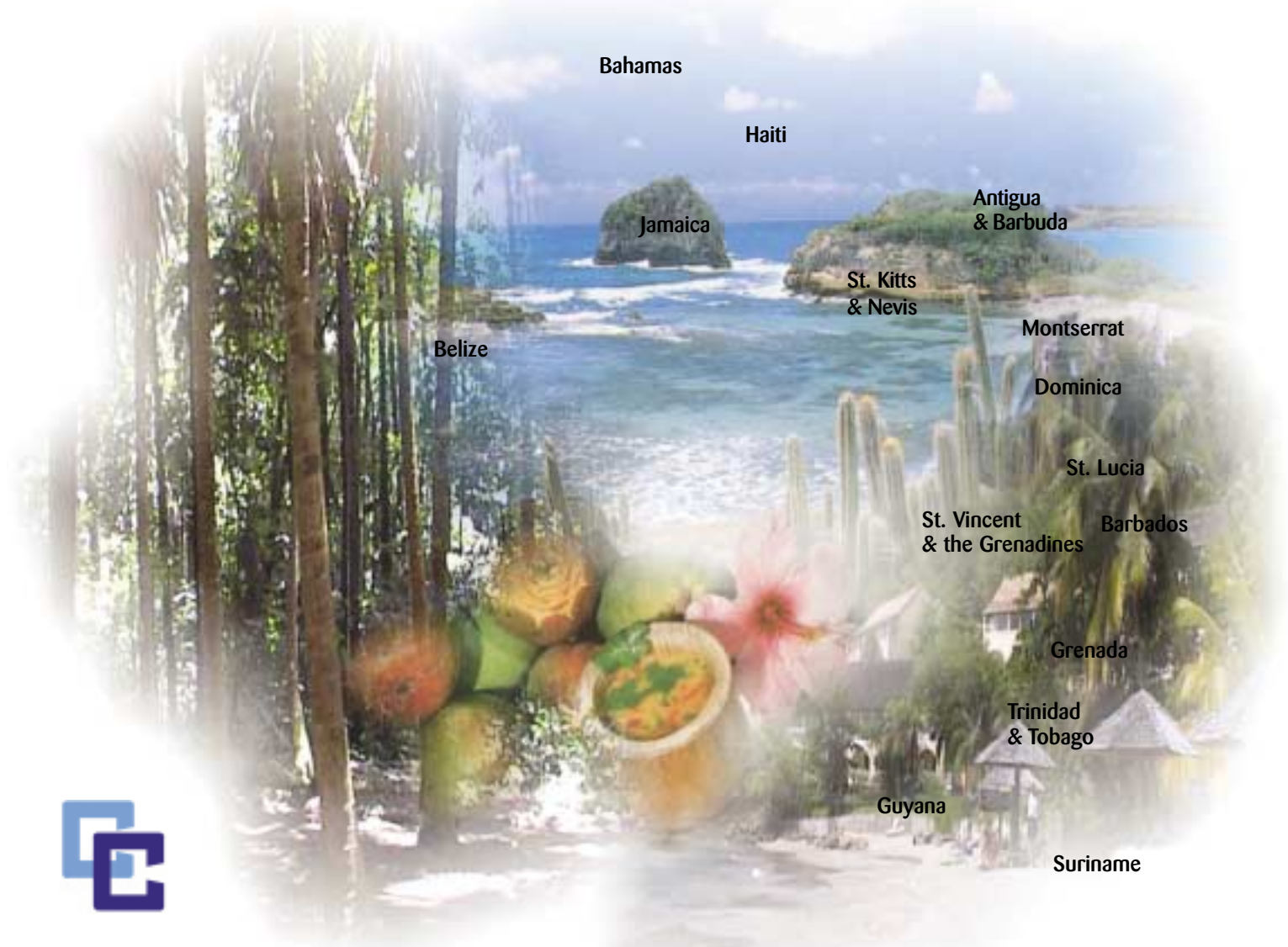
THE CARICOM ENVIRONMENT IN FIGURES 2002



Caribbean Community Secretariat
Statistics Programme

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Department of Economic and Social Affairs
Statistics Division

THE CARICOM ENVIRONMENT IN FIGURES 2002

Caribbean Community Secretariat
Georgetown, 2003

NOTE

The designations used and the presentation of material in this report do not imply the expression of any opinion whatsoever on the part of either the Secretariat of the United Nations or the Caribbean Community Secretariat concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

The term "country" as used in this report also refers, as appropriate, to territories or areas.

The designations "developed" and "developing" regions/countries are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process.

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PREFACE

The CARICOM Environment in Figures has been prepared as one of the main outputs of the United Nations Project, "Strengthening Capacity in the Compilation of Statistics and Indicators for Conference Follow-up in the CARICOM Region," jointly carried out by the United Nations Statistics Division (UNSD) and the Caribbean Community (CARICOM) Secretariat. The Project has been executed in the CARICOM Member States, which are Antigua & Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines, Suriname and Trinidad & Tobago.

In the CARICOM region, most of the 15 Member States are faced with growing competition between economic interests for limited natural resources, pressures from increasing tourism and a greater frequency of natural disasters. To ensure sustainable development in the region, sound policy decisions must be made using timely and reliable information. A major difficulty in assessing the implementation of such decisions, however, has been the lack of basic environmental statistics and indicators. Environment statistics is relatively new to the region, and it is only in Belize and Jamaica that efforts have been made to formally institutionalise environment statistics within the national statistical offices.

This publication brings together available data from a wide range of sources. It is relevant for the follow-up of the United Nations Global Conference on the Sustainable Development of Small Island Developing States (SIDS), held in Barbados in 1994, which adopted the Barbados Declaration and Programme of Action. These agreements build on Agenda 21, the plan of action that was adopted at the United Nations Conference on Environment and Development in Rio de Janeiro, Brazil in 1992. It is also timely for the World Summit on Sustainable Development that was held in Johannesburg, South Africa from 26 August to 4 September 2002. The Summit marked the ten-year review of progress achieved in the implementation of Agenda 21 and it also called for the ten-year review of the Programme of Action for the sustainable development of SIDS, to be held in 2004.

The CARICOM Environment in Figures provides an overview of the state of the environment in the CARICOM region through a presentation of the major issues, with supporting data in tables and charts and accompanying comments on the data. In addition, it is intended to describe the status of environment statistics in the region, including the indication of major data gaps. It should be noted, however, that data gaps are experienced in most regions of the world and may result from, *inter alia*, the lack of environmental data, scattered or one-effort data on the environment, inaccessibility of environmental data for national statistical offices and the lack of institutionalised environment statistics in countries. One outcome of the Project is the recognition of the existing data gaps and data availability at both the national and regional levels, with the aim of developing strategies that could address these gaps.

Each chapter of the publication starts with the general overview of the main environmental issues, followed by their statistical description. Data from national and regional/international sources are presented separately, in the form of tables and charts, accompanied by methodological notes and comments.

Similar data from different sources have also been presented and require a comment. National data, obtained directly from the CARICOM Member States through the UNSD/CARICOM Questionnaire on Environment Statistics, have been used when available and referenced accordingly. For reasons of data availability and

comparability, however, several sources of regional and international environmental and related socio-economic data have also been presented in the publication. It has been noted that there are cases with substantial differences between the national and regional/international data; however, it should be stressed that the explanation is often based on a difference in definitions. In view of the fact that environment statistics is a relatively new and emerging field of statistics, with a large number of data sources and institutions involved, and with a lack of benchmarks and standards, such differences in data values are not surprising. This parallel presentation of data should give rise to interesting and timely discussions on the development of environment statistics in the CARICOM region. It is expected that, as this area of statistics becomes more established, concepts, definitions, classifications and methods of data collection should become increasingly more harmonised and standardised.

The UNSD/CARICOM Project

The Project covers the areas of social/gender and environment statistics, with a supporting component of information technology. Its overall objectives have been to strengthen the capacity of national and regional statistical offices to collect and analyse statistical information, and establish a network of experts to improve intra-regional cooperation. The main outputs include *The CARICOM Environment in Figures,* a publication on social/gender statistics and increased capabilities in information technology.

The environmental component of the Project commenced with the UNSD/CARICOM Workshop on Environment Statistics for the CARICOM Member States in August 2000, in Belize. A list of participants is attached as Annex I. The Workshop included participants from national statistical services and national environment agencies, as well as several regional institutions. At the Workshop, the Member States emphasized the importance of timely and reliable environment statistics in the region, and noted that only through such statistics can sustained monitoring and evaluation of the state of the environment and sustainable development be accomplished. The establishment of basic environment statistics was also seen as a precondition for developing environmental indicators and integrated environmental and economic accounting.

The Workshop agreed upon a list of environmental issues and corresponding statistics and indicators to be collected jointly by UNSD and CARICOM, and to be presented in this publication. It was also decided that, even though several of these indicators were already being compiled by other international and/or regional organizations, some of these data could be collected again, only for this first regional publication, in order to engage national statistical offices in the compilation of environment statistics, a field of statistics with which they had not been associated traditionally. The participants subsequently assisted with the compilation of the UNSD/CARICOM Questionnaire on Environment Statistics, which was based on the agreed list of environmental statistics and indicators and sent out in February 2001, to national statistical services and ministries of environment (or other appropriate institutions) of the CARICOM Member States.

The CARICOM Environment in Figures was prepared by UNSD and CARICOM and has involved many partners. It has attempted to provide, in one document, all available environment statistics for the CARICOM region from national, regional and international data sources. The draft was circulated for comments to several experts and institutions in the region and reviewed by an Expert Group Meeting held in October 2001, in Grenada. The Meeting comprised 18 experts on environment statistics from national statistical offices and ministries of environment, and environmental experts from regional institutions. A list of participants is attached as Annex II. The twenty-sixth meeting of the Standing Committee of Caribbean Statisticians (SCCS), held in The Bahamas from 24 to 26 October 2001, endorsed the draft publication and plans for its completion.

The Project has spurred a number of initiatives in environment statistics at the national level. Several Member States have organized workshops or seminars on environment statistics and have increased inter-agency collaboration. The Project has provided stimulus and support to the existing initiatives of Belize and Jamaica. Two environment statistics compendia have been published in Belize in 1999 and 2000, and one in Jamaica in 2001. Belize is expecting to publish its third compendium shortly. Grenada published its first environment statistics compendium in 2001 and Dominica, St. Lucia and Suriname published their first compendia in 2002. St. Kitts

& Nevis and St. Vincent & the Grenadines have initiated work on draft compendia. These efforts have been achieved through a combination of Government commitment and the additional technical assistance provided by the Project.

Some of the priority next steps for the further development of environment statistics in the CARICOM region include the following:

- the role of the national statistical offices as focal points for environment statistics needs to be strengthened, and national coordination mechanisms, such as inter-agency working groups, which have been established in some Member States in the course of the Project, need to be sustained;
- coordination between regional and international organizations needs to be improved;
- a regional core set of environmental statistics and indicators should be determined, and the process of compilation of this data set should be executed in a way that is manageable for Member States, bearing in mind that it is a new area of statistics;
- more methodological guidance needs to be instituted in Member States;
- training and technical assistance need to be increased and sustained, noting that study tours and intra-regional cooperation have been very promising mechanisms. Technical assistance can also take the form of consultants actively working with Member States for extended periods;
- national environment statistics compendia should continue to be published on a regular basis;
- support should also be provided for development of an environment statistics unit at the CARICOM Secretariat which can act as a repository for these statistics once compiled at the national level.

Some of these activities can be addressed by the CARICOM Advisory Group, established in 2001, comprising directors of selected national statistical offices, and CARICOM and UNSD representatives. To date, three meetings of the Group have been held (The Bahamas, October 2001, Dominica, May 2002 and Grenada, November 2002) to agree on the terms of reference, procedures for its operation and to develop programmes in social/gender and environment statistics with outputs in alternate years. The setting up of the Advisory Group clearly shows the commitment and ownership that the Project has spawned relative to sustaining the activities of data compilation, the organization of national workshops, inter-agency groups or committees and the publication of regional and national compendia in these two fields of statistics.

It is expected that the impact of the UNSD/ CARICOM Project will be sustained in the region and build on some of the above-mentioned initiatives already established in the course of the Project. It is hoped that *The CARICOM Environment in Figures* will make a valuable contribution to sustainable development in the CARICOM region and will be the first in a series of similar reports in the future.

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CONTENTS

Tables

Figures

Boxes

Notes and symbols

If data were not available for a particular country, the country is excluded from the tables and charts.

… Data not available
.. Not applicable
0 Less than half of the unit specified
- Nil, magnitude zero

1US$ = 2.7 EC$

Units of measurement

Units	
bls	barrels
g	gram
h	hour
ha	hectare
j	joule
l, L	litre
m	metre
W	watt
Wh	watt-hour
ppm	parts per million
lbs	pounds
MPN	most probable number
µS	microSiemens

Multiples of Units		
T	tera	10^{12} = 1,000,000,000,000
G	giga	10^{9} = 1,000,000,000
M	mega	10^{6} = 1,000,000
k	kilo	10^{3} = 1,000
h	hecto	10^{2} = 100
da	deka	10^{1} = 10
d	deci	10^{-1} = 0.1
c	centi	10^{-2} = 0.01
m	milli	10^{-3} = 0.001
µ	micro	10^{-6} = 0.000 001

Conversion table

Weights and Measures

Metric	to	**Imperial**	**Imperial**	to	**Metric**
1 mm		0.039 inches	1 inch		25.4 mm
1 metre		1.0936 yards	1 yard = 3 ft		0.9144 m
1 kilometre		0.6214 mile	1 mile		1.6093 km
1 ha		2.4712 acres	1 acre		0.4047 ha
1 km^2 = 100 ha		0.3861 sq. mile	1 sq. mile = 640 acres		2.590 km^2
1 millilitre		0.0352 oz = 0.0338 US oz	1 gal = 1.2009 US gal		4.5461 litres
1 litre		2.113 pints = 1.76 US pint	1 US gal		3.7854 litres
1 m^3		1.3080 yd^3 = 35.3147 cu. ft	1 cu. yard		0.7646 m^3
			1 cu. ft		0.0283 m^3
1 kg = 1000g		2.2046 lbs	1 lb		0.4536 kg
1 tonne (metric ton)		0.9842 long tons	1 long ton		1.0161 tonnes (metric tons)

Acronyms and abbreviations

BOD	biochemical oxygen demand
BWIA	British West Indian Airways
CAMPAM	Caribbean Marine Protected Area Managers
CAREC	Caribbean Epidemiology Centre
CARICOM	Caribbean Community
CARICOMP	Caribbean Coastal Marine Productivity Program
CBD	Convention on Biological Diversity
CCA	Caribbean Conservation Association
CDM	Comprehensive Disaster Management
CDERA	Caribbean Disaster Emergency Response Agency
CDIAC	Carbon Dioxide Information Analysis Center
CEHI	Caribbean Environmental Health Institute
CEIS	Caribbean Energy Information System
CFCs	chlorofluorocarbons
COD	chemical oxygen demand
CPACC	Caribbean Planning for the Adaptation to Global Climate Change
CRED	Centre for Research on the Epidemiology of Disasters
CTO	Caribbean Tourism Organization
DO	dissolved oxygen
EC$	Eastern Caribbean Dollar
ECCB	Eastern Caribbean Central Bank
ECLAC	Economic Commission for Latin America and the Caribbean
EEZ	exclusive economic zone
FAO	Food and Agriculture Organization of the United Nations
FRA 2000	Global Forest Resources Assessment 2000
GDP	gross domestic product
GEF	Global Environment Facility
GIS	geographic information system
HFCFCs	hydrochlorofluorocarbons
IDNDR	International Decade for Natural Disaster Reduction
IPCC	Intergovernmental Panel on Climate Change
ISIC	International Standard Industrial Classification of All Economic Activities
ISSCAAP	International Standard Statistical Classification of Aquatic Animals and Plants
IUCN	World Conservation Union
LBSMP	Land-Based Sources of Marine Pollution Protocol
MEA	multilateral environmental agreement
MPA	marine protected area
NMVOC	non-methane volatile organic compound
NSO	national statistical office
ODP	ozone depleting potential
ODS	ozone depleting substance
OECS	Organisation of Eastern Caribbean States
OLADE	Latin American Energy Organization
PAHO	Pan American Health Organization
POA	Programme of Action
SCCS	Standing Committee of Caribbean Statisticians

SIDS	Small Island Developing States
SPAW	Specially Protected Areas and Wildlife Protocol
SPM	suspended particulate matter
SSC	Species Survival Commission
TDS	total dissolved solids
TSS	total suspended solids
UNCED	United Nations Conference on Environment and Development
UNCLOS	United Nations Convention on the Law of the Sea
UNDHA	United Nations Department of Humanitarian Affairs
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNICEF	United Nations Children's Fund
UNSD	United Nations Statistics Division
US$	United States Dollar
UV-B	solar ultraviolet radiation
VAT	value added tax
WCMC	World Conservation Monitoring Centre
WHO	World Health Organization

CHAPTER 1

INTRODUCTION

GEOGRAPHICAL SETTING

The Caribbean Community (CARICOM)[1] comprises a geographic and political group of islands and mainland countries which all share a common resource, the Caribbean Sea. The region constitutes the eastern perimeter of the wider Caribbean region, and includes the islands of the Greater and Lesser Antilles, those of the Bahamian chain to the north, the low lying states of Guyana and Suriname, as part of the South American mainland, and the Gulf coast state of Belize as part of the Central American mainland.

There are more similarities than differences in the historical origins and social characteristics of the Member States, which range in size from 103 km^2 (Montserrat) to 214,970 km^2 (Guyana). They have varied topographies, geological features and high population densities, particularly in their coastal areas. They also have similar narrow natural resource bases. The small size of the islands, in particular, provides a number of disadvantages including the following:

- a narrow range of resources that forces undue specialization, excessive dependence on international trade and hence vulnerability to global developments;
- high population densities which increase the pressure on already limited resources;
- costly public administration and infrastructure, including transportation and communication;
- limited institutional capacities;
- limited domestic markets, which are too small to provide significant scale economies.

The islands of the CARICOM region lie well within the northern tropics and form a wide arc between Florida in the north and Venezuela in the south, as well as a barrier between the Caribbean Sea and the Atlantic Ocean. Varying considerably in size and with high population densities, the islands, which are the isolated upper parts of a submerged chain of volcanic mountains, are scattered over thousands of square kilometres of sea. The largest four Member States -- Guyana, Suriname, Haiti and Belize -- account for 92.79 per cent of the total geographic area of the region, revealing the disparity that exists among these countries in terms of their physical space.

Three principal geological formations are found throughout the Caribbean. These are igneous and metamorphic rocks, limestone hills or karst, and coastal, sedimentary plains of varying depths. These result in three prevailing types of topography, found either separately or in combination. The first consists of high (over 1,200 metres), rugged, sharply dissected mountains, all covered with dense, evergreen rain forests and cut by swiftly flowing rivers. The second consists of hilly countryside, seldom rising above 600 metres and is usually more gently sloped than the high mountains previously described. Finally, the coastal plains skirt the hills

[1] CARICOM consists of the following Member States: Antigua & Barbuda, The Bahamas, Barbados, Belize, Dominica, Grenada, Guyana, Haiti, Jamaica, Montserrat, St. Kitts & Nevis, St. Lucia, St. Vincent & the Grenadines, Suriname and Trinidad & Tobago. Associate Members of CARICOM include Anguilla, The British Virgin Islands and Turks & Caicos Islands.

and mountains, with their greatest extensions usually on the southern or western sides of the mountains.

Active volcanoes exist in Dominica, St. Lucia, St. Vincent & the Grenadines, and off the coast of Grenada. Grenada also has some older crater lakes formed by earlier volcanic activity. All the islands have rugged coastlines with innumerable inlets fringed by white or dark sands (depending on the rock substratum) of varying texture.

The Caribbean climate is tropical, moderated to some extent by the prevailing northeast trade winds. Individual climatic conditions are strongly dependent on elevation. At sea level there is little variation in temperature, regardless of the time of the day or the season of the year. Temperatures range between 24 and 32 degrees Celsius. These countries experience two predominant seasons: a long rainy season, which in most countries runs from May through October, and a dry season.

During the rainy season, precipitation may fluctuate. The windward sides of the islands receive much rain, whereas leeward sides can have very dry conditions. Flat islands tend to receive slightly less rainfall, but its pattern is more consistent. Most of the rainfall occurs during short heavy outbursts during daylight hours. The period of heaviest rainfall usually occurs after the sun has passed directly overhead, which in these islands would usually be in the middle of May and again in early August. The rainy season also coincides with the summer hurricane season.

Hurricanes are constant features of the Caribbean, with a season that lasts from June to November. Hurricanes develop over the ocean during the summer months when the sea surface temperature is high (over 27 degrees Celsius), and the air pressure falls below 950 millibars. These conditions create an "eye" about 20 kilometres wide, around which a steep pressure gradient forms that generates wind speeds of 110 to 280 kilometres per hour. The diameter of hurricanes can extend as far as 500 to 800 kilometres and, in addition to strong storm winds, they can produce extremely heavy rainfall which often result in considerable destruction of property.

MAJOR SOCIO-ECONOMIC AND ENVIRONMENTAL ISSUES

The following is a review of the major socio-economic and environmental issues in the CARICOM region.

SOCIO-ECONOMIC ISSUES

With regard to economic performance, the 1990s brought marked changes in the economic landscape to the Member States of the region in the form of globalization and trade liberalization of domestic financial markets and international capital flows, with private enterprises taking a predominant role in the production of goods and services and in the provision of public services and social benefits. The economic performance of the region during recent years has been characterized by a marked unevenness and a failure to attain a steady growth pattern.

Intra-regional trade dominated the landscape in the 1990s for CARICOM Member States, attributed to the creation of the CARICOM Common Market. International trade flourished during the 1990s, though regional performance varied. Within the last decade, intra-hemispheric trade as a proportion of the hemisphere's total trade with the world has increased significantly.

With regard to social development, the 1990s brought continued demographic changes that affected the sustainable development goals of the region in various ways. Population size, growth, age structure, and educational, health and socio-economic characteristics all have an effect on the

use of natural resources, as do gender relations and migration patterns. The overall impact of these trends on sustainable development has varied from one country to another. More recently, increasing mortality linked to HIV/ AIDS has been a critical demographic factor constraining development. There has been substantial progress in reducing the poverty rate through economic growth in these countries. Although the region returned moderate levels of growth, the persistently high unemployment rate in many Member States continues to constitute a dilemma for policy makers trying to address the issue of sustainable development.

Progress has also been made in other aspects of poverty reduction, including health care, child and maternal mortality, hunger reduction, access to education, and access to safe water and sanitation. However, at the national level, many people still lack access to safe drinking water and to adequate sanitation. The emergence of HIV/ AIDS has devastated the young adult population, creating enormous obstacles to economic and social development. At the same time, some countries have seen increases in diseases associated with unhealthy diets, sedentary lifestyles and overweight.

Reducing poverty and improving opportunities for sustainable livelihoods require economic and social development, sustainable resource management and environmental protection. Environmental degradation, resource depletion and natural disasters have a disproportionate impact on people in poverty, who also bear a disproportionate burden of disease. Progress requires integrated economic and social policy approaches, so that measures that stimulate competitiveness and seek to improve social cohesion can support and complement each other.

ENVIRONMENTAL ISSUES

Among the disadvantages attached to the islands and low lying coastal states is their vulnerability to natural disasters, particularly in the form of hurricanes, volcanic eruptions, extensive droughts and floods. Of these disasters, hurricanes have been the major cause of loss of life, with 1,745 deaths in the region recorded between 1990 and 1998. These figures are perhaps a reflection of the social vulnerability caused by poverty, environmental degradation and policy failures. While data on the long-term economic impacts of natural disasters are less readily available, the link between economic vulnerability, environmental vulnerability and size was reinforced by the experiences of the northeastern Caribbean, during the second half of the 1990s. During 1995 for example, Hurricanes Marilyn and Luis and Tropical Storm Iris caused a drop in the annual rate of gross domestic product (GDP) growth from 3.0 per cent to 0.7 per cent among the countries of the Organisation of the Eastern Caribbean States (OECS) with the impact on the individual countries being even more severe.

Waste management has maintained its ranking as one of the major environmental issues in the CARICOM region. There is now a better understanding of the process by which waste is generated, the behaviour of waste under various climatic conditions and the constituents of waste. Growth in urban population, industrial activity and tourism continue to outstrip infrastructural capacity to handle waste. Encouraging progress has been made with the management of solid waste in the region. Sizeable investments have also been made by some Member States, most notably, The Bahamas, Barbados, Belize and St. Lucia, in a bid to improve their management of liquid waste. However, overall progress has been slow, largely because of the high costs of installing appropriate sewerage systems.

The coastal environments of the CARICOM region possess a diversity of habitats, including coral reefs, sea-grass beds, mangrove, wetlands and rocky shores. Under the United Nations Convention on the Law of the Sea (UNCLOS), CARICOM island states have acquired rights to vast areas of ocean space that constitute their exclusive economic zones (EEZs). However, the islands have lacked the resources to derive greater benefits from these zones. The priority areas

identified include, *inter alia,* the development of national ocean policies inclusive of coastal zone management accompanied by the necessary legislation and regulations, the strengthening and development of institutional, administrative, scientific and technological capacity to effectively manage and utilize the resources of the EEZ, the development of a comprehensive inventory of living and non-living resources of the EEZ, and the establishment of monitoring mechanisms for marine eco-systems and development of an integrated environmental database, utilizing technologies such as remote sensing and geographic information systems (GIS).

The primary source of freshwater in most Member States is rainfall. In Antigua & Barbuda, The Bahamas, Barbados, St. Lucia and Trinidad & Tobago, desalination is used to augment the water supply. In the Eastern Caribbean States, surface water is the main water type and exhibits variability in flow. In the dry season, yields decline significantly, with livestock and farm irrigation being the main victims. Saline intrusion is a major constraint to water availability in Antigua & Barbuda and Barbados. Groundwater availability varies significantly from country to country. In some countries, such as Antigua & Barbuda, Grenada, St. Lucia, St. Vincent & the Grenadines, no groundwater is utilized. On the other extreme, all freshwater in The Bahamas and Barbados is in the form of groundwater within limestone aquifers.

For most CARICOM Member States, the dominant source of energy is imported fossil fuel. Exceptions lie with Barbados and Trinidad & Tobago, who produce oil and gas, and Barbados, Dominica, Jamaica and St. Vincent & the Grenadines, which have significant amounts of power generated from geothermal, solar, wind, wood and waste products. The dependence on fossil fuels has not only deepened the vulnerability of the region to global fuel price increases, but also it has placed a heavy demand on foreign exchange reserves. Current trends give little hope that energy production costs will stabilize, or decrease, in the short to medium term. In fact, indications are that consumption will also increase, as the expansion of urbanization and the growth in industry and hospitality services continue to fuel a heightened demand for electric power in homes, and in the tourism and transportation sectors.

Tourism is one of the most important economic activities in the region, contributing between 30-50 per cent of the GDP of most Member States. Over the past 20 years, these countries, with less than one per cent of the world's population, have consistently received more than six per cent of the world's tourism arrivals. There is a need to take a broader view of the nature of the environment on which tourism depends, and the threats it faces. However, there have been some noteworthy developments in this regard, both at the national and regional levels. Overall, there is a growing awareness of the importance of the environment in sustaining the social and economic benefits derived from tourism.

All CARICOM Member States face immense challenges in protecting their biodiversity resources. Some countries (Barbados, Jamaica and St. Lucia) have designed systems plans aimed at protecting terrestrial and marine parks and other ecologically fragile areas. Jamaica has published a Green Paper on the subject. Trinidad & Tobago has been focusing on the conservation of biodiversity within its national parks and watersheds. However, the implementation and especially the enforcement of these plans demand resource outlays that these countries are hard pressed to provide. Consequently, destruction of valuable terrestrial biodiversity continues.

CHAPTER 2

POLICY RESPONSES AND MULTILATERAL ENVIRONMENTAL AGREEMENTS

INTRODUCTION AND POLICY BACKGROUND

Sustainable development consists of progress in social development, complemented by economic development and combined with an awareness of the environmental implications of natural resource use on industrial and economic development. This concept presupposes that sustainable development (and its main instruments: environmental policy and legislation) relates to development activities as a whole, and not to its individual components. The close interdependence between the environment and the economy, the limited capacity and narrow resource base, as well as the Caribbean region's vulnerability to natural disasters, together suggest that in order to meet the rigorous demands of the development agenda, sound policy decisions must be made, using reliable and timely information.

The United Nations Conference on Environment and Development (UNCED) held in Rio de Janeiro in 1992, and the ensuing Rio Declaration and Agenda 21, sought to develop a comprehensive blueprint for global sustainable development. The Rio Declaration consists of 27 principles, which reaffirm and elaborate on the 1972 Stockholm Declaration on the Human Environment. Its core concept is sustainable development, but it also includes several other established or emerging principles, including common but differentiated responsibilities for States, the 'precautionary principle', and the 'polluter pays principle.' Agenda 21 is essentially an agenda for sustainable development for the 21st Century, which encompasses 40 sectors and issues. It focuses particularly on national legislation, measures, plans, programmes and standards, as well as on the use of legal and economic instruments for environmental planning and management. Agenda 21 also places a great emphasis on participatory decision-making processes in policy formulation and implementation.

UNCED also laid the groundwork for a new world consensus on global conventions dealing with emerging issues, including biodiversity and climate change. A significant concession won by the representatives of Small Island Development States (SIDS) in the Rio 1992 process was the need for the recognition of the peculiar vulnerabilities and characteristics that make the pursuit of sustainable development complex and difficult for this group of countries. This resulted in the decision by the United Nations General Assembly to convene a conference to look at issues related to SIDS. At the United Nations Global Conference on the Sustainable Development of Small Island Developing States, held in Barbados in 1994, governments adopted the Barbados Declaration and Programme of Action for Small Island Developing States (SIDS/POA). These agreements elaborate principles and set out strategies for development that will protect the fragile environments of SIDS. They build on the Rio Declaration and Agenda 21.

Among the Caribbean SIDS, there is consensus that all the principles/priority areas of the SIDS/POA are relevant to their sustainable development, and significant progress has been made by many of these states in implementing the agreements. Difficulties exist, however, in the ability of international multilateral environmental agreements (MEAs) to assess the extent to which the SIDS/POA has had an impact on the sustainable development of these countries.

The Summit of the Americas for Sustainable Development (Bolivia, 1996) was held as a follow up to the First Summit of the Americas (USA, 1994). The Plan of Action adopted includes 65 initiatives on health, education, agriculture, biodiversity, water resources, coastal zones, cities, energy and mining. At the Third Summit of the Americas (Canada, 2001), governments in the region acknowledged the challenge of environmental management and committed themselves to strengthening environmental protection and the sustainable use of natural resources, with a view to ensuring a balance among economic development, social development and the protection of the environment.

Most recently, the World Summit on Sustainable Development, which was held in Johannesburg from 26 August to 4 September 2002, strongly reaffirmed the commitment to the Rio principles, the full implementation of Agenda 21 and the Programme for the Further Implementation of Agenda 21. The Summit declared its commitment to achieving the internationally agreed development goals, including those contained in the United Nations Millennium Declaration and in the outcomes of the major United Nations conferences and international agreements since 1992.

The subsequent development of these global conventions have led to the assumption by regional governments of a range of management responsibilities which pose both challenges and opportunities for the sustainable development of the CARICOM region. Attempts to meet these challenges have resulted in the creation of institutions and the formulation of government strategies and policies to address the region's sustainable development goals. However, despite this progress, principles of environmental protection and sustainable development have not yet fully penetrated private and public decision-making processes, and in some instances, are viewed as a constraint on economic development. Most of the explicit environmental policies currently implemented are reactive in nature, and prevention and incentive policies to improve environmental quality as it relates to industrial competitiveness are receiving far less attention. Environmental institutions are only just beginning to create the capabilities they need to achieve the goals identified in terms of effective trans-sectoral policies and to improve the international negotiating position of the countries.

With the onset of Agenda 21, the SIDS/POA, the Johannesburg Plan of Implementation and the myriad of international environmental treaties that govern various aspects of environmental management, the governments of the CARICOM region have reiterated their commitment to addressing, in a more holistic manner, the sectoral issues related to the achievement of sustainable development.

In order to successfully monitor and evaluate progress in the region, approaches to sustainable development require consistent, long-term strategies and sound policies, which should be based on timely and reliable information. Extensive fundamental changes in existing governing systems and institutional structures would also be required, if these countries were to be able to derive the benefits from their participation in international environmental treaties and achieve the goal of sustainable development.

MULTILATERAL ENVIRONMENTAL AGREEMENTS

International environmental law has undergone tremendous development in recent decades, as indicated by the hundreds of MEAs existing at international, regional, and bilateral levels. There are two main types of international environmental law: soft law, usually in the form of non-binding legal instruments, and hard law, or legally binding instruments. Non-binding agreements, often precursors to binding policy instruments, continue to dominate international environmental law. These agreements have played a major role in changing societal norms in the management and development of national policies for sustainable development.

GLOBAL MEAs

CARICOM's participation in MEAs has improved significantly over the years. The improvement has been driven primarily by these countries' interface with global environmental institutions, the demands of international financial donor institutions and states and, increasingly, the emergence of local environmental actors and interests. International MEAs and non-binding agreements have increased public knowledge of environmental issues and have had significant impact on the development of national policies and legislation to protect the environment and to promote sustainable development.

A review of MEAs shows that there are more than 100 conventions that hold some relevance to the Caribbean, many of which have attracted significant levels of ratification and/or accession by Caribbean States (United Nations Environment Programme (UNEP), *Caribbean Environment Outlook (1999)*).

The most important MEAs to the region are included in box 2.1 below. The record of acceptance of some of the global MEAs of particular significance to the CARICOM region is presented in table 2.1.

Box 2.1 Global MEAs of particular importance to the Caribbean

Basel: Convention on the Transboundary Movements of Hazardous Wastes and their Disposal. Basel, 22 March 1989.

CBD: Convention on Biological Diversity. Nairobi, 22 May 1992.

CITES: Convention on International Trade in Endangered Species of Wild Fauna and Flora. Washington, 3 March 1973.

Heritage: UNESCO Convention Concerning the Protection of the World Cultural and Natural Heritage. 23 November 1927.

MARPO: International Convention of the Prevention of Pollution from Ships. London, 2 November 1973 (as amended by the Protocol of 1978.

Ozone: Convention for the Protection of the Ozone Layer. Vienna, 22 March 1985; and Protocol on Substances that Deplete the Ozone Layer. Montreal, 16 September 1987.

Ramsar: Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar Convention). Ramsar, 2 February 1971.

UNCLOS: Convention on the Law of the Sea. Montego Bay, 10 December 1982.

UNFCCC: Framework Convention on Climate Change. New York, 9 May 1992.

CCD: Convention to Combat Desertification in those Countries Experiencing Serious Drought and/or Desertification, Particularly in Africa. Paris, 17 June 1994.

Source: Caribbean Environment Outlook.
Note: Dates are dates of adoption, not entry into force.

Table 2.1. Caribbean Community signatories to relevant international environment conventions

	CBD	CITES	CCD	Basel	Ozone	UNFCCC	Ramsar	UNCLOS	Heritage	MARPO
Antigua & Barbuda	●	●	●	●	●	●		●	●	●
Bahamas	●	●		●	●	●	●	●		●
Barbados	●	●	●	●	●	●		●	●	●
Belize	●	●	●	●	●	●	●	●	●	●
Dominica	●	●	●	●	●	●		●	●	
Grenada	●	●	●	●	●	●		●	●	
Guyana	●	●	●	●	●	●		●	●	●
Haiti	●		●	●		●		●	●	
Jamaica	●	●	●	●	●	●	●	●	●	●
St. Kitts & Nevis	●	●	●	●	●	●		●	●	●
St. Lucia	●	●	●	●	●	●		●	●	
St. Vincent & the Grenadines	●	●	●	●	●	●		●		●
Suriname	●	●						●		●[5]
Trinidad & Tobago	●	●	●	●	●	●	●	●		

Key: • Parties to Conventions.
•[5] No. of Annexes accepted by State.

Some difficulties exist in assessing the extent to which the MEAs have impacted on regional and national programming for sustainable development. This is a result of the following:

- Lack of a shared definition of sustainable development, amenable to measurement via a set of indicators;
- The absence of a methodology for determining the impacts of MEAs on the sustainable development planning and development at the national level;
- Lack of adequate collection and compilation of environmental statistics and indicators that can be used for monitoring and control.

The implementation of global MEAs in the CARICOM region has also been restricted because of inadequate international financing to guarantee compliance and to complement national funding efforts. However, where there has been such funding, progress has been made. The Global Environment Facility (GEF), through its twelve operational programmes that are linked to a number of key MEAs, has been a very useful mechanism for the incremental financing of environmental projects. In this instance, projects that can clearly demonstrate global environmental benefits and have clear co-financing arrangements will qualify for funding under the GEF.

REGIONAL MEAs

An evaluation of the impact of regional MEAs on the Caribbean region reflects similar results and limitations as those described for global MEAs. The only environmental convention covering the entire Caribbean is the Cartagena Convention (Convention for the Protection and Development of the Marine Environment of the Wider Caribbean Region; 1983) and its protocols on oil spills (Oilspills Protocol), specially protected areas and wildlife (SPAW Protocol) and the recently developed land-based sources of marine pollution (LBSMP Protocol). The Convention and Oilspils Protocol have attracted widespread support, and after many years the SPAW Protocol has entered into force (April, 2000). The record of acceptance of this regional MEA and its associated Protocols is presented in table 2.2.

It is expected that this Convention and its related Protocols will provide the support required by regional Governments to address the issues related to sustainable oceans management in a more holistic manner. In recent years, CARICOM Governments have assigned very high priority to the sustainable management of the Caribbean Sea. This has led the region to gain acceptance of an international instrument that calls for the development of a management regime for the Caribbean Sea. The resulting United Nations Resolution is entitled "*Promoting an Integrated Approach to the Caribbean Sea in the Context of Sustainable Development.*" It is envisaged that the management regime will be based on the principles embodied in co-management, and will allow for the responsibility for resource management and ocean stewardship to be shared between the Governments of the region and relevant stakeholders.

MEAs have helped to establish a number of important issues on the national environmental agendas of the countries, as well as to broaden stakeholder participation in environmental governance. The onset of MEAs has forced the crucial acknowledgment of the growing need for the development of adequate and timely information to support decision-makers in measuring progress towards sustainable development.

Table 2.2. Status of the Cartagena Convention

	Cartagena Convention	Oil Spills Protocol	SPAW Protocol	LBSMP Protocol
Antigua & Barbuda	•	•		
Bahamas				
Barbados	•	•		
Belize	•	•		
Dominica	•	•		
Grenada	•	•		
Guyana				
Haiti				
Jamaica	•	•		
St. Kitts & Nevis				
St. Lucia	•	•	•	
St. Vincent & the Grenadines	•	•	•	
Suriname				
Trinidad & Tobago	•	•	•	

Key: • Parties to Convention and Protocols.

ENVIRONMENTAL INFORMATION

It is well accepted that a major difficulty in assessing the commitments emanating from international conferences such as UNCED and the SIDS Conference, has been the lack of basic environmental statistics and indicators to measure the progress made. Several countries in the region have created programmes to improve information and data management in support of environmental policies in the fields of land resource management, biodiversity and marine and coastal zones. Many governments have also supported environmental information and training programmes on waste management and sustainable tourism.

Within the region, governments have demonstrated their awareness to the value of environmental information through the creation of institutions responsible for information for environmental management purposes. Institutions such as the Caribbean Conservation Association (CCA) and the CARICOM Secretariat are dedicated to the creation and maintenance of regional databases on socio-economic and environmental data and information. At the national level, however, the situation is different. While there are national statistical offices (NSOs), responsible for national data collection and compilation, they have traditionally focused on the collection and compilation of economic and social statistics. Collection and compilation of environment statistics is a new area of focus, and mechanisms are required for its institutionalisation in the NSOs.

Although all the countries of the region have created institutions and have developed appropriate legislation and regulations, there is still a need to better incorporate sustainable development concepts into the decision making processes at the national level, supported by a sound and reliable data base. As yet the important agreements, such as Agenda 21, SIDS/POA and MEAs, are still to be translated into effective policies and practical initiatives at the national level. The data requirements of effective policies must also be taken seriously, and in many instances a culture of data collection, storage and management must be fostered.

As mentioned in the description of the United Nations Statistics Division (UNSD)/CARICOM Project earlier in this publication, however, a significant amount of progress has now taken place in the development of environment statistics in several Member States in the region. The following chapters of the publication provide an in-depth review of the environmental statistics and indicators available for the major socio-economic and environmental issues in the CARICOM region.

CHAPTER 3

SOCIO-ECONOMIC CHARACTERISTICS

OVERVIEW

Socio-economic activity impacts the environment through the use of natural resources, the generation of pollution and wastes, and the infringement on natural habitats and ecosystems. The impacts of *population and human development*, however, vary according to various demographic variables, such as population size, growth, density and distribution.

The environmental impacts of population size and distribution are linked to economic and production levels, natural resource consumption, land use patterns and pollution and waste generation. High population density in urban areas may lead to increased local pressures on natural resources, such as water and land, and may generate large amounts of wastes and pollution.

The SIDS of the CARICOM region tend to have a high population density with a concentration of the population in the coastal zones.

Economic development may have a major impact on the environment, both in terms of the depletion of natural resources and the degradation of the environment. It should be noted, however, that changes in economic wealth can have both positive and negative impacts on the environment, and that the net impacts will depend on several factors, such as changes in the structure of the economy, changes in capital stock and technologies used, environmental policies and local ecosystems.

In the CARICOM region, tourism is one of the most important economic activities. Other economic activities in the region that have significant impact on the environment include fishing, mining, agriculture and forestry. The data tables and charts for these activities are included in subsequent chapters of this publication.

The per capita income of many of the SIDS tends to be higher than that of developing countries as a group. However, current incomes are often facilitated by migrant remittances. Furthermore, those incomes have been generally unstable over time due to, *inter alia*, the impact of natural disasters and difficulties in the international market for certain commodities.

POPULATION AND HUMAN DEVELOPMENT

Definitions and data origin

The data in table 3.1 are compiled by the CARICOM Secretariat and were obtained from the national statistical offices of Member States.

The total population is as complete and accurate a count as possible of all persons eligible to be counted in the country at the time of a census. The principal approaches in deciding on eligibility are:

(a) *de facto* approach: in this approach, persons, eligible to be counted are all persons in the country at a particular point in time or reference period, which is normally on census night (midnight), and they are associated with the household or institution in which they passed census night, regardless of their usual place of residence;

(b) *de jure* approach: in this approach, persons who are usual residents of the country are eligible to be counted, whether they happen to be in the country or not on census night. Visitors to the country, whose normal place of residence is not in the country, are excluded. Within the country, persons are counted at their place of normal residence and not at the place where they happen to be at census night.

Final population counts were available for Belize, and preliminary census data were available for Antigua & Barbuda, The Bahamas, Barbados, Dominica, Grenada, St. Kitts & Nevis, St. Lucia and Trinidad & Tobago. The census exercises for Guyana and Suriname are forthcoming; therefore, figures for these Member States are mid-year estimates. Jamaica's census took place in 2001 and their preliminary results were not yet available. Mid-year estimates were also submitted for these Member States. Census data for Montserrat and St. Vincent & the Grenadines were not yet available.

Table 3.1. Total area, total population, population density and growth rate

	Surface area (sq. km)	Total population			Population density	Percentage change in population
		1980/81	1990/91	2000/01[1]	2000/01	1990/91 - 2000/01
Antigua & Barbuda[2]	442	61,000	59,355	72,309	164	21.8
Bahamas	13,864	209,632	234,292	303,611	22	29.6
Barbados	431	244,228	247,288	250,010	580	1.1
Belize	22,966	142,847	185,970	232,111	10	24.8
Dominica	750	73,795	69,463	71,239	95	2.6
Grenada	345	89,088	85,123	102,632	297	20.6
Guyana	214,970	758,619	723,673	743,034	3	2.7
Haiti[3]	27,750	5,352,746	6,486,048	7,959,000	287	22.7
Jamaica	10,991	2,190,357[4]	2,314,479	2,605,787	237	12.6
Montserrat	103	11,519	10,639	5,272	51	-50.4
St. Kitts & Nevis	269	43,309	40,618	45,884	171	13.0
St. Lucia	616	113,409	133,308	151,143	245	13.4
St. Vincent & the Grenadines	389	97,845	106,480	111,817	287	5.0
Suriname[5]	163,820	354,860	401,665	435,797	3	8.5
Trinidad & Tobago	5,128	1,055,763	1,125,128	1,262,366	246	12.2
Total	462,834	10,799,017	12,223,529	14,352,012	31	17.4

Source: CARICOM Secretariat.

Key: [1] Data shown for 2000/2001 are final census results in the case of Belize and preliminary census results in the case of Antigua & Barbuda, The Bahamas, Barbados, Dominica, Grenada, St. Kitts & Nevis, St. Lucia and Trinidad & Tobago. The rest are mid-year estimates for 2000, with the exception of Jamaica that is an end-year estimate for 2000.

[2] Antigua & Barbuda did not conduct a census in 1980. The figure shown for 1980 is a United Nations estimate.

[3] UNSD Demographic database.

[4] 1982 for Jamaica.

[5] Suriname has not conducted a census since 1980. The figures shown for 1990/91 and 2000/2001 are estimates.

Comments

The population of the 15 countries in the CARICOM region was estimated at 14.3 million in 2000. This total represents a slight increase from the population of 12.2 million in 1990/91 and 10.7 million in 1980/81. In terms of population size in 2000/01, the largest of the countries is Haiti, accounting for about 55 per cent of the region's total population. Jamaica, Trinidad & Tobago and Guyana are the second, third and fourth largest countries, accounting for about 18, 9 and 5 per cent, respectively, of the region's population. Together, these four countries account for over three-fourths of the region's population.

The population of the region as a whole increased slightly over the period 1980 to 2000. The 1980-1990 decade, in particular, was a period of small population increase, or even decrease, for the majority of countries in the region. Compared to the earlier decade, the 1990-2000 period showed a higher population growth for most of the countries. Montserrat has lost a substantial part of its population during the decade. The main reason for this population decline was the disaster-induced migration due to the volcanic eruption of 1995.

The highest population density in 2000/01 was observed in Barbados with 580 persons per sq. km, followed by Grenada with 297 persons per sq. km and then by St. Vincent & the Grenadines with 287 persons per sq. km.

ECONOMIC DEVELOPMENT

Definitions and data origin

Table 3.2 is compiled by the CARICOM Secretariat and includes data on GDP at constant prices and growth of real GDP. The data were compiled from national statistical offices of the Member States, except in the case of the OECS countries. Data for these Member States were extracted from reports prepared by the Eastern Caribbean Central Bank (ECCB).

GDP at constant prices can be derived by breaking current values down into a price component and a quantity component. For the purposes of deriving constant prices estimates of GDP, a base year is selected which is deemed to be a normal year. Estimates at constant prices are usually derived by deflating the current price GDP values or by extrapolating the base year GDP by appropriate volume indices. Both methods are equivalent to expressing current period quantities at base period prices to reflect changes in volume over time.

GDP at constant prices for the countries of the OECS is calculated at base year 1990. For the other Member States, GDP at constant prices is at varying base years. In an effort to arrive at comparable data, the GDP of The Bahamas, Barbados, Belize, Guyana, Jamaica, Suriname and Trinidad & Tobago have been recalculated from their respective base years to a 1990 base year.

This approach of deriving a common base year is a 'second best' method. Ideally, the best approach would be to use the detailed price and quantity measures at the individual country level to re-base the GDP at constant prices.

However, even with the base years standardised, the data at constant prices are still not totally comparable. Bahamas, Jamaica and Trinidad & Tobago have prepared their constant GDP data at market prices, while the data for other countries are at constant factor cost.

At current prices, the data are at market prices as reported in the GDP expenditure tables of each Member State.

Conversion of the data at current prices to Eastern Caribbean (EC) dollars for the non-OECS Member States generates the problem of annual changes at constant prices being larger than the corresponding changes at current prices for specific Member States. In addition, relative changes in current prices between Member States are affected by the uncoordinated movements between changes in exchange rates and prices. The case of Suriname represents one of these Member States where this phenomenon resulted in the lack of comparability of current price changes across Member States and current versus constant prices within country, in EC dollars, as well as differences in changes in current prices, in EC dollars, as compared to similar changes in national currency of the affected country. This is also evident in Guyana and Jamaica.

Table 3.2. GDP in constant 1990 prices and growth of real GDP

	Real GDP *(EC$Mn)*						Growth of real GDP (%)					
	1985	**1995**	**1996**	**1997**	**1998**	**1999**	**1985**	**1995**	**1996**	**1997**	**1998**	**1999**
Antigua & Barbuda	652	982	1,041	1,099	1,153	1,210	7.9	-5.0	6.1	5.6	4.9	4.9
Barbados	3,583	3,843	3,938	4,051	4,228	4,335	1.1	2.3	2.5	2.9	4.4	2.5
Belize	598	1,137	1,154	1,203	1,224	1,302	0.4	4.0	1.5	4.2	1.7	6.4
Dominica	287	410	423	431	443	450	1.7	1.6	3.1	2.0	2.8	1.6
Grenada	349	527	542	564	606	651	6.2	3.1	2.9	4.2	7.3	7.5
Guyana	895	1,089	1,176	1,249	1,227	1,264	0.4	5.0	7.9	6.2	-1.7	3.0
Jamaica	9,036	13,077	12,909	12,678	12,624	12,568	-4.6	1.0	-1.3	-1.8	-0.4	-0.4
Montserrat	109	122	96	77	69	60	6.0	-7.6	-21.4	-20.0	-10.1	-12.6
St. Lucia	633	1,070	1,085	1,091	1,124	1,164	9.1	1.7	1.4	0.6	3.1	3.5
St. Kitts & Nevis	253	437	462	496	501	520	6.4	3.5	5.9	7.3	1.0	3.7
St. Vincent & the Grenadines	322	526	532	548	580	604	4.6	8.3	1.2	3.1	5.7	4.2
Suriname	4,352	3,986	5,317	5,705	5,991	5,942	2.0	2.5	33.4	7.3	5.0	-0.8
Trinidad & Tobago	15,326	14,662	15,241	15,770	16,652	17,831	-4.1	4.0	3.9	3.5	5.6	7.1

Source: CARICOM Secretariat.

Comments

Table 3.2 shows GDP in constant 1990 prices in EC dollars and the GDP percentage changes for the years 1985 and 1995-1999. Of the countries shown, Trinidad & Tobago had the highest GDP in constant prices in absolute terms for the entire period, followed by Jamaica. Compared to 1985, GDP at constant prices declined in 1995 for Trinidad & Tobago, from EC$15, 326.4 million to EC $14, 662.2 million, an annual average decline of 0.4 per cent. For Jamaica, GDP at constant prices increased from EC$9, 035.6 million in 1985 to EC$13, 076.6 million in 1995, an annual average increase of 3.8 per cent over the period 1985-1995.

In the OECS sub-region, GDP showed positive annual growth rates for all countries for the period 1985-99 and 1995-99, with the exception of Montserrat, for the period 1995-99 with an annual rate of decline of 16.2 per cent. Montserrat's growth was undoubtedly affected by the volcanic activity in this country. Suriname, like Trinidad & Tobago, recorded negative annual growth rate (-0.9 per cent) for the period 1985-1995.

Looking at percentage changes for the individual years, the OECS sub-region recorded positive changes for all countries and years, with the exception of Antigua & Barbuda with a 5 per cent decline in 1995, and Montserrat with negative growth for 1985, for the period 1995-99. Grenada's growth rate of 7.5 per cent was the highest rate of growth in 1999, followed by Trinidad & Tobago with 7.1 per cent, and Belize with 6.4 per cent. The economic structure described in the following paragraphs sheds more light on the industrial profile of economic growth.

Definitions and data origin

Table 3.3 is compiled by the CARICOM Secretariat and includes data on the structure of GDP at current prices by broad economic sectors. The data were compiled from national statistical offices of the Member States, except in the case of the OECS countries. Data for these Member States were extracted from reports prepared by ECCB.

GDP at current prices is the total market value of goods and services produced in the country within a given period of time, after deduction of the cost of goods and services used up in the process of production, but before deduction of allowances for the consumption of fixed capital. It is the sum of the gross value added by all resident and non-resident producers in the economy, plus any taxes minus subsidies not included in the value of production.

The data give a broad indication of the structure of production of each Member State and is measured as a percentage of the country's total GDP. Similar to the previous section, data for The Bahamas and Trinidad & Tobago are in market prices, while data for all the other countries are at factor cost, with the exception of Jamaica. Jamaica's data are in current producer prices.

Output by industrial origin is determined by the International Standard Industrial Classification of All Economic Activities (ISIC). For the purpose of this publication, agriculture includes forestry, fishing and hunting, while services include construction, distribution, financial services, government services, hotels and restaurants, transportation and communication, personal and community services and other general services. With regard to mining and manufacturing, The Bahamas did not report these two sectors separately. Hence, the data for The Bahamas, as appears in the manufacturing table, actually refer to the two sectors.

It should be noted that the utilities sector (electricity, gas and water), imputed service charges and value added tax (VAT) are not included in the data. As a result, the sum of the four major industrial sectors may not add to 100 per cent. In the case of Guyana, "electricity, gas and water" was included in the "other services" category and could not be disaggregated.

Data are presented on the percentage contribution of each Member State's GDP of the four industrial sectors to CARICOM's overall GDP of the respective sector. In both cases, these indicators would be affected by limitations concerning exchange rate conversions, as mentioned earlier.

Table 3.3. Structure of GDP at current prices by broad economic sectors: 1985, 1995 and 1999 (% of country's GDP)

	Sector											
	Agriculture			Mining and quarrying			Manufacturing			Services		
	1985	1995	1999	1985	1995	1999	1985	1995	1999	1985	1995	1999
Antigua & Barbuda	4.9	3.9	4.0	1.0	1.7	1.7	4.3	2.3	2.3	91.6	95.1	97.1
Bahamas	…	3.2	…	…	…	…	…	3.5	…	…	71.0	…
Barbados	6.3	6.3	4.9	1.3	0.6	0.7	10.6	6.7	5.8	78.4	82.9	85.4
Belize	20.4	20.6	19.2	0.4	0.6	0.6	16.7	13.7	12.7	62.8	65.6	68.1
Dominica	27.9	18.9	18.7	0.7	0.9	0.8	6.4	7.4	8.1	66.6	77.8	75.4
Grenada	17.1	10.1	8.1	0.5	0.4	0.5	6.1	6.6	7.3	78.6	83.5	85.6
Guyana	26.9	41.2	34.6	3.1	17.0	15.4	13.9	11.4	10.1	56.1	30.3	39.9
Jamaica	6.0	8.5	7.0	5.1	5.9	4.2	20.0	15.4	13.5	69.3	66.2	72.0
Montserrat	4.9	5.8	0.9	1.3	0.9	0.1	5.8	3.2	0.8	89.2	93.6	99.6
St. Kitts & Nevis	9.1	5.3	3.3	0.2	0.3	0.3	12.1	10.8	10.4	82.0	89.2	90.9
St. Lucia	14.4	9.5	8.0	0.5	0.5	0.4	8.2	6.9	5.6	78.3	87.2	89.5
St. Vincent & the Grenadines	20.0	14.1	10.5	0.2	0.3	0.3	11.6	8.4	6.2	69.0	78.2	82.9
Suriname	9.1	15.9	7.1	6.1	9.3	12.7	13.2	15.0	11.8	72.7	54.9	66.0
Trinidad & Tobago	2.3	1.9	1.5	22.1	14.3	11.1	9.5	16.1	16.1	69.6	64.5	69.6

Source: CARICOM Secretariat.

Comments

Looking at the profile of the economic structure in current prices by industrial sector in table 3.3, it is evident that the services sector dominates these economies. The Services sector includes financial and business services, wholesale and retail trade, hotels and restaurants, transport, construction, as well as government. Tourism of course is a significant service activity in the region, but its contribution to GDP is not reflected as a separate sector and, therefore, cannot be completely or effectively ascertained. There are variations across individual countries with respect to relative importance of services. In Guyana, while the services sector contributed to approximately 56.1 per cent in 1985, and approximately 40 per cent of GDP in 1999, agriculture and to a lesser extent mining and quarrying are dominant sectors in this country's economy, with the contribution of agriculture to GDP in current prices being as high as 41.2 per cent in 1995, and 34.6 per cent in 1999. Mining reflected 17 per cent of GDP in 1995, and 15.4 per cent in 1999 for Guyana. In addition to Guyana, agriculture was also relatively important in Belize with between 19 to 20 per cent, St. Vincent & the Grenadines 10.5 to 20 per cent and Dominica with 18.7 to 27.9 per cent for the years 1985,1995 and 1999. However, the general trend in agriculture to GDP shows a declining contribution for these countries.

Relative to mining and quarrying, Guyana and Trinidad & Tobago showed high percentages of this activity to GDP, with Guyana moving from a contribution of mining and quarrying to GDP of 3.1 per cent in current prices in 1985, to 17 per cent in 1995, and 15.4 per cent in 1999. Trinidad & Tobago's contribution to GDP of mining and quarrying was 22.1 per cent in 1985, followed by declining contribution in 1995 (14.3 per cent) and 1999 (11.1 per cent). These activities reflect oil and natural gas exploration and production. The oil-refining and petrochemical activities are reflected in the manufacturing sector in the case of Trinidad & Tobago. In the case of Guyana, mining activity is mainly in gold, bauxite and other minerals.

The manufacturing sector contributed over 10 per cent of GDP in 1985 for all Member States with the exception of Trinidad & Tobago (9.5 per cent), Dominica (6.4 per cent), Grenada (6.1 per cent), Montserrat (5.8 per cent) and St. Lucia (8.2 per cent). Jamaica had the highest contribution to manufacturing in 1985, with 20 per cent, followed by Belize with 16.7 per cent. No data were available for The Bahamas for 1985 and 1999. Included among the countries with declining contribution to manufacturing to GDP from 1995 to 1999 were Belize, moving from 13.7 per cent in 1995, to 12.7 per cent in 1999, Jamaica from 15.4 to 13.5 per cent, Guyana from 11.4 to 10.1 per cent and St. Kitts & Nevis from 10.8 to 10.4 per cent.

CHAPTER 4

ENVIRONMENTAL HEALTH

OVERVIEW

Health is one of the basic requirements of human welfare. Environmental issues are of increasing concern, not only to human health, but also to the health of plants and animals. Environmental health -- studying and managing the control of environmental factors harmful to human health -- is a public health endeavour.

Clean and adequate water is vital for human health but it is often the main conduit of many fatal diseases such as diarrhoea, malaria or typhoid fever. Trachoma, shistosomiasis, cholera and lead poisoning are also attributed to the degradation of the environment. People in many developing countries do not have access to safe drinking water and, above all, drinking water has often been contaminated because of pollution from human activities. High levels of oxygen demand by organic and inorganic pollutants reduce the oxygen concentration in water, which makes water inapt to fish and other aquatic animals.

Air is another route of exposure to pollutants. Uncontrolled industrial activities, power generation, fuel combustion, traffic and transportation have contaminated ambient air to a large extent. Pollutants such as nitrogen dioxide and sulphur dioxide cause respiratory diseases, and particulate matter is associated with asthma. Transport is the major cause of these pollutants in urban areas. In addition, an increase in ozone depleting substances, i.e. chlorofluorocarbons, halons, etc., have affected the ozone layer in the upper atmosphere, which works as a shield against ultraviolet rays from the sun. Disruption of this layer will have a great impact on human health mainly in the form of raising incidences of skin cancer.

Environmental health concerns in the CARICOM region are the result of poor waste management practices, lack of an adequate supply of good-quality drinking and recreational water, poor agricultural practices in the use and abuse of agro-chemicals and air pollution in the more industrialised countries such as Jamaica, Trinidad & Tobago and Barbados.

Over the last five to ten years there has been a marked improvement in the quality of drinking water in the Caribbean, thus reducing the incidence of water-borne diseases. This improvement in water quality was a direct result of the following two main factors: the cholera outbreak in the early nineties in South America which forced Caribbean Governments to take measures to improve the quality of drinking water, and the sanitation decay of the eighties that focused attention on *water supply and sanitation* in the region.

The most significant *environmentally-related diseases* in the region are gastroenteritis, dengue fever, cholera and malaria. Malaria is mostly prevalent in Guyana and Suriname. In addition, lead poisoning, mostly found in Trinidad, Jamaica and Barbados, as well as pesticide poisoning, are also of concern.

The Caribbean Epidemiology Centre (CAREC) is a regional institution located in Trinidad & Tobago and administered by the Pan American Health Organization (PAHO), the World Health Organization's Regional Office for the Americas. Its goal is to improve the health status of Caribbean people by advancing the capabilities of member countries in epidemiology, laboratory technology and related public health disciplines

through technical cooperation, service, training, research and a well-trained motivated staff.

The Caribbean Environmental Health Institute (CEHI) is a CARICOM-based institution located in St. Lucia and has 16 Member States. Its goal is to provide, *inter alia*, leadership, and technical and advisory services in all areas of environmental health, including environmental quality monitoring, environmental impact assessment, environmental health information, water resources management and waste management. CEHI acts as a regional reference centre for the collection and dissemination of technical and scientific information, and as a focal point for various environmental monitoring networks for the collection and dissemination of environmental, especially health-related, data in the Caribbean region. CEHI provides leadership to Member States in order to improve and support policy development decisions that are consistent with the goals and targets of the Caribbean Cooperation in Health II initiative and in collaboration with national, regional and international organisations.

The following statistics cover issues of water supply and sanitation, and environmentally-related diseases.

WATER SUPPLY AND SANITATION

Definitions and data origin

The data in table 4.1 were compiled from the World Health Organization/United Nations Children's Fund (WHO/ UNICEF) Joint Monitoring Programme for Water Supply and Sanitation. A review of water and sanitation coverage data from the 1980s and the first part of the 1990s showed that the definition of safe, or improved, water supply and sanitation facilities sometimes differed not only from one country to another, but also for a given country over time. Coverage data were based on estimates by service providers, rather than on the responses of consumers to household surveys, and these estimates can differ substantially. The Assessment 2000 marks a shift from just the gathering of provider-based information to the inclusion of consumer-based information.

While the type of water source and the type of excreta disposal facility can be associated with the quality of water and the adequacy of disposal, respectively, they cannot adequately measure population coverage of safe water or of sanitary excreta disposal. Access to water and sanitation does not imply that the level of service or quality of water is "adequate" or "safe."

Access to water supply and sanitation is defined in terms of the types of technology and levels of service afforded. For water, this included house connections, public standpipes, boreholes with handpumps, protected dug wells, protected springs and rainwater collection. Allowance was also made for other locally-defined technologies. "Reasonable access" was broadly defined as the availability of at least 20 litres per person per day, from a source within one kilometre of the user's dwelling. Sanitation was defined to include connection to a sewer or septic tank system, pour-flush latrine, simple pit or ventilated improved pit latrine, again with allowance for acceptable local technologies. The Assessment 2000 did not provide a standard definition of urban or rural areas; it used the working definitions of the countries.

Table 4.1. Water supply and sanitation coverage (2000)

	% Total water supply coverage	% Urban water supply coverage	% Rural water supply coverage	% Total sanitation coverage	% Urban sanitation coverage	% Rural sanitation coverage
Antigua & Barbuda	91	95	89	95	98	94
Bahamas	97	98	86	100	100	100
Barbados	100	100	100	100	100	100
Belize	92	100	82	50	71	25
Dominica	97	100	90	83	86	75
Grenada	95	97	93	97	96	97
Guyana	94	98	91	87	97	81
Haiti	46	49	45	28	50	16
Jamaica	92	98	85	99	99	99
Montserrat	100	100	100	100	100	100
St. Kitts & Nevis	98	…	…	96	…	…
St. Lucia	98	…	…	89	…	…
St. Vincent & the Grenadines	93	…	…	96	…	…
Suriname	82	93	50	93	99	75
Trinidad & Tobago	90	…	…	99	…	…

Source: World Health Organization/United Nations Children's Fund (WHO/UNICEF).

Comments

In most of the CARICOM Member States, the improved water supply, in the sense discussed above, covers practically the entire population. That amounts to over 90 per cent or more for 13 out of the 15 Member States covered in table 4.1. The sanitary conditions, as defined above, are good for a fairly high percentage of the population in almost all the countries. The data for Haiti and Belize, however, show relatively lower coverage. As can be expected, the situation in the urban areas is generally better than in the rural areas.

Definitions and data origin

The data in tables 4.2 and 4.3 on the distribution of households by source of water supply and toilet facilities were compiled by the CARICOM Secretariat. The data were collected from periodic censuses conducted in the region. These censuses are usually carried out every ten years. Categories used in each type of facility and conditions of households below are quite similar across countries in the region. Data cover two periods: the 1980/81 and 1990/91 censuses that were carried out under the supervision of a census coordinating body. The data for type of dwelling facilities were compiled on a household basis. In all censuses a household is defined as one person living alone, or a number of persons all living together and sharing at least one common daily meal. Note that one or more households could occupy one dwelling, sharing the same type of facilities offered by the dwelling. The number of households do not necessarily equate to the number of dwellings in the area.

The following definitions apply for water supply:

Piped into dwelling: running water from public sources, which are generally operated by a public body that is subject to inspection and control by public authorities. In some cases these sources are generated by a cooperative or private enterprise and are piped into the dwelling unit through water pipes within the walls that constitute a dwelling.

Piped into yard: running water from a public source is available in the yard.

Public standpipe: water is available to the dwelling unit from a standpipe on the street.

Private catchment not piped: water from a private well or similar arrangement within the premises, but not piped into the house.

Public well or tank: water from a protected well or tank built by the public authorities or community-based non-governmental organizations to serve the public.

Other: water from other sources, such as river, spring, creek, etc.

The following definitions apply for toilet facilities:

Toilet: an installation for the disposal of human excreta.

Pit: a pit latrine is a type of toilet facility available to the household that is usually built outside the dwelling.

W.C. linked to sewer: a toilet facility that is a flush toilet or water closet (W.C.), which fills from a piped water supply and empties into a sewerage disposal system.

W.C. not linked to sewer: a toilet facility that is water borne and empties into a **septic tank** (a tank in which sewage is decomposed by the action of bacteria) or an absorption pit on such well.

Other: all other types of toilet facilities within the premises not described above.

None: unavailability of toilet facilities to the household on the premises.

Table 4.2. Distribution of households by source of water supply

	Year	Total	Piped into dwelling	Piped into yard	Private catchment not piped	Public standpipe	Public well or tank	Other/not stated
Antigua & Barbuda	**1990/91**	18,476	9,363	2,059	1,075	5,495	69	415
Percentage		100	50.7	11.1	5.8	29.7	0.4	2.2
Bahamas	**1990/91**	61,906	47,610	2,042	3,972	6,331	1,297	654
Percentage		100	76.9	3.3	6.4	10.2	2.1	1.1
	1980	48,233	28,711	2,125	4,437	8,240	1,843	2,877
Percentage		100	59.5	4.4	9.2	17.1	3.8	6.0
Barbados	**1990/91**	82,204	60,580	10,341	. .	1,389	. .	9,894
Percentage		100	73.7	12.6	. .	1.7	. .	12.0
	1980	67,138	41,069	14,242	283	6,690	28	4,826
Percentage		100	61.2	21.2	0.4	10.0	0.0	7.2
Belize[1]	**1990/91**	37,944	11,931	6,877	7,575	2,105	6,440	3,016
Percentage		100	31.4	18.1	20.0	5.5	17.0	7.9
Dominica	**1990/91**	19,371	7,667	2,057	396	7,209	509	1,533
Percentage		100	39.6	10.6	2.0	37.2	2.6	7.9
	1980	17,310	3,813	1,640	278	8,196	172	3,211
Percentage		100	22.0	9.5	1.6	47.3	1.0	18.5
Grenada	**1990/91**	21,974	10,993	2,921	1,668	4,637	129	1,626
Percentage		100	50.0	13.3	7.6	21.1	0.6	7.4
	1980	21,017	7,204	3,007	1,492	7,190	114	2,010
Percentage		100	34.3	14.3	7.1	34.2	0.5	9.6
Guyana	**1990/91**	150,575	42,710	48,805	7,686	15,942	11,924	23,508
Percentage		100	28.4	32.4	5.1	10.6	7.9	15.6
	1980	149,734	56,977	45,741	4,973	15,492	500	26,051
Percentage		100	38.1	30.5	3.3	10.3	0.3	17.4
Jamaica[2]	**1990/91**	588,710	230,018	119,819	65,982	107,746	38,607	26,538
Percentage		100	39.1	20.4	11.2	18.3	6.6	4.5
Montserrat	**1990/91**	3,855	2,849	661	2	242	7	94
Percentage		100	73.9	17.1	0.1	6.3	0.2	2.4
	1980	3,708	1,896	955	8	668	58	123
Percentage		100	51.1	25.8	0.2	18.0	1.6	3.3
St. Kitts & Nevis	**1990/91**	12,056	6,648	2,031	260	2,743	192	182
Percentage		100	55.1	16.8	2.2	22.8	1.6	1.5
	1980	11,615	4,075	1,306	390	4,744	760	340
Percentage		100	35.1	11.2	3.4	40.8	6.5	2.9
St. Lucia	**1991**	33,079	15,812	4,896	695	9,361	232	2,084
Percentage		100	47.8	14.8	2.1	28.3	0.7	6.3
	1980	24,810	5,781	3,846	992	10,098	124	3,969
Percentage		100	23.3	15.5	4.0	40.7	0.5	16.0
	1970	21,753	2,523	1,936	1,044	8,832	109	7,309
Percentage		100	11.6	8.9	4.8	40.6	0.5	33.6
St. Vincent & the Grenadines	**1990/91**	27,002	10,665	3,864	1,346	7,934	279	2,914
Percentage		100	39.5	14.3	5.0	29.4	1.0	10.8
	1980	20,290	5,942	2,690	744	9,197	260	1,457
Percentage		100	29.3	13.3	3.7	45.3	1.3	7.2
Trinidad & Tobago[3]	**1990**	271,871	161,079	32,925	14,012	40,881	4,222	18,752
Percentage		100	59.2	12.1	5.2	15.0	1.6	6.9
	1980	231,536	112,263	36,630	4,204	58,769	4,532	15,138
Percentage		100	48.5	15.8	1.8	25.4	2.0	6.5

Source: CARICOM Secretariat.

Key: [1] 2,835 households as "River/stream" have been added to "Public well or Tank".
[2] 38,607 households reported under "Spring/river" have been added to "Public well or Tank".
[3] 11,721 households reported under "Truck Born" added to "other" category.

Table 4.3. Distribution of households by toilet facilities

	Year	Total	Pit latrine	W.C. linked to sewer	W.C. not linked to sewer	Septic tank	Other	None	Not stated
Antigua & Barbuda	**1990/91**	18,476	7,618	. .	. .	9,773	294	791	-
Percentage		100	41.2	. .	. .	52.9	1.6	4.3	-
Bahamas	**1990/91**	61,906	9,942	6,109	. .	41,587	3,158	929	181
Percentage		100	16.1	9.9	. .	67.2	5.1	1.5	0.3
	1980	48,233	13,647	3,618	. .	26,863	652	1,057	2,396
Percentage		100	28.3	7.5	. .	55.7	1.4	2.2	5.0
Barbados	**1990/91**	82,204	24,217	786	49,215	. .	289	275	7,422
Percentage		100	29.5	1.0	59.9	. .	0.4	0.3	9.0
	1980	67,138	35,060	-	29,259	. .	136	437	2,246
Percentage		100	52.2	-	43.6	. .	0.2	0.7	3.3
Belize	**1990/91**	37,944	19,453	6,141	. .	7,083	2,178	3,089	-
Percentage		100	51.3	16.2	. .	18.7	5.7	8.1	-
Dominica	**1990/91**	19,371	6,850	2,499	. .	4,636	449	4,937	-
Percentage		100	35.4	12.9	. .	23.9	2.3	25.5	-
	1980	17,310	5,886	2,073	. .	1,418	149	6,960	824
Percentage		100	34.0	12.0	. .	8.2	0.9	40.2	4.8
Grenada	**1990/91**	21,974	12,943	643	. .	7,298	240	850	-
Percentage		100	58.9	2.9	. .	33.2	1.1	3.9	-
	1980	21,017	12,993	912	. .	4,848	148	1,459	657
Percentage		100	61.8	4.3	. .	23.1	0.7	6.9	3.1
Guyana	**1990/91**	150,575	101,451	10,833	. .	33,558	2,408	2,325	-
Percentage		100	67.4	7.2	. .	22.3	1.6	1.5	-
	1980	149,734	92,411	15,514	. .	27,902	1,295	4,626	7,986
Percentage		100	61.7	10.4	. .	18.6	0.9	3.1	5.3
Jamaica	**1990/91**	588,710	298,933	234,446	. .	2,278	12,923	. .	40,130
Percentage		100	50.8	39.8	. .	0.4	2.2	. .	6.8
Montserrat	**1990/91**	3,855	715	28	. .	2,666	30	416	-
Percentage		100	18.5	0.7	. .	69.2	0.8	10.8	-
	1980	3,708	1,477	. .	1,731	. .	341	40	119
Percentage		100	39.8	. .	46.7	. .	9.2	1.1	3.2
St. Kitts & Nevis	**1990/91**	12,056	4,828	153	. .	6,557	111	407	-
Percentage		100	40.0	1.3	. .	54.4	0.9	3.4	-
	1980	11,615	6,949	191	. .	3,459	44	547	425
Percentage		100	59.8	1.6	. .	29.8	0.4	4.7	3.7
St. Lucia	**1991**	33,079	16,209	2,779	. .	9,924	1,224	2,943	-
Percentage		100	49.0	8.4	. .	30.0	3.7	8.9	-
	1980	24,810	12,727	1,737	. .	2,853	992	5,409	1,092
Percentage		100	51.3	7.0	. .	11.5	4.0	21.8	4.4
	1970	21,753	11,834	1,109	. .	1,283	1,893	5,308	326
Percentage		100	54.4	5.1	. .	5.9	8.7	24.4	1.5
St. Vincent & the Grenadines	**1990/91**	27,002	16,815	829	. .	8,141	215	1,002	. .
Percentage		100	62.3	3.1	. .	30.1	0.8	3.7	. .
	1980	20,290	13,903	675	4,193	. .	154	824	541
Percentage		100	68.5	3.3	20.7	. .	0.8	4.1	2.7
Trinidad & Tobago	**1991**	271,871	112,318	59,689	97,147	. .	186	1,190	1,341
Percentage		100	41.3	22.0	35.7	. .	0.1	0.4	0.5
	1980	231,436	134,346	46,170	48,919	. .	152	1,029	820
Percentage		100	58.0	19.9	21.1	. .	0.1	0.4	0.4

Source: CARICOM Secretariat.

Comments

According to the data given in table 4.2, for 1980s and 1990s, for all other countries except for Guyana (Jamaica and Belize have data for 1990/91 only), there was an upward movement in percentages of households with improved facility of "piped into dwelling." In 1990/91, The Bahamas, Barbados and Montserrat had over 70 per cent of households with improved facilities; "piped into dwelling," while Guyana and Belize were around 30 per cent, the lowest among all countries. The Bahamas, Dominica, Grenada and St. Lucia had a significant increase in percentages, as well as in number of households from 1980s to 1990s, respectively, for the same water facility; Barbados and Trinidad & Tobago improved marginally between 1980 and 1990.

Table 4.3 shows that Dominica had improved toilet facilities of households from 40.2 per cent, reporting "none" in 1980s, to 25.5 per cent in 1990s. At the same time, households with "septic tank" had improved from 8.2 per cent in 1980s, to 23.9 per cent in 1990s. For most of the countries except Dominica, the percentage for combined "other" and "none" categories seems to be below 15 per cent of households in 1990s, as well as in 1980s. St. Lucia moved from 33.1 per cent of households in 1970, of the two categories combined above, to 25.8 per cent in 1980, to just 12.6 per cent in 1990s.

ENVIRONMENTALLY-RELATED DISEASES

Definitions and data origin

The data in tables 4.4 - 4.15 on the number of reported cases and the incidence rates of cholera, dengue fever, malaria and gastroenteritis have been compiled by the Caribbean Epidemiology Centre (CAREC) located in Trinidad.

The following definitions apply to the data:

Malaria suspected case: one in which the individual experiences chills, followed by fever and sweating.

Malaria confirmed case: a suspected case with laboratory confirmation, i.e., identification of Plasmodiun species on peripheral blood smear.

Imported malaria: malaria acquired outside of the country.

Indigenous malaria: malaria acquired by mosquito transmission in an area where malaria is a regular occurrence.

Gastroenteritis in children under five years: a clinical case of gastroenteritis in a child less than five years who has passed three or more loose or watery stools in the past 24 hours, with or without dehydration.

Yellow fever: an acute viral haemorrhagic fever transmitted to man by mosquitoes infected with the yellow fever virus. It is endemic in parts of Africa, South America and occasionally enzootic in Trinidad (i.e., present in an animal community at all times, but occurring in only small numbers of cases).

Cholera: an acute bacterial, enteric disease, resulting from infection with Vibrio Cholerae of the serogroups O1 or O139. These pathogens are transmitted through the ingestion of water or food, contaminated directly or indirectly with faeces or vomitus of infected persons. A suspected case is a case of acute, profuse, watery, diarrhoea and vomiting, resulting in dehydration or death in a person over the age of five years.

Dengue fever: an acute, febrile illness, caused by one of four types of dengue virus. Viral transmission is through the bite of an infected Aedes Aegypti mosquito. The disease occurs in all countries infested with the vector and is prevalent in the Caribbean. Dengue fever is usually seasonal, with an increase in cases occurring after the onset of the rainy season.

Accidental pesticide poisoning: one of the most well recognised occupational diseases in the CARICOM Member States. The pesticide poisoning data in tables 4.16 and 4.17 have been provided by CEHI for Grenada and Dominica. The data were obtained in 1999, from books of casualties and medical records from medical facilities in Grenada and Dominica.

Table 4.4. Number of reported cases of cholera

	1994	1995	1996	1997	1998	1999	2000
Antigua & Barbuda	…	…	…	…	-	-	-
Bahamas	…	…	…	…	-	-	-
Barbados	…	…	…	…	-	-	-
Belize	6	18	26	2	29	12	-
Dominica	…	…	…	…	-	-	-
Grenada	…	…	…	…	-	-	-
Guyana	-	-	-	-	-	-	-
Jamaica	…	…	…	…	-	-	-
Montserrat	…	…	-	-	-	-	-
St. Kitts & Nevis	…	…	…	…	-	-	-
St. Lucia	…	…	…	…	-	-	-
St. Vincent & the Grenadines	…	…	…	…	-	-	-
Suriname	…	…	…	…	-	-	-
Trinidad & Tobago	…	…	…	…	-	-	-

Source: Caribbean Epidemiology Centre (CAREC).

Table 4.5. Incidence rates of cholera per 100,000 population

	1994	1995	1996	1997	1998	1999	2000
Antigua & Barbuda	…	…	…	…	-	-	-
Bahamas	…	…	…	…	-	-	-
Barbados	…	…	…	…	-	-	-
Belize	2.9	8.7	11.8	0.9	12.4	5.0	-
Dominica	…	…	…	…	-	-	-
Grenada	…	…	…	…	-	-	-
Guyana	-	-	-	-	-	-	-
Jamaica	…	…	…	…	-	-	-
Montserrat	…	…	-	-	-	-	-
St. Kitts & Nevis	…	…	…	…	-	-	-
St. Lucia	…	…	…	…	-	-	-
St. Vincent & the Grenadines	…	…	…	…	-	-	-
Suriname	…	…	…	…	-	-	-
Trinidad & Tobago	…	…	…	…	-	-	-

Source: Caribbean Epidemiology Centre (CAREC).

Table 4.6. Number of reported cases of dengue fever

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	1999
Antigua & Barbuda	1	5	-	-	-	-	-	3	6	4	2
Bahamas	-	-	-	-	-	-	-	-	-	336	-
Barbados	-	99	-	-	7	18	-	5	132	1,155	696
Belize	4	482	127	5	-	3	-	48	-	6	3
Dominica	-	-	-	6	-	-	-	-	3	1	5
Grenada	-	7	3	-	-	3	-	11	21	6	37
Guyana	-	-	-	-	-	-	-	-	3	4	…
Jamaica	9	21	12	3	6	11	296	8	46	1,509	23
Montserrat	-	-	-	-	-	-	-	-	2	-	-
St. Kitts & Nevis	-	-	-	-	-	-	-	7	4	-	2
St. Lucia	6	31	-	164	2	2	3	3	65	24	57
St. Vincent & the Grenadines	-	1	-	-	-	8	7	6	56	205	7
Suriname	-	25	-	64	-	30	77	1,031	677	1,574	1,377
Trinidad & Tobago	-	16	31	145	31	526	642	504	3,588	2,984	1,265

Source: Caribbean Epidemiology Centre (CAREC).

Table 4.7. Incidence rates of dengue fever per 100,000 population

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	1999
Antigua & Barbuda	1.7	8.3	-	-	-	-	-	4.6	9.1	6.0	3.0
Bahamas	-	-	-	-	-	-	-	-	-	116.7	-
Barbados	-	39.6	-	-	2.8	6.9	-	1.9	50.2	435.8	260.7
Belize	2.8	315.0	78.4	2.9	-	1.6	-	23.3	-	2.6	1.3
Dominica	-	-	-	8.0	-	-	-	-	4.1	1.4	7.0
Grenada	-	7.8	3.3	-	-	3.2	-	11.7	21.2	6.5	39.4
Guyana	-	-	-	-	-	-	-	-	0.4	0.5	…
Jamaica	0.4	0.9	0.5	0.1	0.3	0.5	12.1	0.3	1.8	58.7	0.9
Montserrat	-	-	-	-	-	-	-	-	40.0	-	-
St. Kitts & Nevis	-	-	-	-	-	-	-	16.3	9.5	-	4.9
St. Lucia	5.2	28.2	-	130.2	1.6	1.5	2.2	2.1	45.1	16.2	38.0
St. Vincent & the Grenadines	-	0.9	-	-	-	7.0	6.5	5.5	50.5	184.7	6.3
Suriname	-	6.9	-	16.4	-	7.4	18.6	246.7	160.0	367.8	319.5
Trinidad & Tobago	-	1.4	2.6	12.1	2.6	46.7	54.5	42.3	283.0	232.6	98.0

Source: Caribbean Epidemiology Centre (CAREC).

Table 4.8. Number of reported cases of gastroenteritis (<5 yrs old)

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000
Antigua & Barbuda	1,698	93	340	2,088	860	850	1,149	1,334	687	1,691	698
Bahamas	1,146	2,306	1,858	1,486	1,133	34	230	117	858	478	1,104
Barbados	164	187	250	130	25	30	104	36	39	29	12
Belize	719	675	2,259	2,515	1,344	980	69	456	1,363	1,642	390
Dominica	82	42	180	294	153	151	611	138	336	70	130
Grenada	1,041	1,667	1,364	814	455	315	459	339	957	724	701
Guyana	3,195	4,623	3,494	3,640	4,396	181	216	…	8,415	1,828	7,234
Jamaica	14,622	17,065	17,934	14,121	16,500	14,937	18,932	13,698	17,115	11,471	17,149
Montserrat	6	…	177	70	68	95	88	57	42	29	16
St. Kitts & Nevis	601	302	55	337	258	300	563	199	219	224	530
St. Lucia	876	606	1,331	399	828	700	709	681	571	963	357
St. Vincent & the Grenadines	1,015	1,856	1,692	524	1,449	1,179	814	1,427	981	485	1,304
Suriname	674	1,789	1,696	1,500	1,350	1,200	4,450	3,143	2,879	2,797	2,717
Trinidad & Tobago[1]	…	…	…	…	…	…	21,858	15,355	16,187	14,109	17,256

Source: Caribbean Epidemiology Centre (CAREC).
Key: [1] Age unspecified.

Table 4.9. Incidence rates of gastroenteritis (<5 yrs old) per 100,000 population

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000
Antigua & Barbuda	25,343	1,368	5,075	15,022	6,232	6,204	17,677	18,528	9,228	22,445	9,155
Bahamas	5,209	10,026	7,742	3,753	2,876	87	581	424	3,159	1,739	3,968
Barbados	781	891	1,191	531	102	154	528	182	195	143	59
Belize	2,703	2,700	8,068	10,350	5,554	4,066	281	1,974	4,459	6,805	1,597
Dominica	976	483	2,093	3,585	1,913	1,936	7,734	1,747	4,175	859	1,577
Grenada	8,008	15,294	12,991	7,980	4,418	3,029	4,371	3,198	8,891	6,646	6,358
Guyana	2,708	4,693	3,636	3,881	4,841	213	273	…	10,251	2,200	8,604
Jamaica	4,990	5,905	61,844	4,903	5,830	5,316	6,859	4,945	5,902	3,956	5,987
Montserrat	667	…	12,643	3,057	2,969	4,149	3,793	5,182	3,479	2,374	1,294
St. Kitts & Nevis	10,017	5,491	932	5,810	4,526	5,263	10,054	3,685	4,031	4,074	9,526
St. Lucia	4,380	2,635	5,787	2,217	4,600	3,889	3,896	4,152	3,419	5,698	2,087
St. Vincent & the Grenadines	6,465	13,449	12,086	3,743	10,577	8,733	6,512	11,236	7,559	3,693	9,811
Suriname	1,053	3,578	3,326	3,106	2,772	2,444	8,900	5,842	5,213	5,004	4,803
Trinidad & Tobago[1]	…	…	…	…	…	…	1,854	1,288	1,277	1,100	1,329

Source: Caribbean Epidemiology Centre (CAREC).
Key: [1] Age unspecified.

Table 4.10. Number of reported cases of gastroenteritis (>=5 yrs old)

	1994	1995	1996	1997	1998	1999	2000
Antigua & Barbuda	…	…	929	2,664	1,691	1,530	947
Bahamas	90	227	1,193	1,078	891	1,057	1,857
Barbados	1,483	…	2,445	…	…	…	…
Belize	…	228	634	802	1,041	424	515
Dominica	57	37	161	47	48	79	169
Grenada	371	737	800	562	839	1,200	757
Guyana	…	…	3,554	1,436	1,418	3,541	3,938
Jamaica	3,154	4,522	5,274	7,114	4,898	6,038	8,681
Montserrat	96	88	113	43	61	28	34
St. Kitts & Nevis	313	433	396	426	291	268	769
St. Lucia	96	93	113	43	957	944	490
St. Vincent & the Grenadines	1,435	1,092	1,007	1,152	685	2,056	1,255
Suriname	…	…	…	4,443	3,875	3,245	1,561
Trinidad & Tobago[1]	15,355	15,684	16,187	16,026	14,109	19,796	17,256

Source: Caribbean Epidemiology Centre (CAREC).
Key: [1] Age unspecified.

Table 4.11. Incidence rates of gastroenteritis (>=5 yrs old) per 100,000 population

	1994	1995	1996	1997	1998	1999	2000
Antigua & Barbuda	…	…	1,587	4,477	2,844	2,575	1,569
Bahamas	38	96	472	420	342	400	695
Barbados	605	…	1,006	…	…	…	…
Belize	…	124	322	395	498	198	234
Dominica	86	56	244	75	76	126	269
Grenada	445	885	907	684	1,022	1,445	912
Guyana	…	…	544	186	182	448	493
Jamaica	144	204	236	315	215	262	377
Montserrat	970	898	2,979	1,136	1,615	743	903
St. Kitts & Nevis	832	1,152	1,083	1,199	820	756	2,001
St. Lucia	77	74	89	33	730	710	363
St. Vincent & the Grenadines	1,490	1,113	1,027	1,176	700	2,081	1,165
Suriname	…	…	…	1,199	1,041	866	415
Trinidad & Tobago[1]	1,288	1,245	1,277	1,257	1,100	1,533	1,329

Source: Caribbean Epidemiology Centre (CAREC).
Key: [1] Age unspecified.

Table 4.12. Number of reported cases of malaria (indigenous)

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000
Antigua & Barbuda	-	-	-	-	-	-	-	-	-	-	-
Bahamas	-	-	-	-	-	-	-	-	-	5	-
Barbados	-	-	-	-	-	-	-	-	-	-	-
Belize	1,608	3,751	3,854	2,780	1,948	1,600	5,007	10,415	6,605	1,936	1,441
Dominica	-	-	-	-	-	-	-	-	-	-	1
Grenada	-	-	-	-	-	-	-	-	-	-	-
Guyana	2,808	2,025	3,052	15,792	30,000	6,748	31,156	33,915	34,075	10,805	19,670
Jamaica	-	-	-	-	-	-	-	-	-	-	-
Montserrat	-	-	-	-	-	-	-	-	-	-	-
St. Kitts & Nevis	-	-	-	-	-	-	-	-	-	-	-
St. Lucia	-	-	-	-	-	-	1	-	-	-	-
St. Vincent & the Grenadines	-	-	-	-	-	-	-	-	-	-	-
Suriname	4,444	2,799	3,858	1,500	…	2,068	2,944	7,392	15,834	12,380	8,403
Trinidad & Tobago	-	-	-	-	-	-	-	-	-	-	-

Source: Caribbean Epidemiology Centre (CAREC).

Table 4.13. Incidence rates of malaria (indigenous) per 100,000 population

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000
Antigua & Barbuda	-	-	-	-	-	-	-	-	-	-	-
Bahamas	-	-	-	-	-	-	-	-	-	1.7	-
Barbados	-	-	-	-	-	-	-	-	-	-	-
Belize	1,109.0	2,451.6	2,379.0	1,635.3	1,088.3	846.6	2,516.1	5,055.8	2,988.7	830.9	588.2
Dominica	-	-	-	-	-	-	-	-	-	-	1.4
Grenada	-	-	-	-	-	-	-			-	-
Guyana	326.5	267.2	403.2	2,086.1	3,968.3	898.5	4,148.6	4,608.0	4,629.8	1,250.6	2,227.6
Jamaica	-	-	-	-	-	-	-	-	-	-	-
Montserrat	-	-	-	-	-	-	-	-	-	-	-
St. Kitts & Nevis	-	-	-	-	-	-	-	-	-	-	-
St. Lucia	-	-	-	-	-	-	0.7	-	-	-	-
St. Vincent & the Grenadines	-	-	-	-	-	-	-	-	-	-	-
Suriname	1,244.8	771.1	1,020.6	384.6	…	511.9	712.8	1,768.4	3,743.3	2,892.5	1,940.6
Trinidad & Tobago	-	-	-	-	-	-	-	-	-	-	-

Source: Caribbean Epidemiology Centre (CAREC).

Table 4.14. Number of reported cases of malaria (imported)

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000
Antigua & Barbuda	…	…	…	…	…	…	1	1	2	…	…
Bahamas	3	5	3	2	17	4	2	-	-	16	2
Barbados	1	1	2	2	1	3	-	3	2	4	3
Belize	-	-	-	-	-	-	-	…	…	-	-
Dominica	-	-	-	1	-	-	-	3	2	1	-
Grenada	-	-	-	1	-	-	-	1	-	2	-
Guyana	-	-	-	-	-	-	-	…	…	-	-
Jamaica	-	2	5	10	6	-	6	3	14	3	7
Montserrat	-	-	-	-	-	-	-	-	…	-	-
St. Kitts & Nevis	-	-	-	-	-	-	1	-	1	-	-
St. Lucia	-	-	-	-	1	-	1	-	-	-	1
St. Vincent & the Grenadines	-	-	-	-	-	-	1	-	-	-	-
Suriname	-	-	-	-	-	-	-	-	-	…	-
Trinidad & Tobago	2	4	4	18	6	4	-	20	11	-	5

Source: Caribbean Epidemiology Centre (CAREC).

Table 4.15. Incidence rates of malaria (imported) per 100,000 population

	1980	1982	1984	1986	1988	1990	1992	1994	1996	1998	2000
Antigua & Barbuda	…	…	…	…	…	…	1.5	1.5	3.0	…	…
Bahamas	1.4	2.3	1.3	0.8	6.9	1.6	0.8	-	-	5.6	0.7
Barbados	0.4	0.4	0.8	0.8	0.4	1.2	-	1.1	0.8	1.5	1.1
Belize	-	-	-	-	-	-	-	…	…	-	-
Dominica	-	-	-	1.3	-	-	-	4.1	2.7	1.4	-
Grenada	-	-	-	1.1	-	-	-	1.1	-	2.2	-
Guyana	-	-	-	-	-	-	-	…	…	-	-
Jamaica	-	0.1	0.2	0.4	0.3	-	0.2	0.1	0.6	0.1	0.3
Montserrat	-	-	-	-	-	-	-	-	…	-	-
St. Kitts & Nevis	-	-	-	-	-	-	2.4	-	2.4	-	-
St. Lucia	-	-	-	-	0.8	-	0.7	-	-	-	0.7
St. Vincent & the Grenadines	-	-	-	-	-	-	-	-	-	-	-
Suriname	-	-	-	-	-	-	-	-	-	…	-
Trinidad & Tobago	0.2	0.4	0.3	1.5	0.5	0.4	-	1.7	0.9	-	0.4

Source: Caribbean Epidemiology Centre (CAREC).

Table 4.16. Accidental poisoning cases reported at St. George's General Hospital, Grenada emergency room during 1999

Date	Sex	Age	Way of poisoning	Name of pesticide	Discharge
18/02/1999	F	8	Ingestion	Rat poison	Alive
21/06/1999	M	2	Ingestion	Rat poison	Alive
11/07/1999	M	3	Ingestion	Insecticide	Alive
30/08/1999	M	10m	Ingestion	Baygon	Alive
02/09/1999	M	2	Ingestion	Rat poison	Alive

Source: PAHO-Ministry of Health, 2000. Prevention and management of agricultural pesticide-related illnesses in Dominica, Nicaragua and Grenada phase I Field assessment of pesticide use. Report no.1. Grenada.

Table 4.17. Accidental poisoning cases registered at Portsmouth Hospital, Dominica from 1996 to 2000

Date	Sex	Age	Way of poisoning	Name of pesticide
30/06/1997	F	1	Ingestion	Poison

Source: PAHO-Ministry of Health, 2000. Prevention and management of agricultural pesticide-related illnesses in Dominica, Nicaragua and Grenada phase I Field assessment of pesticide use. Report no.2. Dominica.

Comments

From 1994 to 2000, cholera was only reported in Belize. The number of cases peaked at 29 in 1998, but dropped to zero in 2000. All the CARICOM Member States reported cases of dengue fever for some of the years from 1980 to 1999. The highest number of reported cases of dengue fever was 3,588 for Trinidad & Tobago in 1996. In Jamaica, cases of dengue fever were reported each year. For gastroenteritis (both under five, and five and over), Jamaica reported the highest number of cases every year, although Trinidad & Tobago reported higher numbers for some of the years, but the age was unspecified. Indigenous cases of malaria have been reported in The Bahamas, Belize, Dominica, Guyana, St. Lucia and Suriname. With regard to imported malaria, however, cases have been reported in most of the Member States.

The data on acute pesticide poisoning from Dominica and Grenada refer to accidental pesticide poisoning by ingestion. The majority of the cases were male individuals. It is believed that mild cases of pesticide poisonings occur in these two countries but are unrecognised because of no specific symptoms and a lack of training among medical personnel in the recognition of pesticide poisoning.

CHAPTER 5

TOURISM

OVERVIEW

Tourism is one of the most important economic activities in the CARICOM region, earning foreign exchange and providing labour opportunities. Tourism accounts for 20 per cent of the labour force and absorbs 25 per cent of capital expenditure. Indeed, in the OECS region it has surpassed agriculture as the leading foreign exchange earner.

At the same time, tourism exerts pressures on the existing scarce resources in a country. A study by the National Water Commission of Jamaica found that tourists consume almost 10 times the water consumed by the local population. Because of the seasonal nature of tourism (the Caribbean tourist season coincides with the Northern winter and the Caribbean dry season), there are additional burdens on water supply. Furthermore tourism generates a disproportionately high level of waste.

The tourism sector in Caribbean SIDS is plagued by some major difficulties. Some of these are inherent in the industry itself, while others are derived from the countries themselves. These include, *inter alia*, vulnerability to economic shocks in the source markets, susceptibility to natural disasters in the destinations and inadequate/inappropriate policy, planning and institutional mechanisms to enable the adoption of integrated approaches to tourism development. Such strategic integration would balance economic growth with human and social development and preserve the natural environment, cultures and heritage of local communities.

In the CARICOM region, the coastal zones are particularly attractive for travellers; here, space is needed for hotels and other establishments and infrastructure, while at the same time conservation of pristine ecosystems is important. Marine protected areas have been established to protect and maintain the resources in coastal and marine waters. Eco-tourism, linking areas of high ecological value to low-impact tourism, may present important and environmentally sustainable opportunities for tourism development in the CARICOM region.

The statistics presented on the following pages describe the capacity and use of tourism infrastructure, the size and significance of tourism, and the importance of the tourism sector to the economies of the CARICOM countries.

Table 5.1. Tourist accommodation, tourist nights and direct employment in the tourism industry

	Year	Number of tourist nights (thousands)	Number of hotel rooms	Number of beds	Number of employees
Barbados	1990	2,306	6,709	…	…
	1995	2,488	5,084	…	11,900
	2000	2,695	6,456	…	14,200
Belize	1990	…	2,115	3,451	…
	1995	…	3,708	5,137	3,300[1]
	1999	…	3,963	6,810	5,490[2]
Grenada	1996	…	1,669	2,964	…
	1999	…	1,928	3,274	…
Jamaica	1990	…	16,103	…	20,561
	1995	…	20,896	…	27,937
	1999	…	23,067	…	30,325
St. Lucia	1994	2,011	…	…	…
	1995	2,081	…	…	…
	2000	2,371	…	…	…
St. Vincent & the Grenadines	1994	…	1,176	…	…
	1995	…	1,176	…	2,207
	2000	…	1,747	…	2,321[3]

Source: National.
Key: [1] Number of employees in hotels and restaurants. Hotels only: 2,107.
[2] Number of employees in hotels and restaurants. Hotels only: 2,570.
[3] The number of employees refers to 1998.

Data also available for:
Barbados: 1991-1994, 1996-1999;
Belize: 1991-1994, 1996-1998 (hotel rooms and beds), 1996-1998 (employees);
Grenada: 1997-1998;
Jamaica: 1991-1994, 1996-1998;
St. Lucia: 1996-1999;
St. Vincent & the Grenadines: 1996-1999 (hotel rooms).

NATIONAL DATA ON TOURIST ARRIVALS

The national data for tourist arrivals and cruise ship passenger arrivals received from Barbados, Belize, Grenada (cruise ship passengers only), Jamaica and St. Vincent & the Grenadines are the same or very close to those compiled by the Caribbean Tourism Organization (CTO).

However, St. Vincent & the Grenadines has significant numbers of one-day visitors who do not come on cruise ships, about 20-30,000 persons per year. These numbers are not included in the CTO data reported here.

NATIONAL DATA ON TOURIST EXPENDITURES

The figures reported by Barbados, Belize, Jamaica and St. Vincent & the Grenadines are the same as the CTO figures in table 5.5.

Definitions and data origin

The data in tables 5.2 - 5.6 on tourist expenditures, tourist arrivals, cruise passenger arrivals, average length of stay and tourism penetration ratio have been compiled by CTO. The following definitions are used:

Tourist: person who stays more than 24 hours and less than 365 days in a destination.

Tourist arrivals: all stay-over visitors, not cruise passenger arrivals. Since most cruise ships stop at more than one destination, the total number of arrivals at all destinations is considerably larger than the number of cruise passengers visiting the region.

Average length of stay: intended length of stay, unless otherwise stated.

Tourism penetration ratio: average number of tourists per 1000 inhabitants of the country at any point in time.

Table 5.2. Tourist arrivals (thousands)

	1995	1996	1997	1998	1999	2000
Antigua & Barbuda	220	228	240	234	240	207
Bahamas	1,598	1,633	1,618	1,528[1]	1,577	1,596[2]
Barbados	442	447	472	512	518	545
Belize	321	349	305	288	327	Jan-Jul 127[2]
Dominica	61	63	65	66	74	69
Grenada	108	108	111	116	125	129
Guyana	106	92	76	69[1]	75[3]	…
Haiti	145	150	149	147	143	…
Jamaica	1,147	1,162	1,192	1,225	1,248	1,323
Montserrat	18	9	5	8	10	10
St. Kitts & Nevis	79	84	88	93	84	69
St. Lucia	232	236	248	252	261	259
St. Vincent & the Grenadines	60	58	65	67	68	73
Suriname[4]	43	53	61	55	63	…
Trinidad & Tobago	260	266	324	348	359	Jan only 25

Source: Caribbean Tourism Organization (CTO).
Key: [1] Revised.
[2] Air arrivals only.
[3] CTO estimate.
[4] Non-resident air arrivals only.

Table 5.3. Average length of stay[1]

	Number of nights				
	1995	1996	1997	1998	1999
Bahamas[2]	6	6	6	5	…
Barbados	11	11	11	11	10
Belize	…	8	7	7	7
Dominica	…	…	…	…	9
Grenada	7	8	7	7	7
Jamaica	11	11	11	11	10
Montserrat	…	…	…	…	14
St. Kitts & Nevis	9	9	8	9	9
St. Lucia	9	9	9	9	9
St. Vincent & the Grenadines	12	11	10	11	11

Source: Caribbean Tourism Organization (CTO).
Key: [1] Intended length of stay, unless otherwise stated.
[2] Hotels registrations only.

Table 5.4. Cruise passenger arrivals (thousands)

	1995	1996	1997	1998	1999	2000
Antigua & Barbuda	227	271	286	337	328	427
Bahamas[1]	1,544	1,687	1,751	1,730	1,982	…
Barbados	485	510	518	507	433	533
Belize	8	0	3	14	34	58
Dominica	135	194	230	245[2]	202	240
Grenada	250	267	247	266	246	180
Haiti	225	250	238	246	243	…
Jamaica	605	658	712	674	764	908
Montserrat	9	..	..	..	..	..
St. Kitts & Nevis	121	86	103	154	137	169
St. Lucia	176	182	310	372	351	444
St. Vincent & the Grenadines	85	63	31	35[2]	48	86
Trinidad & Tobago	49	46	32	39	57	82

Source: Caribbean Tourism Organization (CTO).
Key: [1] At first port of entry only.
[2] Revised.

Figure 5.1. Cruise passenger and tourist arrivals (1999)

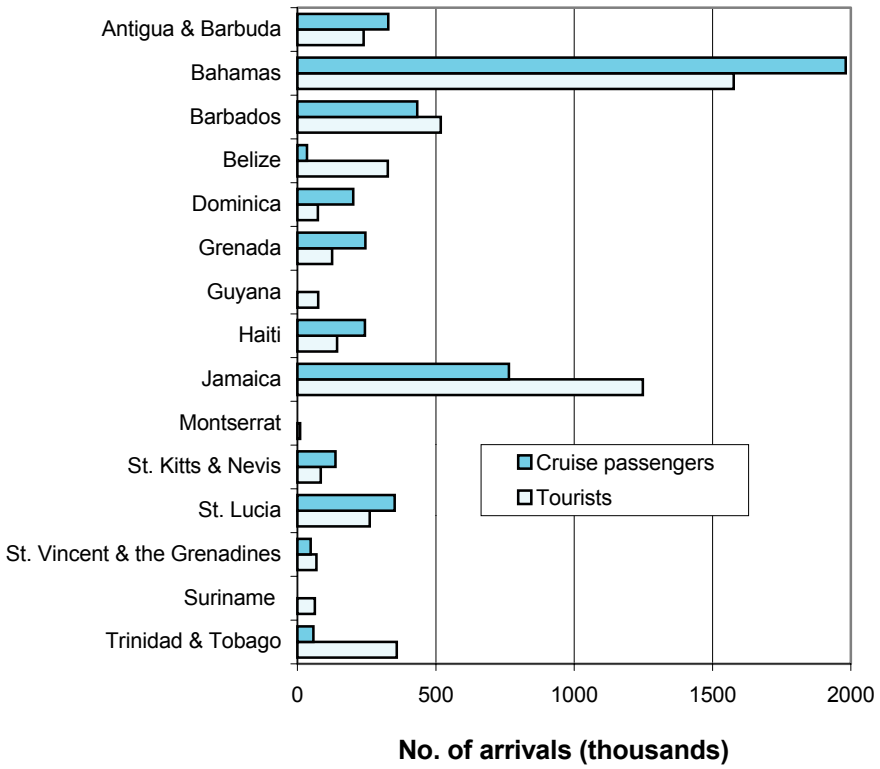


Table 5.5. Tourist expenditures (US$ millions)

	1995	1996	1997	1998	1999
Antigua & Barbuda[1]	247	258	269	256	290
Bahamas	1,346	1,450	1,416	1,354	1,583
Barbados	612	633	657	703	666
Belize	77[2]	89[2]	88	108[2]	112
Dominica[1]	34	37	40	38	49
Grenada	58	60	59	61[2]	67
Guyana[3]	78	70	60	54	59
Haiti [3]	56	58	57	56	55
Jamaica	1,069	1,092	1,131	1,197	1,280
Montserrat[3]	20	10	6	8	11
St. Kitts & Nevis	65	67	67	76	70
St. Lucia	268	269	284	291	311
St. Vincent & the Grenadines[1]	41	64	71	74	79
Suriname	31	38	63	44	53
Trinidad & Tobago[1]	73[2]	110[2]	193	201	210

Source: Caribbean Tourism Organization (CTO).
Key: [1] Central Bank estimates.
[2] Revised.
[3] CTO estimate.

Table 5.6. Tourism penetration ratio

	1995	1996	1997	1998	1999
Antigua & Barbuda	94	92	94	92	…
Bahamas	89	91	92	77	77
Barbados	50	50	51	59	54
Belize	34	31	26	24	…
Dominica	21	21	22	19	24
Grenada	22	22	23	23	25
Jamaica	14	14	14	14	14
St. Kitts & Nevis	47	48	49	55	51
St. Lucia	39	38	40	40	44
St. Vincent & the Grenadines	17	15	17	18	18

Source: Caribbean Tourism Organization (CTO).

Comments

The economies of The Bahamas and Jamaica receive particularly large incomes from tourist expenditures. Barbados, St. Lucia and Antigua & Barbuda also have high figures, and Trinidad & Tobago has growing incomes from tourist expenditures. The trends are slowly increasing, most noticeably in Jamaica and The Bahamas. In 1998, the tourist expenditures amounted to over 40 per cent of GDP in St. Lucia, Antigua & Barbuda and The Bahamas. These countries are thus particularly dependent on tourism. In all the other Member States, the ratio was 15 to 30 per cent, with the exception of Guyana, Haiti, Suriname and Trinidad & Tobago, where it was two to eight per cent.

The Bahamas and Jamaica have by far the largest numbers of arrivals. The proximity to the United States and Canada is a favourable factor for these countries. On the other hand, the average length of stay is lower in The Bahamas, since many tourists can conveniently travel there for a few days' visit. While trends have been fairly stable over the period 1995-1999, large fluctuations occurred in 2000 compared to previous years.

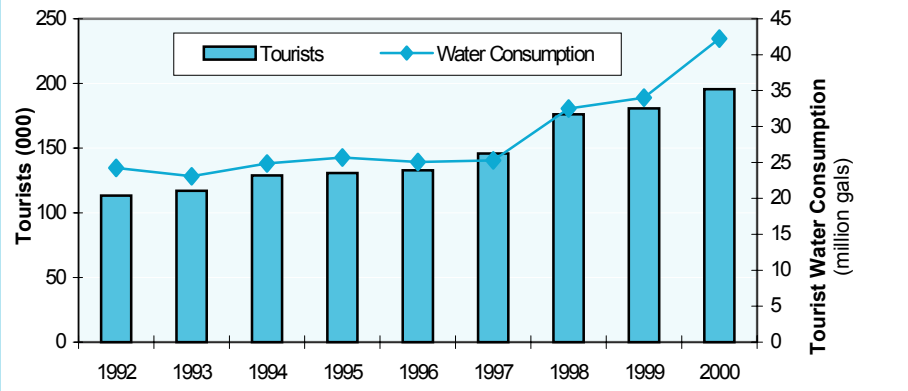
The average length of stay shows only slight variations over the period 1995-1999. The high figure for Montserrat is assumed to be influenced by nationals living abroad and visiting their country.

The tourism penetration ratio has been stable over the period 1995-1999 in all countries reported except in The Bahamas, where there was a large decrease in 1998 and 1999. The highest ratio observed is in Antigua & Barbuda, where almost one out of ten persons can be expected to be a tourist at any time. High rates are also registered for The Bahamas, Barbados, St. Kitts & Nevis and St. Lucia.

In order to determine the full impact of tourism on the environment, it is also important to measure the use of natural resources, such as water, land and energy, as well as the wastes and pollution generated by the tourism industry. In practice, however, this is quite difficult to measure, but an example of such estimates for Belize is included in box 5.1 below.

Box 5.1. Estimating the environmental impacts of tourism in Belize

Tourist Water Consumption, 1992 - 2000



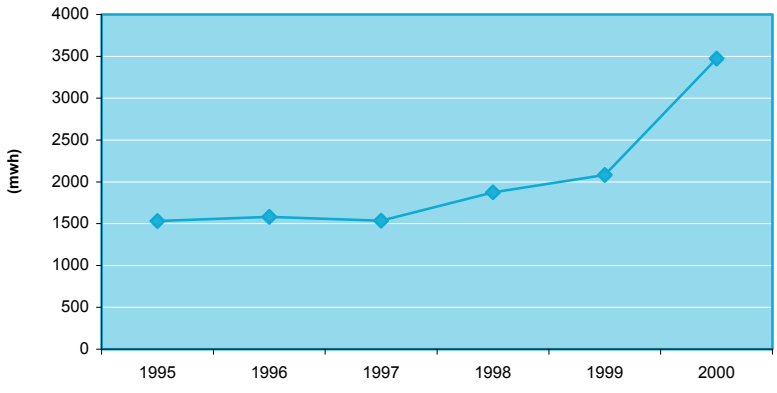
Tourist water consumption has been derived by multiplying the total number of tourist arrivals, by the average length of stay, and by the national daily per capita water consumption (includes both residential and commercial). It is foreseen that this estimate might underestimate the actual water consumption as tourists tend to use more water than nationals do.

Waste Produced by Tourists
(1995 - 2000) (tons)

1995	1,042
1996	1,058
1997	971
1998	1,283
1999	1,490
2000	1,925

Waste produced by tourists has been derived by multiplying the national daily per capita waste generation by the average length of stay and by the number of tourist arrivals.

Tourist Electricity Consumption, 1995 - 2000



Tourist electricity consumption has been derived by multiplying the national daily per capita electricity consumption (includes both residual and commercial consumption by the number of tourist arrivals and by the average length of stay.

Source: Central Statistical Office, Belize.

CHAPTER 6

FRESHWATER

OVERVIEW

Freshwater resources are of vital environmental and biological importance, since water is a basic support element for human life and ecosystems. Inadequate protection of the quality and *supply* of freshwater resources can set important limits to sustainable development. Freshwater occupies only 2.5 per cent of Earth's surface and exists in the shape of rivers, lakes, ponds, wells, reservoirs, aquifers and glaciers.

Freshwater provides goods, such as inputs into production, and services, such as transportation, biodiversity maintenance, habitats for fish, provision of food, dilution of waste and recreation for humans. In some cases, humans have altered and restructured the natural hydrological systems to get more benefits from water and, in the interim, these changes might lead to water-borne diseases, pressure on ecosystems, soil erosion, water logging, and loss of habitats and biodiversity.

Many of the CARICOM Member States face severe constraints in terms of both the quality and the quantity of freshwater because of their small size and particular geological, topographical and climatic conditions. This is even more the case for low-lying coral-based islands, where there are limited supplies of groundwater and which are protected only by a thin permeable soil. Apart from Barbados, Jamaica and Trinidad & Tobago, no other CARICOM Member State has completed a full assessment of its water resources. Jamaica has the most complete assessment, with an inventory of water availability, as well as present and projected demands. Notwithstanding these deficiencies, all countries are moving toward expanding their agriculture and tourism sectors, while improving the delivery of water to the local population.

Water *abstraction* is water removed from any source, either permanently or temporarily, during a specified period of time. It can be unsustainable if the rate of abstraction, i.e., the volume per time unit, exceeds the rate of replenishment of the resource. In addition, issues relating to the quality of water when it eventually returns to streams, rivers and lakes, are also of concern. Water used for cleaning, cooling and irrigation carries with it soluble salts, chemicals, soil particles and biological wastes, which could deteriorate the quality of the water body and adversely impact the ecosystem.

Given the already limited groundwater supply in most of the Member States of the CARICOM region, proper management and sustainable abstraction is considered necessary. In Trinidad & Tobago for example, as a result of over-exploitation of groundwater resources, saltwater intrusion has been problematic. The Government has responded by limiting abstraction in order to permit recovery. Additionally, measures are now in place to avoid this problem in the future. They include safe-yield amounts, the siting of wells farther inland and frequent monitoring.

The *use* of water is wide and includes recreational and many economic activities, such as agriculture and forestry, fishing, manufacturing, hotels and restaurants, as well as households. It is important to know the amounts of water used according to a standardised breakdown of economic activities and households to determine how best to design policies for water resources management. Growing populations, as well as increased economic activities, have caused an increase in

the demand for freshwater resources. In the CARICOM region, the tourism industry is a major user of water, and sustainable tourism policies can be designed to control water use.

Waste water is a major problem in many countries, especially in developing countries, mostly due to a lack of *wastewater treatment* facilities. Waste water is often drained into rivers, lakes and ponds without any, or with minimal treatment. One important point source for phosphorous and nitrogen inputs are domestic wastewaters and related discharges from sewage treatment plants. Excessive nutrients lead to the eutrophication of water bodies, which is the excessive growth of algae, and may result in the subsequent depletion of dissolved oxygen, thereby affecting aquatic life.

A major cause of the deterioration of *water quality* is the discharge of industrial and household wastes into water bodies. Coastal zones, estuaries and shorelines of large lakes are particularly favoured for the location of highly polluting industries, because they appear to be an easy solution for waste disposal. The contaminants of major concern are toxins, such as heavy metals and pesticides, organic matter, nutrient loadings, such as fertilizer run-off, deposits from acid precipitation and pathogens, such as faecal coliform. Such contamination can lead to, *inter alia*, eutrophication, toxic dispersion and the spread of water-borne diseases, and can therefore be detrimental to both human health and the health of aquatic ecosystems. The main variables that address quality concerns related to the oxygen regime are biochemical oxygen demand (BOD), chemical oxygen demand (COD), dissolved oxygen (DO), total dissolved solids (TDS) and total suspended solids (TSS).

In the CARICOM Member States, a common threat to the water quality is the contamination of supply by human and livestock waste, industry-related pollution, and in some cases, pesticides and other agricultural chemicals. The leaching of pollutants into ground water supplies is also a concern in CARICOM Member States. Pollutants in water bodies come from either point or non-point sources. Point sources of pollution include specific agricultural and industrial sites that discharge heavy metals such as lead, zinc, copper, and nutrients like phosphates and nitrates. Petroleum products and domestic waste, mentioned previously, are also regarded as point source pollutants. The major non-point sources of pollution are agricultural runoff, storm-water run-off and percolation of contaminated water from solid waste landfills and sewerage systems. Pesticides and fertilizers are some of the deleterious components of contaminated agricultural runoff.

The statistics presented in the following pages describe the situation in the CARICOM region with regard to water resources, use and quality, as well as waste water treatment.

WATER SUPPLY, ABSTRACTION AND USE

Table 6.1. Water abstraction, water supply and water use (million m^3)

	Year	Characterization	Volume	of which: lost in transport	supplied in urban areas	supplied to /used by households	supplied to/used by economic activities	supplied to/used by agriculture
Bahamas[1]	1990	supply	10.16	5.27	…	…	…	…
	1995	supply	11.03	5.44	…	3.55	2.04	…
	1998	supply	12.89	6.50	…	4.19	2.20	…
Barbados[2]	1990	abstraction	64.10	…	…	…	…	…
	1995	abstraction	64.10	…	…	…	…	…
	2000	abstraction	61.50	…	…	…	…	…
Belize	1994	abstraction	7.00	…	…	…	…	…
	1995	abstraction	8.64	…	…	…	…	…
	1999	abstraction	8.65	4.18	4.47	…	…	…
Jamaica[3]	1990	estimated use	913.00	…	…	159.00	72.00	682.00
	2000	estimated use	1,437.00	…	…	207.00	81.00	1,149.00
St. Lucia[4]	1990	production	2.40	0.52	1.88	…	…	…
	1995	production	2.58	0.46	2.12	…	…	…
	1998	production	2.91	0.91	2.00	…	…	…
St. Vincent & the Grenadines[5]	1990	abstraction	7.07	…	…	…	…	…
	1995	abstraction	7.37	…	…	…	…	…
	2000	abstraction	8.53	…	…	…	…	…

Source: National.

Key:
[1] New Providence only.
[2] About 95% fresh groundwater up to 1999, and 84% in 2000, when a desalination plant started operating.
[3] The figures for 2000 are a projection from 1990.
[4] Total production and consumption from the Water and Sewerage Company.
[5] All water abstracted is fresh surface water.

Data also available for:
Bahamas: 1991-1994, 1996-1997;
Barbados: 1991-1994, 1996-1999;
Belize: 1996-1998 (abstractions), 1997-1998 (supply);
Jamaica: 1999 (public supply only);
St. Lucia: 1982-1989, 1991-1994, 1996-1997;
St. Vincent & the Grenadines: 1992-1994, 1996-1999.

Comments

The figures provided are not easily comparable with each other. Total water abstraction is extremely difficult to estimate, since it will include abstraction of many types that are never measured, e.g., individual or private abstraction of water from rivers and wells, and from rainwater tanks. Therefore, it must be expected that the variables may cover different things, and that the estimation methods differ.

The figures relating to households translate to a daily water use of 37 litres per person in The Bahamas, and 214 litres in Jamaica.

WASTE WATER TREATMENT

Table 6.2. Waste water treatment

	Year	Public treatment plants						Independent plants			Effluent quality
		Number of									
		mechanical	biological	advanced	Total	Design capacity million l/ day	of which: used million l/ day	No.	Design capacity million l/ day	of which: used million l/ day	
Bahamas[1]	1990	-	1	-	1	2.3	1.1	7	2.6	1.7	…
	1995	1	3	-	4	18.3	14.4	7	2.6	1.7	…
	2000	1	4	-	5	18.7	15.8	7	2.6	1.7	…[2]
Jamaica[3]	1995	…	…	…	49	…	…	72	…	…	…
	1999	3	48	2	53	240.0[4]	…	…	…	…	…

Source: National.

Key: [1] No information is provided for treatment plants operated by water supply franchise areas.
[2] For 1998, the effluent quality data are reported: BOD 6.8 mg/l, COD 418 mg/l, TSS 2 mg/l, phosphates 1.9 mg/l, pH 7.3. All are annual averages and refer to the Fox Hill treatment plant.
[3] In Jamaica, the types of treatment are called primary, secondary and tertiary.
[4] The design capacity for the three types of plants is 18.0, 147.0 and 75.0 million l/day, respectively.

Data also available for The Bahamas: 1991-1994, 1996-1999.

Comments

A transition to higher capacity and more advanced treatment can be discerned. Both underutilisation and problems with down periods of the plants are reflected in the percentage of the design capacity that has been used.

It has not been possible to establish how large a proportion of the population is served by sewage treatment.

WATER QUALITY

Table 6.3. Water quality in rivers, lagoons and dams: annual averages of readings

Country, Site	Type	Readings: Years	Readings: no. per year	BOD	TDS	Phosphates	Nitrates	pH	Dissolved oxygen	Faecal colif.
Unit				mg O_2/l Min - Max	mg/l Min - Max	microgram/l Min - Max	microgram/l Min - Max	Min - Max	mg O_2/l Min - Max	no. per 100 ml Min - Max
Bahamas										
Winsor Pumping St.	...	1992-1997	52	...	1,464-2,162	...	nil - 0.3	...	...	87-100 %[1]
Blue Hill Pumping St.	...	1992-1997	52	...	900-1,614	...	nil - 0.3	...	...	96-100 %[1]
Belize										
N. Stann Creek Mouth	river	1997-2000	2 - 9	...	...	1.5 - 2.5	2.5 - 3.0	7.0 - 7.8	6.5 - 7.2	...
Belize River Mouth	river	1997-2000	2 - 9	...	...	1.2 - 2.5	4.2 - 8.2	7.6 - 8.5	4.9 - 7.2	...
Gales Point	lagoon	1997-2000	6 - 12	...	...	< 1.0 - 1.7	3.0 - 4.5	8.0 - 8.2	7.0 - 7.5	...
Fabers Lagoon Centre	lagoon	1997-2000	6 - 12	...	...	< 1.0	2.0 - 2.8	7.3 - 7.9	6.0 - 6.7	...
Jamaica										
Montego River #3	river	1997-2000	1 - 3	15 - 60	...	380 - 1,585	120 - 345	...	...	1,600 - 2,400
Rio Cobre, NIC Dam	river	1996-2000	2 - 4	0.5 - 2.4	...	104 - 350	550 - 1,140	...	...	...
St. Vincent & the Grenadines										
Vermont River	river	1990-2000	...	...	...	...	...	7.3 - 7.5	...	56 - 63
Hermitage River	river	1990-2000	...	...	...	...	...	7.3 - 7.6	...	55 - 70

Source: National.
Key: [1] per cent time absent on an annual basis.

Comments

Water quality data should be related to standard guidelines that should not be exceeded. There are various such standards, set by national, regional and international bodies and a combination of standards is reproduced in box 6.1 below.

Box 6.1. Standards for water quality

The following standards are compiled from WHO (drinking water), the National Irrigation Commission of Jamaica (irrigation) and the Jamaica National Ambient (Freshwater) Water Quality Standards (ambient[1]). The industrial use and recreation standards refer to a Canadian and a US standard. The units are mg/L except for pH and where otherwise stated.

Drinking water

Nitrate	< 44
Chloride	< 250
Sodium	< 200
TDS[2]	< 1000
Sulphate	< 400

Irrigation

Conductivity	< 3000 µS/cm

Industrial use

Hardness	< 300 mg$CaCO_3$/L

Recreation

Total coliform	< 2400 MPN/100ml

Ambient[1]

Calcium	< 101
Magnesium	< 27
Sodium	< 12
Chloride	< 20
Nitrate	0.1 - 7.5
Phosphate	0.01 - 0.80
pH	7.0 - 8.4
Potassium	< 5
Silica	< 39
Sulphate	< 10
Conductivity	150 - 600 µS/cm
Hardness	127 - 381 mg$CaCO_3$/L
TDS	120 - 300
BOD	< 1.7

[1] The (ambient) standard defines typical concentration/s of selected parameters in relatively unpolluted freshwater (ground and surface water) for Jamaica (water which is considered safe and generally suitable for all main uses and supportive of natural ecosystems). The standard, or rather level in this case, provides a typical/normal value and does not say what is an acceptable standard in contrast to, for example, the drinking water standard.

CHAPTER 7

COASTAL AND MARINE RESOURCES

OVERVIEW

The coastal and marine resources in the CARICOM region are of critical importance. As most of the Member States are either small-island or low-lying coastal states, the issues affecting them are similar in nature, though different in magnitude. Traditionally, the coastal zone has been considered as a band about fourteen miles wide inland from the land-water interface and extending no more than three miles sea-ward to the extent of the territorial sea. In the case of most of the insular CARICOM Member States, this so-called coastal zone encompasses the entire island, or a significant portion of the inhabited land area. Therefore, not only are the resources of this area of major importance to the Member States, but they also continue to be under threat from natural and anthropogenic activities. Within this context, a number of issues surface which are likely to have a significant impact, or be impacted upon, as a consequence of the status of coastal and marine resources of the region. These issues include, but are not limited to, climate change, tourism and biodiversity.

According to the Intergovernmental Panel on Climate Change (IPCC), climate change is expected to lead to changes in sea level, increasing it on average. In addition, it could lead to altered ocean circulation, vertical mixing, and wave climate. As a result, nutrient availability, biological productivity, the structure and functions of marine ecosystems, and heat and carbon storage capacity may be affected, with important feedbacks to the climate system (IPCC, 1996a). Low-lying island States are especially vulnerable to climate change and associated sea-level rise because, in many cases, much of the land area rarely exceeds three to four metres above present mean sea level. Some coastal ecosystems are particularly at risk, including mangrove ecosystems, coastal wetlands, sandy beaches and coral reefs (IPCC, 1996b). Changes in these ecosystems would have major negative effects on tourism, freshwater supplies, fisheries and biological diversity (*ibid*).

Tourism, covered in more detail in Chapter 5, has become one of the principal industries in the CARICOM region and is the fastest growing economic sector. Poor planning of tourist activities and the facilities they require, such as hotels, marinas, airports, major roads, restaurants, etc., can cause serious problems in coastal and marine ecosystems. This occurs specifically through destabilizing the coastal belt, eroding beaches, interrupting currents and natural drainage, producing contamination through inadequate waste disposal and degrading water quality.

Biodiversity conservation, in particular in small states like those in the CARICOM region, helps reduce vulnerability to natural disasters, providing a wide gene pool from which to re-colonize damaged coastal and marine areas. There are many threats to coastal and marine biodiversity, ranging from land-based sources of pollution to unsustainable fishing practices, aquaculture and natural disasters. Biodiversity issues are described in more detail in Chapter 10.

In the following, selected environmental issues regarding coastal and marine resources are described. These include:

- marine water quality
- beaches and coastlines
- marine protected areas

- coral reefs, sea grass beds and mangroves
- capture fisheries
- aquaculture production.

Marine water quality has a great impact, not only on aquatic life, but also on humans. Marine animals survive in a certain environment, and any kind of change in water quality, e.g., pollution, may affect their lives significantly. Marine transportation, coastal activities and discharges of wastes from municipal and industrial areas contribute to the deterioration of the quality of marine water and the degradation of aquatic animals and plants. Oil pollution from ships and oil tankers can be dangerous to aquatic life as it prevents oxygen from entering into marine water. Communities inhabiting coastal areas depend almost entirely on fish products, which also represent a great source of income. Those countries that export large amounts of fish products may be affected by marine water pollution.

The most common variables needed to monitor marine water quality include BOD, COD, pH and temperature, but no regional data source could be identified. The UNEP-Caribbean Regional Coordinating Unit in Jamaica did, however, publish a report in 1994, entitled: "Regional Overview of Land-Based Sources of Pollution in the Wider Caribbean Region." It contains relevant data for pressures of various kinds on the coastal waters, such as population and industries in coastal areas, sewage, sediments and waste loads from households and industries being discharged into coastal waters. However, none of the data from this study are included in this publication, mainly because follow-up data from recent years have not been available.

The *beach* serves as a buffer zone between the land and the water and is usually made up of unconsolidated sediments, such as sand, stones, coral rubble, and boulders. Beaches are dynamic environments, constantly changing as a result of natural processes, including storms, hurricanes, tidal changes and sea level rise. They also change as a result of human action. Removing sand from the beach for construction, vegetation clearance, and building of seawalls are major problems in many of the Member States. Animals occupying this environment have adapted to the constant motion of the sand, gravel, or shell. Many important animals such as sea turtles use beaches in the region to dig their nests and deposit their eggs. The beach also provides a habitat for a multitude of burrowing species, such as crabs, clams, and other invertebrates.

Data on beach erosion are not available for the CARICOM region. Data on the length of coastlines are the closest possible data available and are included in table 7.4 compiled by the UNEP-World Conservation Monitoring Centre (WCMC).

Marine protected areas (MPAs) are used as management tools to protect, maintain, or restore natural and cultural resources in coastal and marine waters. New MPAs are designated worldwide every year, and it is becoming more and more difficult to make a current analysis of the coverage offered by MPAs. Nevertheless, inventories are necessary for effective planning, and regional MPA databases are becoming more common. MPAs have different shapes, sizes, and management characteristics, and have been established for different purposes.

In the CARICOM region a significant number of the MPAs, particularly in the insular states, have been established as fisheries management tools, with the recognition of their utility as tourism attractions. MPAs are often unique ecosystems that make them attractive to tourists, for scuba diving, sight seeing and other activities. Without proper management, however, tourists can quickly degrade the very resources that they have travelled to see. Although there are an increasing number of MPAs in the CARICOM region, the amount of tourists visiting the region is also growing; hence the carrying capacities of the existing MPAs may be soon exceeded by the numbers of tourists utilizing them.

Coral reefs are among the most important coastal resources in the CARICOM region in terms of providing food, habitats and nursery areas for numerous fishes and other aquatic animals. Coral reefs protect coastal areas from erosion and storms by creating natural breakwaters. They exist in clear and warm waters, tropical coastlines, and areas where salinity is persistent. Their natural aesthetics attract tourists, primarily divers and snorkelers, closely linking tourism to the economy of the region. Because they survive only in clean water and constant salinity, there is a large impact of water pollution on coral reefs.

Sea grass beds are of considerable importance as a basis for fishery production, as a food source for aquatic animals such as fishes, turtles and sea urchins, and for coastal stabilization. They also provide a habitat and shelter for the young of many commercially important species, such as lobsters, snappers and conchs. Sea grass beds are also extremely important elements in coastal waters because of their ability to filter pollutants. Loss of these habitats not only decreases biodiversity, but also the ability of a coastal system to absorb pollutants from human activities, such as farming, aquaculture, sewage effluent, urban runoff and oil spills.

Mangroves are found along tropical and subtropical coastal areas. They protect beaches from erosion by breaking storm waves and absorbing the impact of tidal currents. Mangroves, along with sea grass beds, are important elements in coastal waters because of their ability to filter pollutants. They also provide a feeding ground to many fishes, nursery grounds for the young of commercially important fish species and habitat for various fishes and birds. In addition, they are economically important in terms of providing wood for commercial use. Water pollution and logging are significant problems and contribute to the degradation of the environment and the depletion of mangroves. Other factors contributing to the decline in wetlands in general include deforestation, charcoal production, construction, land reclamation, garbage dumping and other forms of pollution.

The products of marine and freshwater -- *capture fisheries* -- are of growing importance as a source of protein for humankind. In addition, they are used increasingly in animal feed, fertilizers and industrial chemicals. During recent years, a continuous increase in the level of global fish catches has raised serious concern as many of the more valuable fish stocks are being over-fished. In the small states of the CARICOM region where population and economic development are concentrated in the coastal zone, the over-exploitation of fish is becoming an increasing threat to the marine fish stocks. In addition, indiscriminate fishing practices often aggravate the problem by catching fish species (or sizes) that are not necessarily intended to be caught.

Aquaculture is the farming of aquatic organisms, including fish, molluscs, crustaceans and aquatic plants. Farming implies some form of intervention in the rearing process to enhance production, such as regular stocking, feeding, protection from predators, etc. Farming also implies individual or corporate ownership of the stock being cultivated. One of the environmental problems associated with aquaculture is that of eutrophication.

Based on data availability, the statistical variables that describe MPAs, coral reefs, sea grass beds and mangroves, capture fisheries production, and aquaculture in the CARICOM region are presented in the following pages.

MARINE PROTECTED AREAS

Table 7.1. Total and protected marine area (sq. km)

	Total	Protected			
		1970	1980	1990	2000
Bahamas	245,065	1,217	1,217	1,225	1,225
Barbados	48,800	…	…	…	4
Belize	236,544	-	-	…	2,469
Grenada[1]	…	-	-	-	…
Jamaica	…	-	-	-	1,815[2]
St. Vincent & the Grenadines	27,500	…	…	97	97

Source: National.
Key: [1] Two areas were established in 1999.
[2] The area given covers only marine parks and areas protected under the Natural Resources Conservation Authority (NRCA) Act.

In addition, there are areas with several other types of protection (data not available).

Comments

The national data on marine protected areas in table 7.1 are similar to those in table 7.2 below, possibly with some recent additions. Discrepancies are due to the varying legal status of MPAs, cf. note 2 in the table (referring to Jamaica), which makes it difficult to define precisely which areas should be included.

Definitions and data origin

The most commonly referred to definition of MPAs is that of the World Conservation Union's (IUCN) Marine Program (BC Parks, 1997), which defines a **MPA** as: "an area of intertidal or subtidal terrain, together with its overlying waters and associated flora, fauna, historical and cultural features which have been reserved by legislation to protect part or all of the enclosed environments" (BC Parks, 1997).

IUCN has defined the following six protected area management categories that are also described in Chapter 10 on Biodiversity:

Category Ia: Strict Nature Reserve;
Category Ib: Wilderness area;
Category II: National Park;
Category III: Natural Monument;
Category IV: Habitat/Species Management Area;
Category V: Protected Landscape/Seascape;
Category VI: Managed Resource Protected Area.

From the coastal and marine resources point of view, these categories cover national marine sanctuaries, fisheries management zones, national seashores, national parks, national monuments, critical habitats, national wildlife refuges and national estuarine research reserves.

The data in table 7.2 were obtained from the Caribbean Marine Protected Area Managers (CAMPAM) Database that contains information on MPAs in the Caribbean. CAMPAM is hosted on the website of UNEP's Caribbean Regional Coordinating Unit located in Jamaica.

Table 7.2. Marine protected areas

	IUCN Management Category	Name of Protected Area	Area (hectares)	Established
Antigua & Barbuda		Cades Reef (proposed)	...	...
		Crump Island Coral Reef Marine Park (proposed)	...	...
	II	Diamond Reef Marine Reserve	2,000	1973
	IV	Guana Island to North Bird Island Reef	600	...
	II	Nelsons Dockyard National Park	4,128	1984
	II	Palaster Reef Marine Park	500	1973
Bahamas	IV	Andros Barrier Reef (proposed)	...	...
		Bimini Chain Reef (proposed)	...	...
	IV	Black Sand Cay Reserve	1	1988
		Colonial Beach (proposed)	...	...
	II	Conception Island Land-and-Sea Park	809	1973
		Corrie Sound (proposed)	...	...
		Elizabeth Harbour (proposed)	...	...
	II	Exuma Cays Land and Sea Park	45,620	1958
	II	Inagua National Park	74,333	1965
	II	Lucayan National Park	16	1982
	II	Pelican Cays Land-and-Sea Park	850	1981
	II	Peterson Cay National Park	1	1971
	IV	Union Creek Reserve	1,813	1965
Barbados	IV	Folkestone Marine Park	...	...
		Northeast Coast Marine Park (proposed)	5,000	...
Belize	II	Bacalar Chico Marine Reserve	6,300	1996
		Caye Caulker Marine Reserve	3,900	1998
		Gladden Split / Silk Caye Marine Reserve	10,400	2000
	IV	Glovers Reef Marine Reserve	32,900	1993
	IV	Hol Chan Marine Reserve	1,100	1987
	IV	Port Honduras Marine Reserve	40,900	2000
	IV	Sapodilla Cayes Marine Reserve	13,500	1996
	IV	South Water Caye Marine Reserve	31,700	1996
Dominica	II	Cabrits National Park	531	1987
		Soufriere - Scotts Head Marine Reserve	...	...
Grenada		Bianca C. Wreck (proposed)	...	...
		Calivigny Island Protected Seascape (proposed)	5	...
		La Sagesse Protected Seascape (proposed)	5	...
		Lauriston Point, Sandy Island and Mabouya (proposed)	236	...
		Levera National Park (proposed)	222	...
		Lilmair - Thibaud Protected Seascape (proposed)	6	...
		Molinere Reef (proposed)	265	...
		Northern Seascape (proposed)	148	...
		Sabazan Protected Seascape	2	...
		Southern Seascape (proposed)	39	...
		Tyrrel Bay Mangrove (proposed)	113	...
		White Is. and Saline Is. Coral Reefs (proposed)	390	...
Jamaica		Bogue Lagoon Fish Sanctuary	...	1979
		Discovery Bay Marine Park (proposed)	...	...
	II	Montego Bay Marine Park	15,300	1992
		Morant Cays Managed Area	...	...
		Negril (proposed)	...	...
		Negril Bay/Bloody Bay - Hanover Fisheries Sanctuary (proposed)	...	...
		Ocho Rios [Marine Park or Underwater Park]	...	1966
		Palisadoes - Port Royal Cays (proposed)	100	...
		Pedro Bank and Cays Managed Area	...	...
		Port Antonio Marine Park	...	...
		Priory Marine Park (proposed)	...	...
		San San/Blue Lagoon Marine Park (proposed)	...	...
		South Coast Marine Park and Protected Area	...	...
		Unity Hall Marine Park (proposed)	...	...
Montserrat		Foxs Bay Bird Sanctuary	6	1979

Table 7.2. Marine protected areas cont'd

	IUCN Management Category	Name of Protected Area	Area (hectares)	Established
St. Lucia		Anse Cochon Artificial Reef Marine Reserve (Wreck of the Lesleen M.)	...	...
		Anse Galet-Anse Cochon Reefs Marine Reserve	...	1990
		Anse Pointe Sable-Man Kote Mangroves Marine Reserve	...	1986
		Bois D'Orange Mangroves Marine Reserve	...	1986
		Caesar Point to Mathurin Point Reefs Marine Reserve	...	...
		Cas-en-Bas Mangroves Marine Reserve	...	1986
		Choc Bay Mangroves Marine Reserve	...	1986
		Esperance Harbour Mangroves Marine Reserve	...	...
		Fond D'Or Beach Marine Reserve	...	1986
		Grand Anse Beach and Mangrove Marine Reserve	...	1986
		Louvet Mangroves Marine Reserve	...	1986
		Maria Islands Wildlife Reserve	...	...
		Marigot Bay Mangroves Marine Reserve	...	1986
		Marquis Mangroves Marine Reserve	...	1986
		Moule-a-Chique Artificial Reef Marine Reserve	...	1990
		Pigeon Island National Park	...	...
		Praslin Mangroves Marine Reserve	...	1986
		Rodney Bay Artificial Reefs Marine Reserve	...	1986
		Savannes Bay Mangrove Area Marine Reserve	500	1986
		Soufriere Marine Management Area	11*	1995
		Vigie Beach Artificial Reef Marine Reserve	...	...
St. Vincent & the Grenadines		Tobago Cays Marine Reserve	3,885	1986
Suriname	IV	Bigi Pan Management Area	68,000	1987
	I	Coppenamemonding Nature Reserve	12,000	1961
	I	Galibi Nature Reserve	4,000	1969
	I	Wia-wia Nature Reserve	36,000	1961
Trinidad & Tobago	IV	Buccoo Reef Park Nature Reserve	650	1973
		Caroni Swamp Wildlife Reserve	...	...
		Kronstadt Islands Wildlife Sanctuary	...	...
		Little Tobago Wildlife Sanctuary	...	...
		Saut d'Eau Wildlife Sanctuary	...	...
		Soldado Rock Wildlife Sanctuary	...	...
		Southern Watershed Wildlife Sanctuary	...	...
		St. Giles Island Wildlife Sanctuary	...	...

Source: United Nations Environment Programme - Caribbean Regional Coordinating Unit, Jamaica.
Key: * 11 km of coastline.

Comments

The data show that most of the MPAs in the region fall into either category II or category IV. This suggests a recognition in the region of the need to protect natural heritage for future generations, and the capacity of MPAs to serve as resource management tools. It should be noted, however, that in the table only available information for the MPAs is included, and some of the data need to be updated. It should also be mentioned that in a number of CARICOM Member States, MPAs have not been demarcated; neither has their actual role or function been determined. Therefore, it is not possible to either place them in an IUCN Management Category, or to determine the area of the MPA.

In positing an example of the value which can be ascribed to MPAs, it is worthy of note that Ruitenbeek and Cartier (2000) have suggested that for the Nelson's Dockyard Marine Park in Antigua & Barbuda, local natural values of mangrove, beach and shoreline, and coral reef and marine areas are on the order of EC$ 1.2 million per year, EC$12.9 million per year and EC$6.6 million per year, respectively. For St. Vincent & the Grenadines and St. Lucia, overall, the direct use benefits suggest biodiversity values of MPAs of EC$79 million per year and EC$13 million per year, respectively.

CORAL REEFS, SEA GRASS BEDS AND MANGROVES

Table 7.3. Mangroves, sea grass beds and coral reefs (sq. km)

	Mangroves				Sea grass beds	Living coral reefs
	1989	1992	1995	1998	1997	2000
Barbados	…	…	…	0.1[1]	0.2[1]	37.5
Belize	…	312.5	…	…	4,209.0	…
Grenada	…	…	2.3	…	…	…
Guyana	…	…	…	804.0[1]	…	…
Jamaica	97.5	…	…	97.3	…	…
St. Lucia[2]	1.1[2]	…	…	1.0[3]	…	…
St. Vincent & the Grenadines	0.5	…	…	…	…	…

Source: National.
Key: [1] In 2000.
[2] In 1985.
[3] In 1997.

Comments

Mangrove data from Belize and Jamaica were calculated in the course of a general land use mapping, where mangroves were defined as one of the several types of forest. In Guyana, the mangroves are also managed as a part of the forests. In Grenada and St. Vincent & the Grenadines, the data refer to one-time studies. Definitions may vary between the countries.

Definitions and data origin

The data in table 7.4 on coastlines, mangroves, sea grass beds and coral reefs are compiled by UNEP-WCMC. A coastline does not have a finite length, and the magnitude of any estimate of its length will depend heavily on the scale and projection of the map from which it is derived. In several cases, more than one estimate is provided for the area of mangrove vegetation, in order to reflect existing uncertainties. The data on sea grass beds are primarily derived from the standard taxonomic monograph on sea grasses and relate to distribution records for specimens of species.

Table 7.4. Coastlines, mangroves, sea grass beds and coral reefs

	Coastlines (km)	Mangroves (km^2)	Seagrass (species)	Coral reefs
Antigua & Barbuda	153	12 / 15	2[1]	There is an estimated 25 km^2 of reef, mostly fringing.
Bahamas	3,542	1,420 / 2,332	1[1]	There are extensive reef areas. An estimated 1,832 km^2 of Great Bahama Bank and 324 km^2 of Little Bahama Bank are covered in reef. The reefs fringe most of the windward northern and eastern coasts and the bank edges.
Belize	386	730 / 783	…[1]	There is an almost continuous barrier reef 257 km long, the largest in the Western Hemisphere. Three atolls also occur.
Dominica	148	0.1	2[1]	There is only limited reef development, mainly on the west coast and the northern side of promontories.
Grenada	121	1.16	1	Reefs occur patchily around all coasts of Grenada except the west. Carriacou has a large bank barrier reef complex on its windward side.
Guyana	459	800 / 1,500	…[1]	…
Haiti	1,771	180	3[1]	Reefs are very little known, but there appear to be seven major areas of development. One is a barrier reef along the north coast.
Jamaica	1,022	106 / 202	4[1]	The north coast has almost continuous narrow fringing reefs; the south has less continuous reefs but a greater variety.
Montserrat	49	0.04	…[1]	Small scattered patches of reef are present on all but the windward coast.
St. Kitts & Nevis	…	0.2 / 0.79	…[1]	Bank barrier reefs with associated fringe or bench reefs occur along much of the coast of both islands.
St. Lucia	156	1.57 / 1.79	…[1]	Reefs are widespread but are generally small and not well-developed.
St. Vincent & the Grenadines[2]	91	0.5	2[1]	The southern, south-eatern and western coasts have several small fringing reefs.
Suriname	386	1,150	…	…
Trinidad & Tobago	362	76 / 90	2[1]	Trinidad has only small patches of coral, with the greatest development along the north coast; Tobago has more important but still not extensive reefs.

Source: United Nations Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC).
Key: [1] Pasture-forming species are present.
[2] Estimate for St. Vincent only.

Comments

As can be seen from table 7.4, many of the data are estimates; in the case of mangroves, two estimates are often provided because of existing uncertainties within the data. It must also be emphasized that data on sea grass beds are known to be incomplete, as information on sea grass beds is sparse. Inventories are costly and not carried out with enough frequency to allow for the interpretation of trends.

Data are also available on coral reefs from the Caribbean Coastal Marine Productivity Program (CARICOMP) website but could not be easily summarised for inclusion in this publication. Raw data, however, from Calabash Cay off Belize are available at the website. These data suggest that at least 28 different species of hard and soft coral can be found in the two transects studied at the site. Data on mangroves obtained from the CARICOMP website also could not be easily summarised for inclusion in this publication, but data from selected sites in the Bahamas, Barbados and Belize are available at the website. The sea grass biomass data, available on the CARICOMP website, show wide variability among months and years for the different sites, with standard deviations on the order of magnitude of 6 per cent to 71 per cent of the estimated mean biomasses.

Data on coral reefs, sea grass beds and mangroves may also be available from the Caribbean Planning for Adaptation to Global Climate Change (CPACC) project, as part of its Coral Reef Monitoring for Climate Change Impact component.

Definitions and data origin

The data on mangroves in table 7.5 were compiled by OECS from a variety of sources from the region.

Table 7.5. Mangroves

	Mangrove area km^2	Type(s) of mangrove
Antigua & Barbuda	36 known sites	Red, black, white, buttonwood
Belize	312.6	Dwarf, medium and tall
Grenada	0.9	…
Jamaica	97.3	…
St. Lucia	1.8	Red, white, black (2 species), buttonwood
St. Vincent & the Grenadines	0.5	…

***Source**:* Organisation of Eastern Caribbean States (OECS).

CAPTURE FISHERIES PRODUCTION

Table 7.6. Fish landings (metric tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Bahamas[1]	3,507	4,038	4,287	4,641	4,476	4,312	4,603	5,188	5,078	4,952	3,199
Barbados[2]	2,627	1,853	3,002	3,777	2,175	2,172	2,451	1,945	2,647	3,794	3,618
Belize[3]	…	…	…	651	654	762	869	884	660	666	615
Grenada	1,776	1,982	2,046	2,098	1,630	1,485	1,274	1,511	1,846	1,797	1,682
Jamaica[4]	…	…	…	…	…	10,769	14,496	7,747	6,045	7,984	…
St. Lucia	573	495	968	1,114	883	983	1,316	1,312	1,462	…	…
St. Vincent & the Grenadines[5]	469	418	306	351	383	774	605	833	944	747	…

***Source**:* National.

Key:
[1] The data only cover Nassau grouper, Caribbean spiny lobster and stromboid conchs.
[2] The data only cover flying fish, dolphin and king fish, which normally make up 70-80% of the landings.
[3] The data refer to fish production. Between 60% and 80% consists of lobster and conch.
[4] In 1997, 58% of the catch was coral reef finfish, and 28% crustaceans. It is estimated that 134,000 boatdays were used in 1996.
[5] 25-38% of the catch is mackerel scad and jacks.

Comments

The year-to-year variations are fairly large, which is normal for fisheries everywhere. The data from The Bahamas (referring to certain species only), St. Lucia and St. Vincent & the Grenadines show an increasing trend over the period 1990-1999/2000. Belize and Grenada have a stable pattern, with some decline for Grenada in the middle of the period.

The data on fish landings from Grenada and Jamaica are quite close to the data of the Food and Agriculture Organization of the United Nations (FAO) on fish catches, with a 5 per cent difference at most. The FAO data on fish catches and the national data on fish landings for Belize and St. Vincent & the Grenadines show enormous discrepancies, not only in size, but also in fluctuation patterns. These discrepancies are mostly explained by the fact that FAO includes catches from all ships under the flag of a country, wherever the catch is landed, while the national data refer to landings in the home country, or, in the case of Belize, to production. Both the national figures and the FAO figures have obvious relevance; the national data are of importance, e.g., for the country's economy and nutrition, and indicate the stress on the fish resources in nearby waters, while the FAO data are important in a global perspective.

Definitions and data origin

The data in table 7.7 are compiled by FAO and cover, as far as possible, both marine and inland fisheries. The data are expressed in terms of live weight, that is the nominal weight of the aquatic organisms at the time of capture. The data relate to the nominal catch of fish, crustaceans and molluscs but exclude seaweed and aquatic mammals, such as whales and dolphins. The harvest from mariculture, aquaculture and other kinds of fish farming is excluded. Data include landings by domestic craft in foreign ports and exclude the landings by foreign craft in domestic ports. The flag of the fishing vessel is used to assign nationality to catches, unless the wording of chartering and joint operation contracts indicates otherwise.

Fish, crustaceans, molluscs and all other aquatic organisms included in the FAO database have been classified according to approximately 1,200 commercial species items, further arranged within the 50 groups of species constituting the nine divisions of the FAO International Standard Statistical Classification of Aquatic Animals and Plants (ISSCAAP).

Table 7.7. Capture fisheries production (metric tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Antigua & Barbuda	885	1,498	1,712	582	629	1,429	2,798	3,372	2,876	3,185
Bahamas	7,498	9,199	9,846	10,073	9,703	9,557	9,866	10,439	10,124	10,473
Barbados	2,967	2,221	3,523	3,123	2,736	3,539	3,444	2,753	3,594	3,206
Belize	1,414	1,481	1,895	2,239	1,333	1,716	977	10,444	17,164	39,940
Dominica	458	552	711	794	882	950	1,030	1,079	1,212	1,200[1]
Grenada	1,778	1,983	2,052	2,103	1,634	1,487	1,278	1,408	1,712	1,631
Guyana	36,872	40,741	41,252	44,123	46,367	47,900[1]	48,583	53,998	52,840	53,844
Haiti	5,150[1]	5,200[1]	5,000[1]	5,150[1]	5,500[1]	5,517[1]	5,245[1]	5,301[1]	5,259[1]	5,000[1]
Jamaica	8,450	8,750[1]	9,350[1]	10,000[1]	10,327[1]	10,367[1]	12,504[1]	8,198	6,560	8,508
Montserrat	15	32	23	58	62	48	38	45	46	50[1]
St. Kitts & Nevis	620[1]	450[1]	300[1]	250[1]	212	192	352	216	407	352
St. Lucia	931	990	1,073	1,336	1,252	1,188	1,274	1,311	1,314	1,718
St. Vincent & the Grenadines	10,179	9,548	2,309	2,038	1,090	1,015	921[1]	6,092[1]	33,891	15,573
Suriname	6,500[1]	7,358	10,930	9,500	14,465	13,000[1]	13,150[1]	13,000[1]	12,960[1]	12,960[1]
Trinidad & Tobago	8,574	12,661	15,548	11,033	14,296	13,000[1]	14,360	15,000	14,500[1]	15,000[1]

Source: Food and Agriculture Organization of the United Nations (FAO).
Key: [1] FAO estimates.

Comments

Fishing in the CARICOM Member States is carried out on a large scale mainly by Guyanese vessels. In most of the other nations, the fishermen mainly use small open boats with outboard motors; consequently, a significant proportion of the fishing is done in the nearshore zones. Although the fishermen are organized, it may be difficult to measure all the catches. Apart from Guyana, the largest catches are landed by vessels from Trinidad & Tobago, Suriname, The Bahamas and Jamaica. The large increases registered for Belize and St. Vincent & the Grenadines are due to vessels registered in these countries but mainly active in other waters.

Other nations also fish in the Caribbean Sea and nearby Atlantic waters; therefore, the total pressures on the fish stock cannot be judged from the CARICOM data only. It seems to be a general opinion, however, that the Caribbean is over-fished, and that returns on fishing efforts are diminishing.

AQUACULTURE PRODUCTION

Definitions and data origin

The data in table 7.8 are compiled by FAO and refer to the production of fish, crustaceans and molluscs. The data are expressed in live weight, that is the nominal weight of the aquatic organisms at the time of capture. The harvest of aquatic plants is excluded from these data. For FAO statistical purposes, aquatic organisms, which are harvested by an individual or corporate body which has owned them throughout their rearing period, contribute to aquaculture; aquatic organisms, which are exploitable by the public as a common property resource, with or without appropriate licenses, are the harvest of fisheries.

Fish, crustaceans, molluscs and all other aquatic organisms included in the database have been classified according to approximately 350 commercial species items, further arranged within the 50 groups of species constituting the nine divisions of the FAO ISSCAAP.

Table 7.8. Aquaculture production (metric tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Bahamas	49	6	10	8	4	24	1	1[1]	1[1]	1[1]
Belize	99	158	301[1]	602[1]	656	950	1,004	1,397	1,642	3,163
Dominica	-	-	6	3[1]	3	4	4[1]	5[1]	5[1]	5[1]
Grenada	-	-	-	-	-	0	0	0	0	1
Guyana	50[1]	65[1]	85[1]	140[1]	210[1]	230[1]	250[1]	270[1]	300[1]	606
Jamaica	3,404	3,140	3,240	3,340	3,440	3,500	3,450	3,410	4,150	4,150
St. Kitts & Nevis	...	3[1]	3[1]	3[1]	4[1]	4[1]	4[1]	4[1]	4[1]	5
St. Lucia	0	0	1	2	1	1	2	3	2	1
Suriname	0	0	3[1]	3[1]	1	1[1]	1[1]	1[1]	106	106[1]
Trinidad & Tobago	2	9	9	10[1]	11[1]	24[1]	24[1]	25[1]	27[1]	27[1]

Source: Food and Agriculture Organization of the United Nations (FAO).
Key: [1] FAO estimates.

Comments

Aquaculture consists mainly of freshwater cultivation of tilapia in Jamaica, and of rapidly growing shrimp farming in coastal waters of Belize. Both tilapia and shrimps are cultivated in Guyana. In Belize there has been a dramatic increase in production from 99 tons in 1990, to 3,163 tons in 1999; for Jamaica and Guyana, there has been a gradual increase in production. In the smaller countries, aquaculture production has been less probably as a consequence of relatively limited water resources.

CHAPTER 8

LAND USE AND AGRICULTURE

OVERVIEW

The small size of most CARICOM Member States, coupled with their special land tenure systems, soil types, relief and climatic variation, limit the area available for urban settlement, agriculture, mining, commercial forestry, tourism and other infrastructure, and create intense competition between land-use choices. The major long-term land management issue in most of the Member States is the degradation of the limited land area because of a variety of factors, including overuse caused by high population pressure on a limited resource base; deforestation due to unsustainable commercial logging; and episodic events, such as fire and other natural disasters.

The restructuring of the natural environment through *land use* changes has major consequences for soil resources, wildlife diversity, landscapes and the quality of air and water. Land use changes are the effect of growing populations and changing economic activities. Forest land is cleared for agriculture, roads and other infrastructure or settlements, and fertile agricultural land may be converted irreversibly to built-up land. Changes that cut across major land use categories, such as the change from forest land to agricultural or grazing pursuits, are generally more environmentally significant than changes within the same land use category, such as those from crop land to pasture land.

In order to produce crop yields that satisfy human needs and to maintain soil fertility, nutrients are added to the soil in farming. The main sources of added soil nutrients are commercial *fertilizers* and animal manure. The major nutrients in these inputs are nitrogen (N), phosphorous (P) and potassium (K). Not all fertilizers applied will be used by the crops and some, for example, may be carried off by rainwater. Extensive fertilizer use may cause eutrophication of water bodies, soil acidification and potential contamination of sources of water supply with nitrates. The actual environmental impact will depend on the amounts applied, on the soil and plant types and on meteorological conditions.

Pesticides are often used to avoid harvest loss due to damage caused by fungi, plants or animals. The use of pesticides in agriculture adds chemicals to ecosystems that have different environmental impacts. Some add persistent organic chemicals that can take decades or even centuries to break down naturally. They tend to accumulate in the soil and biota, and residues may reach surface and ground waters through leaching. Humans can be exposed to pesticides through the food chain. Pesticides are used routinely on large plantations, but not always on smaller farms.

The statistics presented in this chapter describe the main characteristics of land use, as well as the use of fertilizers and pesticides.

LAND USE

Table 8.1. Land use (km^2)

	Year	Agricultural land	Forests	Built-up land	Wet open land	Other (incl. Inland waters)	Total area
Barbados	1989	189	1	15	…	…	432
Belize	1990	2,168	17,200	84	…	3,514[1]	22,966
Grenada	1995	26	41	…	…	…	340
Guyana	2000	…[2]	168,788	…	…	…	214,970
Jamaica	1989	4,150	3,439	531	109	2,761[3]	10,990
	1999	4,026	3,402	572	109	2,881[3]	10,990
St. Lucia	1996	336[4]	201	56	…	17	622
St. Vincent & the Grenadines	1990	105	15	…	…	…	390
	2000	65	7	…	…	…	390

Source: National.
Key: [1] Including Range land 1,922 km^2, Unproductive land 399 km^2 and Cayes and Not defined 1,194 km^2.
[2] Guyana reports 400 km^2 under sugar cane and 727 km^2 under paddy.
[3] Classified as Mixed land use/cover (major part), Cays and Inland waters.
[4] Including mixed farmland (forest intensive).

Data also available for St. Vincent & the Grenadines: 1990.

Definitions and data origin

Table 8.2 presents total area data from four sources: UNSD, CARICOM, UNEP-WCMC and FAO, as well as land area data from FAO. Data included in tables 8.3 and 8.4 are compiled by FAO.

UNSD defines the **total area** as the total surface area of the country. It comprises land area and inland waters (assumed to consist of major rivers and lakes) and excludes uninhabited islands. **Land area** is the total area, excluding area under inland water bodies.

FAO defines **arable land** as land under temporary crops (double-cropped areas are counted only once); temporary meadows for mowing or pasture; land under market and kitchen gardens; and land temporarily fallow (less than five years). Abandoned land resulting from shifting cultivation is not included in this category. Data for "arable land" are not meant to indicate the amount of land that is potentially cultivable.

FAO defines **land under permanent crops** as land cultivated with crops that occupy the land for long periods and need not be replanted after each harvest, such as cocoa, coffee and rubber. This category includes land under flowering shrubs, fruit trees, nut trees and vines, but excludes land under trees grown for wood or timber.

For the definition of **forest** in table 8.3, see Chapter 9 on Forests. **Other** refers to the difference between the sub-categories and the total land area.

When FAO cannot obtain data from the countries, the areas are estimated. These estimates are sometimes difficult to make, and the precision in these data may be lower. Such data are marked by footnotes in table 8.4 and should be noted when referring to table 8.3.

Table 8.2. Total area of CARICOM Member States (km^2)

	UNSD	CARICOM	UNEP-WCMC	FAO	FAO (land area only)
Antigua & Barbuda	442	442	442	440	440
Bahamas	13,878	13,864	13,865	13,880	10,010
Barbados	430	431	430	430	430
Belize	22,966	22,966	22,965	22,960	22,800
Dominica	751	750	751	750	750
Grenada	344	345	345	340	340
Guyana	214,969	214,970	214,970	214,970	196,850
Haiti	27,750	27,750	27,750	27,750	27,560
Jamaica	10,990	10,991	11,425	10,990	10,830
Montserrat	102	103	104	100	100
St. Kitts & Nevis	261	269	261	360[1]	360[1]
St. Lucia	622	616	619	620	610
St. Vincent & the Grenadines	388	389	389	390	390
Suriname	163,820	163,820	163,820	163,270	156,000
Trinidad & Tobago	5,130	5,128	5,130	5,130	5,130

Key: [1] Includes Anguilla.

Comments

The data in table 8.2 illustrate the slight variations in total area for the countries according to the data source. The variations can be linked to differences in, *inter alia*, definitions of total area, geographical boundaries and scales used for land measurements. The data from the various sources are included in this publication, since other indicators, such as those on protected area as a percentage of land area, and forest area as a percentage of land area, are compiled by UNEP-WCMC and FAO, respectively, using their figures for total area and land area.

Table 8.3. Land use in 1990 and 2000 (km^2)

	1990	Land Use (1990)			Land Use (1999/2000)[1]		
	Total land	Arable land and permanent crops	Forest	Other[2]	Arable land and permanent crops	Forest	Other[2]
Antigua & Barbuda	440	80[3]	90	270	80[3]	90	270
Bahamas	10,010	100	8,420	1,490	100	8,420	1,490
Barbados	430	170	20	240	170	20	240
Belize	22,800	680	17,040	5,080	890	13,480	8,430
Dominica	750	160	500	90	150	460	140
Grenada	340	120	50	170	100	50	190
Guyana	196,850	4,950	173,650	18,250	4,960	168,790	23,100
Haiti	27,560	9,000	1,580	16,930	9,100	880	18,372
Jamaica	10,830	2,190	3,790	4,850	2,740	3,250	4,840
Montserrat	100	20[3]	30	50	20[3]	30	50
St. Kitts & Nevis	360	100	40	220	80	40	240
St. Lucia	610	180	140	290	170	90	350
St. Vincent & the Grenadines	390	110	70	210	110	60	220
Suriname	156,000	680	141,130	14,190	680	141,130	14,190
Trinidad & Tobago	5,130	1,200	2,810	1,120	1,220	2,590	1,320

Source: Food and Agriculture Organization of the United Nations (FAO).
Key: [1] Arable land and permanent crops data are for 1999. Forest land data are for 2000.
[2] Includes built-up land and some other categories, such as wetlands, bare rocks, mixed-land cover etc.
[3] Arable land only.

Table 8.4. Agricultural land use (km^2)

	Land use (1980)		Land use (1985)		Land use (1990)		Land use (1995)		Land use (1999)		Net change (1980-1999)	
	Arable land	Permanent crops	Arable land	Permanent crops	Arable land	Permanent crops	Arable land	Permanent crops	Arable land	Permanent crops	Arable land	Permanent crops
Antigua & Barbuda	80[1]	…	80[1]	…	80[1]	…	80[1]	…	80[1]	…	0	…
Bahamas	70[1]	20[1]	80[1]	20[1]	80[1]	20[1]	60	40	60	40	-10	20
Barbados	160[1]	10[1]	160[1]	10[1]	160[1]	10[1]	160[1]	10[1]	160[1]	10[1]	0	0
Belize	450	70	430	100	500[1]	180[1]	600[1]	250[1]	640[1]	250[1]	190	180
Dominica	70[2]	100[2]	60[1]	110[1]	50[1]	110[1]	30	120	30[1]	120[1]	-40	20
Grenada	30[1]	120[1]	30[1]	100[1]	20[1]	100[1]	20[1]	90[1]	10[1]	100[1]	-20	-20
Guyana	4,800	150[1]	4,800[1]	150[1]	4,800[1]	150[1]	4,800[1]	160[1]	4,800[1]	160[1]	0	10
Haiti	5,450[1]	3,450[1]	5,530[1]	3,500[1]	5,550[1]	3,500[1]	5,600[1]	3,500[1]	5,600[1]	3,500[1]	150	50
Jamaica	1,350[1]	1,050[1]	1,150[1]	1,050[1]	1,190[1]	1,000[1]	1,740[1]	1,000[1]	1,740[1]	1000[1]	390	-50
Montserrat	10[2]	…	20[1]	…	20[1]	…	20[1]	…	20[1]	…[1]	10	…
St. Kitts & Nevis	80[2]	60[2]	80[1]	40[1]	80[1]	20[1]	70[1]	10[1]	70	10	-10	-50
St. Lucia	50[2]	120[2]	50[1]	120[1]	50[1]	130[1]	50	140	30[1]	140[1]	-20	20
St. Vincent & the Grenadines	50[1]	50[1]	40[1]	60[1]	40[1]	70[1]	40[1]	70[1]	40[1]	70[1]	-10	20
Suriname	400[1]	90[1]	520[1]	100	570[1]	110[1]	570	110	570[1]	100[1]	170	10
Trinidad & Tobago	700[1]	460[1]	720[1]	460[1]	740[1]	460[1]	750[1]	470[1]	750[1]	470[1]	50	10

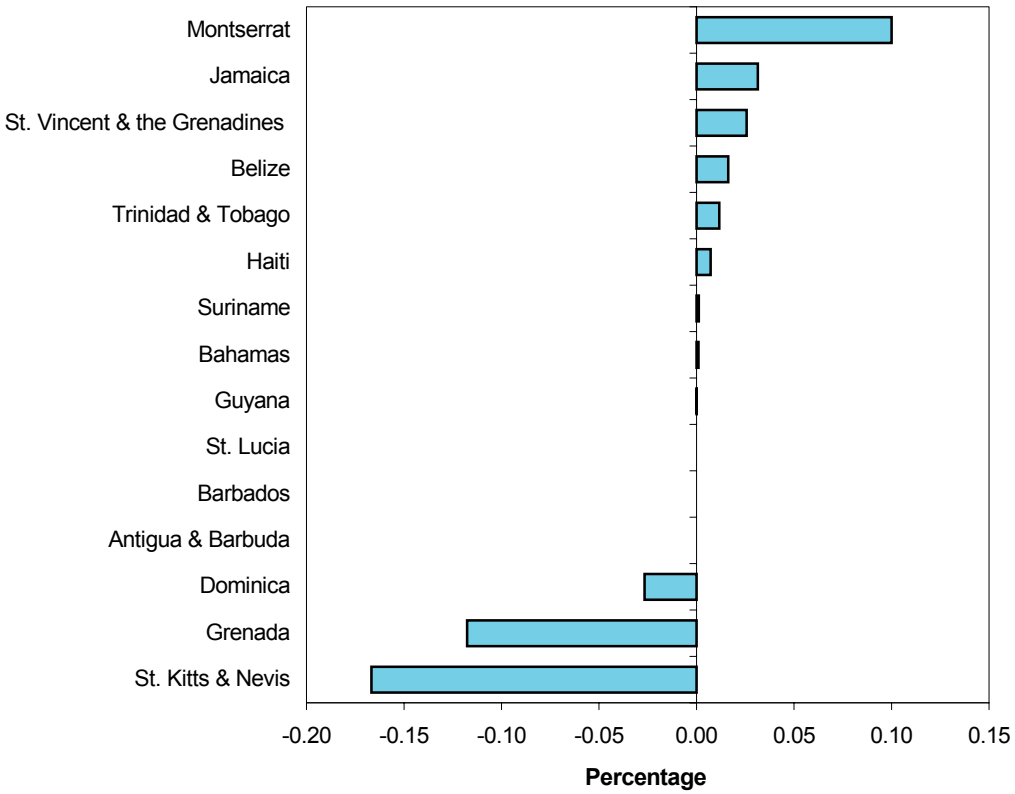
Source: Food and Agriculture Organization of the United Nations (FAO).
Key: [1] FAO estimate.
[2] Provisional.

Comments

Changes in arable land and permanent crops, as well as in forestland, provide important information about Member States' endowment in agricultural and forest resources, both from an economic and environmental perspective. The data show large increases of agricultural land over the period 1980 - 1999 in Belize, Haiti, Jamaica and Suriname. In Belize, Haiti and Suriname, agricultural land has expanded over forestland. For Jamaica, however, the figures are contradicted by national data on agricultural holdings, which show a decrease of agricultural land. The Jamaica data in the table are probably showing too low estimates for 1980.

The agricultural land has been reduced most significantly in St. Kitts & Nevis and in Grenada, reflecting mainly the decline of sugar production in St. Kitts & Nevis and the growth of settlements and infrastructure areas in Grenada.

Figure 8.1. Change in agricultural land (1980-1999) as a percentage of land area



USE OF FERTILIZERS

Table 8.5. Use of fertilizers (metric tons)

	Year	Total[1]
Barbados	1990	9,661
	1995	3,826
	1997	5,719
Belize	1996	27,182
	1998	23,139
	2000	26,025
Grenada	1996	1,624
	1998	1,311
	1999	875
Jamaica	1995	111,790
	1998	87,064
	1999	89,601
St. Vincent & the Grenadines	1980	4,468
	1990	9,290
	2000	5,509

Source: National.
Key: [1] The total refers to apparent consumption which is production plus imports minus exports.

Data also available for:
Barbados: 1991-1994, 1996;
Belize: 1996, 1997, 1999;
St. Vincent & the Grenadines: 1970, 1991-1999.

Comments

There are considerable variations in the annual figures. Most countries have used data for imports plus production, since no data on actual use are available. This means that there may be stocks from one year to the next, and it is likely that the actual use shows less variation than the data provided. Imports that are further refined in local production have not been included, since the quantities of the table are intended to show how much has been distributed to the fields.

The content of fertilizers is often a combination of nitrogen, phosphorus and potassium compounds, and the breakdown into three types is difficult and may be misleading. Therefore, such data reported from two of the countries have not been included here. It should also be noted that the actual nutrients make up less than the total weight of fertilizers. However, the weight is the figure most readily available in most countries. The total weight can serve as an indicator, rather than an exact measure, of the supply of nutrients through fertilizers.

Definitions and data origin

The data in tables 8.6 - 8.8 on the consumption of fertilizers are obtained from FAO. Nitrogenous fertilizers refer to the nitrogen content of commercial inorganic fertilizers. Phosphate fertilizers refer to commercial phosphoric acid (P_2O_5) and cover the P_2O_5 of superphosphates, ammonium phosphate and basic slag. Potash fertilizers refer to the K_2O content of commercial potash, muriate, nitrate and sulphate of potash, manure salts, kainit and nitrate of soda potash.

Table 8.6. Nitrogenous fertilizer consumption (metric tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Bahamas	...	200	200	100	100	100	200	100	100	100
Barbados	1,500	1,500	1,500	1,500	1,500	2,000	2,000	2,000	1,800	1,800
Belize	1,500	1,500	1,500	1,500	1,200	1,300	1,000	1,300	2,056	1,200
Dominica	2,200	2,400	2,000	2,000	1,800[1]	1,077[1]	929[1]	1,000	1,000	1,000
Guyana	8,000	13,000	10,500	10,000	8,100	12,000	10,900	13,974[1]	13,800	10,000
Haiti	900	2,700	4,200	4,000	4,000	5,400	4,000	8,529[1]	6,307[1]	4,956
Jamaica	7,400	9,200	4,200	6,000	8,200	8,100	8,100	9,020[1]	8,906[1]	9,210
St. Kitts & Nevis	390	500	500	800	700[1]	639[1]	639[1]	800	800	800
St. Lucia	2,375[1]	3,000	3,000	3,000	5,000[2]	7,000[2]	8,995	9,647[1]	2,160	2,000
St. Vincent & the Grenadines	500	500	500	1,000	1,000	1,000	1,000	1,000	5,694	1,300
Suriname	600	600	2,600	3,000	4,000	4,000	7,000	6,800	5,000	6,309[1]
Trinidad & Tobago	6,000	5,900	6,950	3,000	3,000	3,000	6,000	6,000	5,600	5,000
TOTAL	31,365	41,000	37,650	35,900	38,600	45,616	50,763	60,170	53,223	43,675

Source: Food and Agriculture Organization of the United Nations (FAO).
Note: All values are unofficial FAO figures except those with footnotes 1 and 2.
Unofficial figures are those for which the sources of data are generally non-governmental organisations.
Key: [1] Data supplied by countries.
[2] FAO estimates.

Table 8.7. Phosphate fertilizer consumption (metric tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Bahamas	...	...	...	...	...	...	100	100	100	100
Barbados	200	200	200	200	200	200	200	200	200	200
Belize	1,700	2,000	2,400	3,000	1,400	2,700	1,300	2,500[1]	2,700	2,800
Dominica	600	1,300	1,300	1,300	1,300[1]	1,079	905[1]	1,000	1,000	1,000
Guyana	2,200	1,600	900	1,000	1,000	1,000	1,400	700	900	3,600
Haiti	...	100	...	...	500	1,000	2,000	2,042[1]	2,161[1]	1,748
Jamaica	3,600	3,800	4,100	5,400	5,400	5,000	5,300	5,952[1]	5,237[1]	5,046
St. Kitts & Nevis	228[1]	300	300	300	420[1]	364	364[1]	500	500	500
St. Lucia	1,675[1]	1,800	1,800	2,000	2,000	2,000	2,000	2,000	...	2,500
St. Vincent & the Grenadines	900	900	1,000	1,000	1,000	1,000	1,000	1,000	1,300	1,300
Suriname	200	200	100	100	100	100	100	100	800	...
Trinidad & Tobago	200	200	100	100	100	100	100	100	400	300
TOTAL	11,503	12,400	12,200	14,400	13,420	14,543	14,769	16,194	15,298	19,094

Source: Food and Agriculture Organization of the United Nations (FAO).
Note: All values are unofficial FAO figures except those with footnote 1.
Unofficial figures are those for which the sources of data are generally non-governmental organisations.
Key: [1] Data supplied by countries.

Table 8.8. Potash fertilizer consumption (metric tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Bahamas	100	100	100	100	100	100	100	100[1]	100	100
Barbados	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
Belize	1,900	1,700	1,900	1,900	2,000	1,000	1,000	1,000	1,000	1,000
Dominica	600	1,300	1,300	1,300	1,300	1,056	905	1,000	1,000	1,000
Guyana	1,800	1,000	800	1,000	2,000	2,000	1,000	1,000	200	600
Haiti	100	100	100	100	600	1,000	1,000	1,999[1]	2,460[1]	2,012
Jamaica	8,100	12,700	13,000	12,000	9,600	13,418	10,400	8,425[1]	9,302[1]	8,787
St. Kitts & Nevis	264[1]	300	300	...	470[1]	324[1]	324[1]	400	400	400
St. Lucia	1,671[1]	1,700	1,700	2,000	2,000	2,000	2,000	2,000	...	800
St. Vincent & the Grenadines	900	900	900	900	1,000	1,000	1,000	1,000	1,300	1,300
Suriname	200	200	200	200	200	200	200	200	1,100	500
Trinidad & Tobago	1,400	1,600	1,800	1,800	1,400	3,000	3,430	3,600	1,400	600
TOTAL	18,035	22,600	23,100	22,300	21,670	26,098	22,359	21,724	19,262	18,099

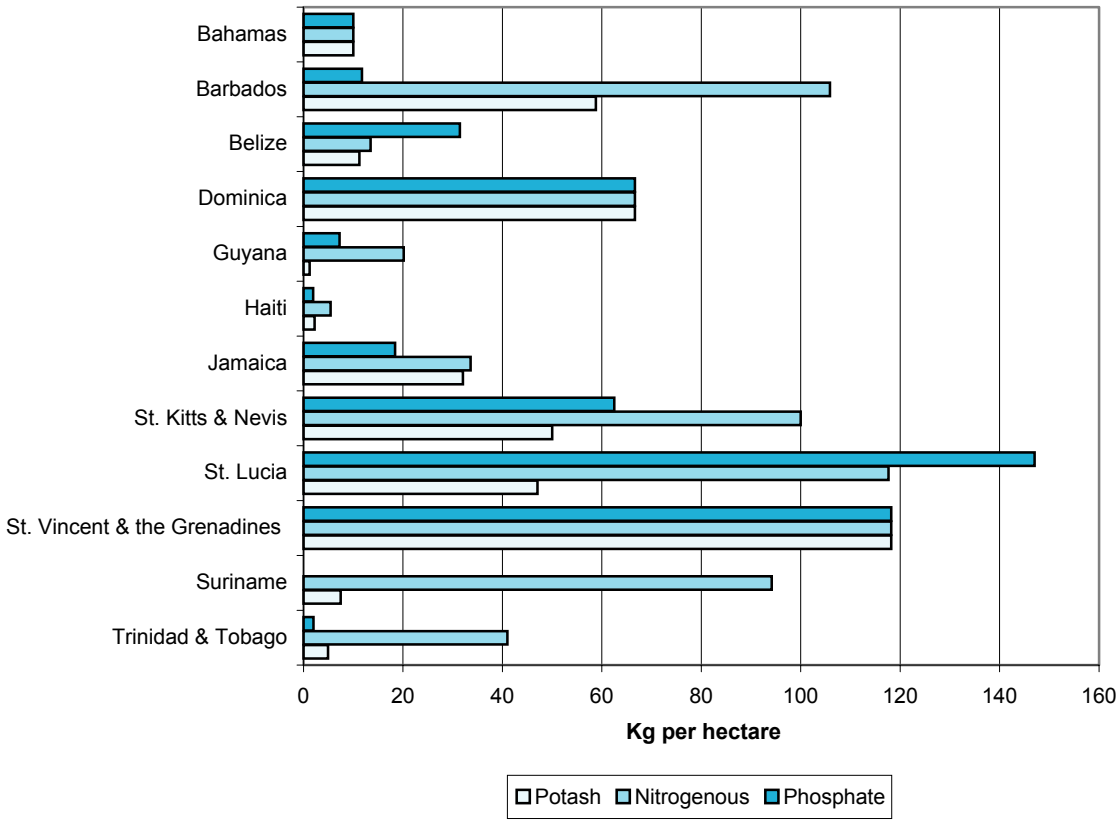
Source: Food and Agriculture Organization of the United Nations (FAO).
Note: All values are unofficial FAO figures except those with footnote 1.
Unofficial figures are those for which the sources of data are generally non-governmental organisations.
Key: [1] Data supplied by countries.

Table 8.9. Fertilizer intensity for agricultural area (arable + permanent land) (kg/ha)

	Nitrogenous		Phosphate		Potash	
	1991	1999	1991	1999	1991	1999
Bahamas	20.0	10.0	…	10.0	10.0	10.0
Barbados	88.2	105.9	11.8	11.8	58.8	58.8
Belize	22.1	13.5	29.4	31.5	25.0	11.2
Dominica	150.0	66.7	81.3	66.7	81.3	66.7
Guyana	26.3	20.2	3.2	7.3	2.0	1.2
Haiti	3.0	5.4	0.1	1.9	0.1	2.2
Jamaica	42.0	33.6	17.4	18.4	58.0	32.1
St. Kitts & Nevis	50.0	100.0	30.0	62.5	30.0	50.0
St. Lucia	166.7	117.6	100.0	147.1	94.4	47.1
St. Vincent & the Grenadines	45.5	118.2	81.8	118.2	81.8	118.2
Suriname	8.8	94.2	2.9	...	2.9	7.5
Trinidad & Tobago	49.2	41.0	1.7	2.5	13.3	4.9

Source: United Nations Statistics Division (UNSD).

Figure 8.2. Fertilizer intensity in 1999



Comments

Looking at the trends in tables 8.6 to 8.8, it is seen that nitrogen application increased from 1991 to 1999 for Barbados, St. Kitts & Nevis, St. Vincent & the Grenadines and Suriname, and decreased for St. Lucia and Dominica in particular. For phosphates, the trends are similar, except for St. Lucia, which shows an increase in the use of phosphates. It can be expected that fertiliser use in the banana industry will explain most of the changes in these countries.

As can be seen in figure 8.2 and in table 8.9, the highest doses per hectare of both nitrogen and phosphate are recorded in Barbados, St. Kitts & Nevis, St. Lucia and St. Vincent & the Grenadines, which may be explained both by the poorer soils in these islands and by large plantations. Dominica and Suriname also have considerable use of fertilizers. Low values signal a mainly small-scale agriculture with limited means, as in Haiti, and perhaps in The Bahamas.

USE OF PESTICIDES

Table 8.10. Use of pesticides (metric tons)

	Year	Insecticides	Herbicides	Fungicides	Others	Total[1]
Barbados	1990	510	452	70	-	1,032
	1995	354	445	16	67	882
	1997	472	391	18	-	881
Belize	1990	456	204	94	19	773
	1995	610	337	330	254	1,531
	2000	628	445	135	236	1,444
Jamaica	1994	715	605	1,297	…	…
	1995	555	642	1,410	…	…
	1999	296	769	521	…	…
St. Vincent & the Grenadines	1980	416	14	61	2	493
	1990	269	71	359	5	704
	2000	318	124	285	6	733

Source: National.
Key: [1] The total refers to apparent consumption which is production plus imports minus exports.

Data also available for:
Barbados: 1991-1994, 1996;
Belize: 1996, 1997, 1999;
Jamaica: 1996-1998;
St. Vincent & the Grenadines: 1970, 1991-1999.

Comments

Pesticides are imported to the countries reporting; only in Jamaica is there also some local production with imported ingredients. The data are most likely import (and production) data, although only Belize states this explicitly. As with fertilizers, stocks may be kept, so that pesticides are not always used in the same year that they were imported. Further variations may depend on insect or fungus infestations. The active ingredients are not easily deduced from the total amounts. The comments given on the international data apply.

Definitions and data origin

The data in table 8.11 on the consumption of pesticides are obtained from FAO and are expressed in metric tons. Pesticides are divided into insecticides, herbicides, fungicides, bactericides and seed treatments, plant growth regulators, and rodenticides.

Table 8.11. Pesticides in use (metric tons)

		1989	1990	1991	1992	1993	1994	1995	1996	1997	1998
Barbados	Insecticides	...	...	...	...	188	102	121	120	...	...
	Herbicides	...	...	...	...	283	335	445	265	...	...
	Fungicides, Bactericides and Seed Treatments	...	...	...	...	14	9	16	25	...	...
	Plant Growth Regulators	...	...	...	...	15	21	45	41	...	...
	Rodenticides	...	...	...	...	50	47	37	24	...	...
Belize	Insecticides	336	455	360	594	...	...	...	...	...	...
	Herbicides	197	204	172	266	...	...	...	...	...	...
	Fungicides, Bactericides and Seed Treatments	236	94	76	119	...	...	...	...	...	...
	Plant Growth Regulators	0	0	0	4	...	...	...	...	...	...
	Rodenticides	21	18	88	14	...	...	...	...	...	...
Haiti	Insecticides	...	7	8	4	3	3	4	5	6[1]	7
	Herbicides	...	0	0	0	0	0	0	0	0	0
	Fungicides, Bactericides and Seed Treatments	...	7	7	5	3	4	5	6	6[1]	6
	Plant Growth Regulators	...	...	...	...	...	...	...	...	...	...
	Rodenticides	...	3	3	2	1	1	3	3	4[1]	5
Jamaica[2]	Insecticides	...	...	...	...	...	716	555	1,059	658	...
	Herbicides	...	...	...	...	...	606	642	703	652	...
	Fungicides, Bactericides and Seed Treatments	...	...	...	...	...	1,298	1,410	1,217	295	...
	Plant Growth Regulators	...	...	...	...	...	1	44	30	11	...
	Rodenticides	...	...	...	...	...	23	22	22	33	...
St. Lucia	Insecticides	...	...	...	...	...	...	...	...	66	28
	Herbicides	...	...	...	...	...	...	...	...	17	17
	Fungicides, Bactericides and Seed Treatments	...	...	...	...	...	...	...	...	14	4
	Plant Growth Regulators	...	...	...	...	...	...	...	...	...	...
	Rodenticides	...	...	...	...	...	...	...	...	0	0
Suriname	Insecticides	116	28	59	...	...	...	46	47	45	...
	Herbicides	96	157	101	...	...	...	48	84	55	...
	Fungicides, Bactericides and Seed Treatments	41	32	47	...	...	...	75	10	39	...
	Plant Growth Regulators	...	...	...	...	...	...	...	...	...	...
	Rodenticides	0	0	0	...	...	...	0	0	0	...
Trinidad & Tobago[3]	Insecticides	1,032	227	450	417	212	...	...	...	...	...
	Herbicides	510	436	577	537	580	...	...	...	...	...
	Fungicides, Bactericides and Seed Treatments	59	183	72	96	69	...	...	...	...	...
	Plant Growth Regulators	...	...	2	12	16	...	...	...	...	...
	Rodenticides	...	...	15	26	10	...	...	...	...	...

Source: Food and Agriculture Organization of the United Nations (FAO).

Key: [1] FAO estimate.
[2] Data refer to total imports since information on stocks and production is not available.
[3] Data refer to weight of formulated products and not to active ingredients.

Comments

The consumption of pesticides generally decreased for the period 1989 to 1998, in all the countries for which there are data. To some extent, the agricultural areas have decreased; however, another possible explanation could be the shift to different types of pesticides, where smaller quantities are required per hectare in order to achieve the desired effect. The toxic properties of the pesticides cannot be inferred from only the weight; therefore, the decreasing trends may or may not indicate an improvement in the environmental situation. Infestations of certain insects, as well as fungus infections, may vary considerably, and some of the year-to-year variations are due to these factors.

In box 8.1 below is an example of organic banana farming in the Caribbean where the bananas are packaged and then sold in Britain with an environmental and social conscience.

Box 8.1. Organic bananas from the Caribbean

Consumers are increasingly concerned with the use of pesticides, herbicides and other farm chemicals that not only may affect their long-term health, but also cause damage to the environment. Organic fruit is rapidly becoming big business – one major British supermarket chain aims to have 5 per cent of its food sales certified organic within two years.

Organic produce must be grown on land that has been free of chemicals for at least five years. To be certified organic, produce must pass a stringent test. Organic bananas from the four Windward Islands -- Dominica, Grenada, St. Lucia and St. Vincent & the Grenadines -- are certified by the Soil Association, an internationally respected body, based in Bristol, England. The Windward Islands already have several natural advantages for banana farming: year round warmth, good soil, plenty of rainfall, and easy transport from the airports. In terms of organic farming, the Windwards have a major advantage: they are free of Black Sigatoka disease, a disease that is impossible to control through organic methods.

Aside from being environmentally responsible, there are several other reasons why many British consumers prefer organic bananas from the Windwards. The volcanic soils of the Windwards are rich in potassium, which stimulates taste-enhancing biological processes in the fruit. Although organic bananas from the Windwards are usually slightly more costly than their counterparts from South America, the higher labour standards in the Windwards also appeal to consumers who are concerned about exploited workers that exist in many other parts of the world. In the Windwards, "Fair Trade" bananas -- certified as meeting employment and environmental standards -- sell with a "social premium" of US$1.75 a box, which is given to rural farmer community groups to improve farm infrastructure or for social development projects. All of these factors make organic bananas from the Windwards more appealing to British consumers than ever.

Source: British West Indian Airways (BWIA).

CHAPTER 9

FORESTS

OVERVIEW

Among the most diverse and widespread ecosystems of the world, forests provide many significant resources, such as fuelwood and other timber products and serve as habitats for a multitude of animal and plant species. Hence they are important for the conservation of biological diversity. In addition, forests are a tourist attraction, provide recreational opportunities and represent a major resource for watershed protection and management. Forests also play an important role in the global carbon cycle by acting as a carbon sink; their management or destruction could significantly affect the course of global warming in this century.

Deforestation and degradation of forests in many parts of the world are negatively affecting the availability of forest goods and services. In order to achieve sustainable forest management, it is important to monitor the production levels of forest products, such as fuelwood, roundwood and sawnwood, and develop appropriate policies and legislation.

FAO estimates that there are 3,860 million hectares of forest worldwide, of which almost 95 per cent are natural forests, and five per cent are forest plantations. Although the CARICOM Member States account for only one per cent of the world's forest area, the large number of endemic plants, the particular characteristics of Caribbean wetlands and the importance of forest cover in local economies, in particular for tourism, make forests important in the region.

The forests in the region are primarily tropical rain forests, tropical moist forests and tropical dry forests. In some small islands in the region, where commercial agriculture has been on the decline, there is the possibility that agricultural land may revert to forest. However, the growing tourism industry and increased urbanization may result in reduced forested areas.

CARICOM's share of world production and trade in forest products is minor, and its members are heavily dependent on imports to meet their paper, sawn wood and wood-based panel requirements.

In the following, statistics are presented to describe the main characteristics of forests in the CARICOM countries. The indicators used to describe forestry issues include forest area, protected forest area and volume of standing timber.

Table 9.1. Forest areas and timber volumes

	Year	Forest areas, km^2					Volume of standing timber 000 m^3
		Pre-dominantly coniferous	Pre-dominantly broadleaved	Mixed, other	Total forest area	Of which: protected forest area	
Belize	1981	987	15,812	4,522	21,321	…	…
	1994	649	14,311	2,262	17,222	…	…
Grenada	2000	-	42	-	42	…	…
Guyana	2000	…	…	…	168,789	3,662	351,000
Jamaica	1989	-	2,699	740	3,439	…	…
	1998	-	2,669	733	3,402	1,193	66,950
St. Vincent & the Grenadines	1960	…	82	…	140	…	…
	1980	…	92	…	132	…	…
	1995	…	78	…	127	32	…

Source: National.
Note: 1990 data also available for St. Vincent & the Grenadines.

Comments

Table 9.1 presents data on forest area protected forest area and timber volumes. Forest data of this nature are not collected regularly, and definitions are usually different to some degree in each country.

The smaller islands have quite small forest areas, while in Belize, forests cover 75 per cent of the country and play an important role in the economy.

In Belize, the total forest area in 1981 is most likely not comparable to that of 1994 and, therefore, cannot be used for a computation of the deforestation rate. Instead, the loss of 780 km^2 in ten years can be used, which amounts to about 0.4 per cent per year. In Jamaica, the deforestation is now estimated at 0.1 per cent annually, while in St. Vincent & the Grenadines, it is about 0.3 per cent per year.

Definitions and data origin

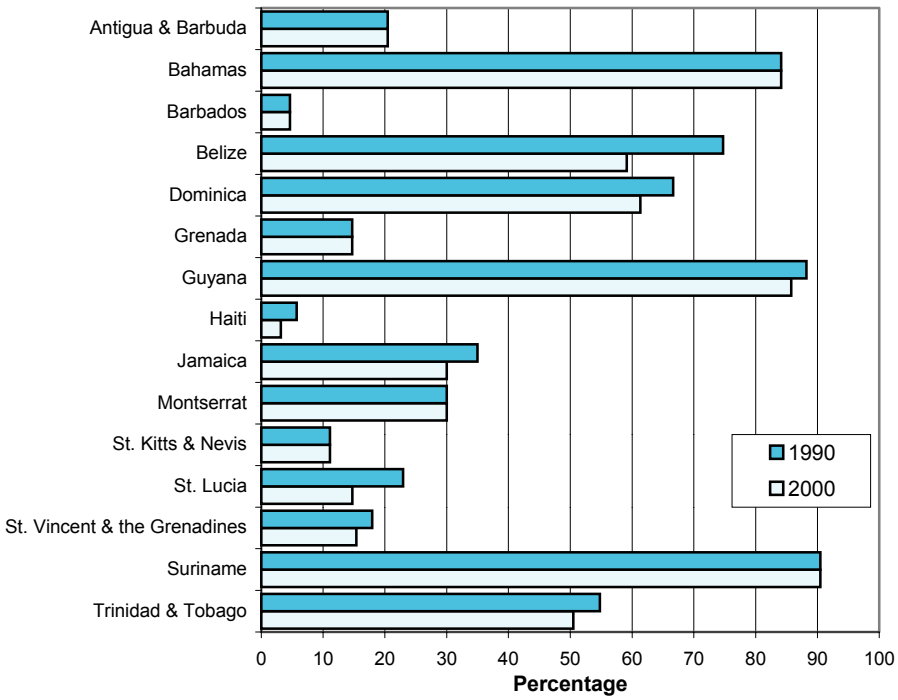
The data in table 9.2 on forest area and change are obtained from FAO, the organization that coordinated the Global Forest Resources Assessment 2000 (FRA 2000). The following definition was used for "forest" in the FRA 2000. "Forest" includes natural forests and forest plantations and is used to refer to land with a tree crown cover (or equivalent stocking level) of more than ten per cent and an area of more than 0.5 hectares. The trees should be able to reach a minimum height of five metres at maturity *in situ*. The term "forest" may be applied either to closed forest formations, where trees of various storeys and undergrowth cover a high proportion of the ground, or open forest formations with a continuous vegetation cover in which the tree crown cover exceeds ten per cent. Young natural stands and all plantations established for forestry purposes that have yet to reach a crown density of ten per cent, or tree height of five metres, are included under forest. Areas normally forming part of the forest area that are temporarily unstocked as a result of human intervention or natural causes, but that are expected to revert to forest, are also included.

Table 9.2. Forest area (1990-2000)

	Total land area (1980) km²	Total forest area (1990) km²	Forest area as a % of land area (1990) %	Total forest area (2000) km²	Forest area as a % of land area (2000) %	Forest area change (1990-2000) Average annual change km²	Forest area change (1990-2000) Average annual rate of change %
Antigua & Barbuda	440	90	20	90	20	n.s.	n.s.
Bahamas	10,010	8,420	84	8,420	84	n.s.	n.s.
Barbados	430	20	5	20	5	n.s.	n.s.
Belize	22,800	17,040	75	13,480	59	-360	-2.3
Dominica	750	500	67	460	61	n.s.	-0.7
Grenada	340	50	15	50	15	n.s.	0.9
Guyana	196,850	173,650	88	168,790	86	-490	-0.3
Haiti	27,560	1,580	6	880	3	-70	-5.7
Jamaica	10,830	3,790	35	3,250	30	-50	-1.5
Montserrat	100	30	30	30	30	n.s.	n.s.
St. Kitts & Nevis	360	40	11	40	11	n.s.	-0.6
St. Lucia	610	140	23	90	15	-10	-4.9
St. Vincent & the Grenadines	390	70	18	60	15	n.s.	-1.4
Suriname	156,000	141,130	90	141,130	90	n.s.	n.s.
Trinidad & Tobago	5,130	2,810	55	2,590	50	-20	-0.8

Source: Food and Agriculture Organization of the United Nations (FAO).
Key: n.s. = Not significant.

Figure 9.1. Forest area as a percentage of land area in 1990 and 2000



Comments

The mainland countries have very large areas that are covered by forests, with a high proportion of broadleaved or hardwood forests. The coverage is about 90 per cent in Guyana and Suriname, and about 60 per cent in Belize. Logging and forest-based industries are important in these countries. Of the larger islands, Jamaica and Trinidad & Tobago have sizeable forest areas, while Dominica stands out for its high coverage, with over 60 per cent. Many of the other islands have 15-30 per cent coverage, while Barbados and Haiti have almost none.

Between 1990 and 2000 the highest annual deforestation took place in Guyana followed by Belize while the highest average annual rate of deforestation occurred in Haiti followed by St. Lucia.

CHAPTER 10

BIODIVERSITY

OVERVIEW

Biological diversity, or biodiversity, is the variety of life on Earth, and the natural patterns it forms. This diversity is often understood in terms of the wide variety of plants, animals and micro-organisms. Biodiversity also includes genetic differences within each species, as well as ecosystem varieties. Protecting biodiversity is in humankind's self-interest, as biological resources are the foundations for future generations. The loss of biodiversity can threaten our food supply, as well as reduce opportunities for recreation and tourism.

The Convention on Biological Diversity (CBD), the first global agreement on the conservation and sustainable use of biological diversity, was one of the agreements signed at the United Nations Conference on Environment and Development in Rio de Janeiro in 1992. All CARICOM Member States that are signatory to the CBD, have either prepared or are in the process of preparing National Biodiversity Strategies and Action Plans. These processes have yielded a wealth of information that should be of immense benefit to these countries in their formulation and implementation of sectoral and cross-sectoral plans aimed at meeting the objectives of the CBD. For many countries, this was the first time that they were undertaking a comprehensive inventory of their terrestrial biodiversity.

The CARICOM Member States are renowned for their species diversity and endemism. Measures of species richness and endemism are some of the simplest ways of indicating how important areas are for biodiversity. In order to try to maintain maximum biodiversity in the most efficient way possible, it is also important, however, to know which aspects of it are under immediate threat. An assessment of the status of individual *threatened species* is carried out to try to determine the degree of threat they are under, i.e., the likelihood of their becoming extinct in a given period.

While the loss of individual species, as described above, catches our immediate attention, it is the fragmentation, degradation, and overall loss of forests, wetlands, coral reefs, and other ecosystems that pose the greatest threat to biological diversity.

According to the CBD, about 45 per cent of the Earth's original forests are gone, cleared mostly during the past century. Despite some regrowth, the world's total forests are still shrinking rapidly. Up to 10 per cent of coral reefs -- among the richest ecosystems -- have been destroyed, and one third of the remainder face collapse over the next 10 to 20 years. Coastal mangroves, a vital nursery habitat for countless species, are also vulnerable, with half already gone.

The establishment of *protected areas* and effective management are essential for ecosystem conservation. These areas are necessary to protect as wide a range as possible of natural ecological communities and the species that depend on them.

The indicators used here to describe biodiversity issues include the number of known and threatened species and the number and extension of protected areas according to the level of management.

THREATENED SPECIES

Table 10.1. Fauna and flora - number of known and threatened species

		Mammals		Birds		Reptiles		Fishes		Flowering Plants		Ferns	
	Year	Kn.	Thr.	Kn.	Thr.	Kn.	Thr.	Kn.	Thr.	Kn.	Thr.	Kn.	Thr.
Barbados	2000	...	-	...	-	...	4	...	-	...	20	...	10
Belize	1998	163	52	571	81	121	-	645	2	3,409	57	...	...
Jamaica	2000	28	4	165	7	43	12	...	...	3,006	427	609	30
St. Lucia	2000	9	-	>150	3	17	7	...	...	1,310	27	118	-
St. Vincent & the Grenadines	2000	16	...	153	...	12	...	...	...	...	...	...	...

Source: National.
Key: Kn. = Known.
Thr. = Threatened.

Definitions and data origin

The data in table 10.2 on the numbers of threatened species in each group of animals and plants are compiled by the World Conservation Union (IUCN)/Species Survival Commission (SSC), Gland, Switzerland and Cambridge, U. K., and published in the 2000 IUCN Red List of Threatened Species. The data cover mammals, birds, reptiles, amphibia, fishes, molluscs, other invertebrates and plants.

There are seven categories of threat in the IUCN Red List 2000 system: Extinct, Extinct in the Wild, Critically Endangered, Endangered, Vulnerable, Near Threatened and Least Concern. A species is listed as threatened if it falls in the Critically Endangered, Endangered or Vulnerable categories.

The number of threatened species should preferably be related to the total number of species, in order to evaluate its significance. However, the total number of species, and the ratio between the two numbers, is not available in many countries of the world.

Table 10.2. Number of threatened species: country totals by taxonomic group in 2000

	Mammals	Birds	Reptiles	Amphibia	Fishes	Molluscs	Other Invertebrates	Plants
Antigua & Barbuda	-	1	5	-	-	-	-	4
Bahamas	5	4	5	-	1	-	1	4
Barbados	-	1	2	-	-	-	-	2
Belize	4	2	4	-	4	-	1	28
Dominica	1	3	4	-	-	-	-	11
Grenada	-	1	4	-	1	-	-	3
Guyana	9	2	6	-	-	-	1	23
Haiti	4	14	7	1	-	-	2	27
Jamaica	5	12	8	4	-	-	5	206
Montserrat	1	2	4	-	-	-	-	3
St. Kitts & Nevis	-	1	3	-	-	-	-	2
St. Lucia	1	5	6	-	-	-	-	6
St. Vincent & the Grenadines	2	2	4	-	-	-	-	4
Suriname	11	1	6	-	-	-	-	27
Trinidad & Tobago	1	1	5	-	-	-	-	1

Source: World Conservation Union/Species Survival Commission (IUCN/SSC).

Comments

The number of threatened species reported depends on many factors, including the total number of species, the level of knowledge, and the effort given towards data collection. In addition, national experts may use varying methods in their appraisals.

There are few mammal species in the islands in the CARICOM region, while the mainland countries, Belize, Guyana and Suriname, have many more. This explains why so many mammals are threatened in the mainland countries. Certain species, for example the West Indian manatee, will be listed as threatened in several countries, and therefore makes it difficult to analyse the data from a regional perspective. Among the birds, there are many endemic species in the islands. These are more vulnerable, since the populations are often small, and loss of specialized habitats may occur easily.

The situation for the lower orders of animals is not at all well known, and the small numbers reflect lack of information rather than lack of threatened species. A group of invertebrates that has been studied are, for example, the Jamaican butterflies; all five threatened invertebrates in Jamaica included in the Red List are in fact butterflies.

There is a similar uncertainty about the actual situation for plants. The high number of threatened plants in Jamaica reflects both a high degree of endemism with small populations, and a well-researched field.

PROTECTED AREAS

Definitions and data origin

The United Nations List of Protected Areas is the definitive list of the world's national parks and reserves. It is regularly compiled under the authority of the United Nations, and from 1962 to 1990, ten editions of the List were printed. Since then the 1993 List and the 1997 List have been available, both as printed publications and as web-based databases that can be queried.

The United Nations List is compiled by UNEP-WCMC, working in close collaboration with the World Conservation Union (IUCN) World Commission on Protected Areas. Information is provided by national protected areas authorities and the secretariats of international conventions and programmes.

Countries vary considerably in their mechanisms for creating and maintaining systems of protected areas. In order to facilitate international comparisons for protected areas, IUCN has adopted the following definition of a protected area: an area of land and/or sea especially dedicated to the protection and maintenance of biological diversity, and of natural and associated cultural resources, and managed through legal or other effective means.

IUCN has defined a series of six protected area management categories, based on primary management objectives. These categories are as follows:

Category Ia: Strict Nature Reserve;
Category Ib: Wilderness Area;
Category II: National Park;
Category III: Natural Monument;
Category IV: Habitat/Species Management Area;
Category V: Protected Landscape/Seascape;
Category VI: Managed Resource Protected Area.

Although the data on protected areas are useful, they do not, however, indicate the quality of management, or whether the areas are actually protected from incompatible uses.

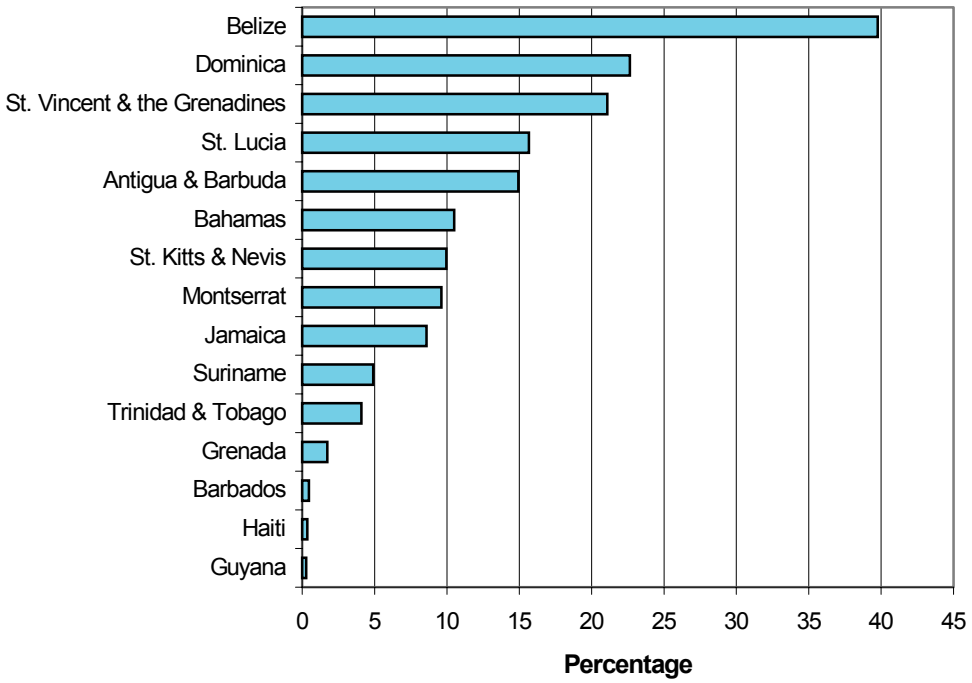
Table 10.3 and figure 10.1 present data for 1997 for the number of areas for the six protected area management categories as well as the protected area as a percentage of total area.

Table 10.3. Protected areas (1997) (km^2)

	Total Area of Country	Management Categories Ia/Ib No.	Ia/Ib Area	II No.	II Area	III No.	III Area	IV No.	IV Area	V No.	V Area	VI No.	VI Area	Total No.	Total Area	Total %
Antigua & Barbuda	442	-	-	5	66	-	-	3	0	3	0	-	-	11	66	14.9
Bahamas	13,865	1	18	10	1,421	-	-	27	18	-	-	-	-	38	1,457	10.5
Barbados	430	1	0	1	2	1	0	3	0	-	-	-	-	6	2	0.5
Belize	22,965	4	609	7	1,286	2	80	19	2,818	-	-	17	4,337	49	9,130	39.8
Dominica	751	-	-	3	75	-	-	1	0	-	-	3	95	7	170	22.6
Grenada	345	-	-	-	-	-	-	-	-	-	-	1	6	1	6	1.7
Guyana	214,970	-	-	1	585	-	-	-	-	-	-	-	-	1	585	0.3
Haiti	27,750	-	-	2	75	-	-	-	-	6	22	-	-	8	97	0.3
Jamaica	11,425	-	-	2	15	1	0	2	0	-	-	137	967	142	982	8.6
Montserrat	104	1	0	2	8	6	0	1	0	1	0	7	2	18	10	9.6
St. Kitts & Nevis	261	-	-	2	26	-	-	-	-	-	-	-	-	2	26	10.0
St. Lucia	619	1	0	1	0	1	0	28	23	-	-	15	74	46	97	15.7
St. Vincent & the Grenadines	389	-	-	-	-	-	-	25	82	-	-	-	-	25	82	21.1
Suriname	163,820	-	-	1	84	-	-	12	7,275	-	-	1	683	14	8,042	4.9
Trinidad & Tobago	5,130	3	26	-	-	-	-	9	149	-	-	2	35	14	210	4.1

Source: United Nations Environment Programme - World Conservation Monitoring Centre (UNEP-WCMC).
Note: Percentages are based on a country's total area and, therefore, are inflated by marine protected areas.

Figure 10.1. Protected area as a percentage of total area (1997)



Comments

In some of the CARICOM Member States, there have been very strong initiatives to protect the ecosystems and landscape. These endeavours have been easier to accommodate where the human population density is low, and the possible conflicts with economic and individual interests have been comparatively smaller. Belize has both the largest protected area and the highest percentage of land area designated as protected area. Among the islands, the largest protected areas are found in The Bahamas and Jamaica, whilst Dominica and St. Vincent & the Grenadines have the highest percentages of land area designated as protected area.

It should be noted that new protected areas are declared every year, and in some Member States, the areas and percentages may be considerably larger today than in 1997.

CHAPTER 11

MINERALS, ENERGY AND TRANSPORT

OVERVIEW

Minerals are non-renewable resources, and the most important ones in the CARICOM region include gold, diamonds and bauxite. Unsustainable exploitation will cause depletion in the long term, which can ultimately have a great impact on the economy of a country. The activities associated with *mineral production*, such as explosions, drilling and smelting, are a major source of air, water and soil pollution caused by the discharges of mineral wastes or mine tailings. In addition, these activities can also cause loss of habitats of wildlife.

Mineral reserves estimates, particularly in terms of years remaining at current rates of extraction, are crucial for the assessment of sustainable development. The factors for estimating the availability of non-renewable resources are exhaustibility, uncertainty and economic supply as a function of price and technology. The conservation of energy and the increased use of recycling materials can result in reducing mineral exploitation.

The attainment of energy and its usage for different purposes, i.e. transportation, industry, power generation and combustion, has been imperative to all countries for economic development. Patterns of *energy production and consumption*, however, have not been sustainable, and this poses a major threat to the environment in the long term. The production and consumption of energy causes air pollution, as well as alters the ambient temperature.

Unsustainable exploitation of non-renewable resources, i.e., fossil fuels, whether solid, liquid or gaseous, would have a significant impact on the economy as well as on the environment. The Kyoto Protocol, a follow-up of the United Nations Framework Convention on Climate Change (UNFCCC) agreed upon at UNCED in 1992, determines targets for signatories to control emissions. The policies in place to reduce these emissions include those that seek to improve efficiency in energy production and use, and to improve public transport.

Most CARICOM Member States are heavily dependent on imported petroleum products, mostly for electricity generation and transport. They are also dependent on indigenous biomass fuels for cooking and crop-drying. The electricity-generating sector is the major source of air borne emissions in the region.

More recently, the region has been giving increasing attention to the development of renewable energy sources. During the past two decades, over 120 projects and studies, estimated at US$30 million, have been undertaken on various aspects of renewable energy. Two countries that have given strong attention to encouraging energy efficiency and conservation, as well as the use of renewable sources of energy development, are Barbados and St. Lucia. Barbados now has a significant number of solar water heaters both in residential and hotel properties, partly because of government's fiscal incentives. Over the last few years, the Government of St. Lucia has pursued a number of initiatives, including the removal of taxes and duties on renewable energy technologies, and the development of a wind farm capable of adding 13.5 megawatts to the national electricity grid.

Transport is essential to a modern society. From an environmental point of view, transport requires

infrastructure -- roads, airports and harbours -- that competes with other land use. In addition, transport uses energy and produces emissions, mainly to air. Motorized transportation is increasingly becoming part of the daily lives of more and more persons in the CARICOM region.

The number of *motor vehicles in use* is a first indication of the environmental pressures created by transport. The use of motor vehicles impact the environment in various ways, including the consumption of non-renewable energy in the form of fossil fuels, the generation of wastes, emissions and spills, thus contributing to ground, air and water pollution, and to the potential for climate change. The number of motor vehicles, and, more or less, elaborate assumptions about average distances covered during a year and other factors are used to calculate various air emissions from traffic, including emissions of greenhouse gases. Other impacts of motor vehicles in use include noise and congestion that affect the quality of life, particularly in urban areas.

In the CARICOM region, motor vehicles are an increasing contributor to air pollution and the number of motor vehicles in use generally increases with rising incomes.

The indicators used in this chapter include mineral production, energy production and consumption and the number of motor vehicles in use.

MINERAL PRODUCTION

Table 11.1. Mineral production

	Year	Gold kg	Silver kg	Diamonds 000 metric carats	Aluminium or Bauxite 000 metric tons	Sand & gravel 000 cu. m	Lime-stone 000 cu. m	Dolomite 000 metric tons	Gypsum 000 metric tons	Stone 000 cu. m	Clay/fill 000 cu. m	Lime sand 000 metric tons
Belize	1993	…	…	…	…	48	122	3.5	…	1.24	…	…
	1995	…	…	…	…	51	140	5.0	…	0.22	75[1]	…
	2000	6.2	…	…	…	114	245	…	…	…	255	104.3
Guyana	1990	1,204.1	50	15.3	1,423[2]	…	…	…	…	49,000.00[3]	2,000[3]	…
	1995	9,004.9	450	52.4	2,028[2]	…	…	…	…	…	…	…
	2000	13,526.7	660	83.9	2,689[2]	…	…	…	…	…	…	…
Jamaica	1990	…	…	…	10,965[4]	950[5]	2,600	…	82	…	2,900[6]	…
	1995	…	…	…	10,871[4]	1,816[5]	3,385	…	208	…	3,920[6]	…
	1999	…	…	…	11,688[4]	2,069[5]	3,300	…	236	…	4,490[6]	…

Source: National.
Key: [1] Refers to 1996.
[2] Aluminium.
[3] Unit: metric tons.
[4] Crude bauxite. About 80% is refined to alumina in Jamaica.
[5] Including small quantities of silica sand.
[6] Marl/fill.

Data also available for most intermediate years.

Definitions and data origin

The data in table 11.2 have been compiled by the CARICOM Secretariat, based on figures published in the various country statistical reports and other published reports. In addition, data obtained through inquiries made from statistical offices of Member States and other relevant agencies, have also been included.

There are several types of bauxite for Guyana. They are: MAZ: Metallurgical Grade; AAC: Abrasive Grade; ACGB: Aluminous Cement Grade; and CeGB: Cement Grade. It should be noted that in processing bauxite in Guyana, there are two grades of ore that are received at the Bauxite Plant from the mines, and the chemical composition of the ore determines how it is processed. The crude ore is crushed and washed, and either processed at high temperatures to produce calcined bauxite for the refactory industry, or dried to produce MAZ that is used to manufacture alumina, from which aluminium is smelted.

The figures for bauxite for Jamaica represent the production of crude bauxite, in addition to the equivalent of alumina produced from the bauxite.

Table 11.2. Production of selected commodities (1000 metric tons)

Commodity	Country	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Gold[1]													
	Guyana[2]	1,204	1,844	2,475	9,635	11,678	9,005	12,007	14,571	14,146	12,905	13,527	14,181
Diamonds													
	Guyana[3]	15.3	29.3	46.0	50.9	36.8	52.4	46.7	36.5	35.3	46.7	83.9	184.3
Gravel													
	Antigua & Barbuda	...	...	...	...	...	...	...	...	...	...	...	...
Sand													
	Dominica[4]	53.5	...	...	...	...	...	...	...	...	...	...	...
	Dominica	...	...	...	50.9	59.0	51.3	...	...	...	...	...	...
	Guyana	...	...	...	...	...	...	...	113	193	192	237	221
Aggregate[5] (crushed stones)													
	Dominica[4]	45.9	...	...	...	...	...	...	...	...	...	...	...
Stones													
	Antigua & Barbuda	...	...	...	...	...	...	...	...	...	...	...	...
	Dominica	...	...	...	55.1	47.1	56.0	...	...	...	...	...	...
	Guyana	...	...	...	...	...	...	...	127	194	117	109	107
Bauxite[6]													
	Jamaica	10,965	11,610	1,367	11,184	11,787	10,871	11,757	11,988	12,647	11,688	11,126	...
	Suriname	3,283	3,134	3,250	3,413	3,772	3,530	3,703	3,877	3,931	3,715	3,610	4,303
	Guyana	2,593	3,622	3,501	3,269	2,986	3,006	3,299	3,442	3,402	3,414	3,549	2,604
Bauxite (MAZ)[7]													
	Guyana	920	1,596	1,910	1,588	1,689	1,587	1,966	2,145	2,066	2,214	2,365	1,618
Bauxite (AAC)													
	Guyana	28	29	3	5	2	15	-	-	-	-	-	-
Bauxite (ACGB)													
	Guyana	-	-	6	10	15	20	22	-	-	-	-	-
Bauxite (CeGB)													
	Guyana	. .	. .	. .	. .	. .	. .	. .	. .	25	41	39	17
Bauxite (CALCINED)													
	Guyana	288	331	215	267	173	194	163	178	147	108	106	91
Bauxite (CHEMICAL)													
	Guyana	220	248	202	240	213	220	218	167	251	176	157	223

Source: CARICOM Secretariat.
Key: [1] Raw gold production.
[2] unit in kg.
[3] unit in 1000 m/carat.
[4] unit in 1000 cu. m.
[5] "Aggregate" is crushed stones.
[6] Bauxite production figures for Jamaica are given as Dried equivalent of crude bauxite ore and for Guyana are given as bauxite ore.
[7] Exports based on ships' Bill of Lading Weights.

Comments

In Jamaica, the production of crude bauxite ranged from 10.9 to 12.6 million metric tons per year from 1990 to 2000; about 80 per cent of this is refined to alumina before being exported. In Suriname, bauxite production remained on average at about 3.5 million metric tons per annum from 1990 to 1997.

In Guyana, the average production of bauxite ore, from 1990 to 2001, was about 3.2 million metric tons per annum. Calcined bauxite production shows a downward trend from 288 thousand metric tons in 1990, to 106 thousand metric tons in 2000. The decrease of about 14 per cent in the production of calcined bauxite in 2001, was mainly due to difficulties encountered in the production process. The decrease in bauxite (MAZ) in the same year was due to zero production experienced in one company.

Sand production in Guyana ranged from 113 to 237 thousand metric tons with an upward trend; however, stones production varied from 107 to 194 thousand metric tons during this period without much variation in production, except for 1998, which recorded as high as 194 thousand metric tons.

The production of raw gold in Guyana in 1990 was 1,204 kilograms, and this increased by 700 per cent (to 9,635 kilograms) in 1993, mainly because of the increased production of a new gold mining company. According to the Gold Board of Guyana, a substantial portion of the gold that is mined in the country has not been declared annually. It is said that the largest gold producing company will cease its operation by year 2005.

The substantial increase in the production of diamonds in Guyana in 2000 and 2001 (119 per cent over 2000) is said to be due mainly to an inflow of Brazilian miners who use new technology to work in new areas, as well as old (worked out) areas.

ENERGY PRODUCTION AND CONSUMPTION

Table 11.3. Energy consumption

	Year	Primary energy consumption				Secondary
		Import of liquid fuels	Gases	Traditional fuels[1]	Hydro-electricity generation	Total electricity generation[2]
		000 cu. m	000 metric tons	000 metric tons	000 MWh	000 MWh
Belize	1991	94.6	…	175.0	…	…
	1995	117.3	…	167.0	46.7	169.1
	1999	266.9	…	262.0	67.8	228.9
Jamaica	1994	…	…	…	111.0	2,323.5
	1995	3,272.5	…	…	100.0	2,415.5
	1999	3,721.4	…	…	89.0	3,099.1
St. Lucia	1997	109.9	…	…	…	180.7
	1998	110.7	…	…	…	196.6
	1999	111.6	…	1589.0[3]	…	235.9
St. Vincent & the Grenadines	1990	29.5	2.6	…	…	51.0
	1995	44.7	3.6	…	…	72.0
	2000	47.3	3.9	…	…	101.0

Source: National.
Key: [1] Charcoal, fuelwood, bagasse.
[2] Hydroelectricity plus electricity generated from imported liquid fuels plus (in Belize) import of electricity.
[3] Unit: metric tons of oil equivalent.

Data also available for:
Belize: 1996-1998, 2000 (fuel imports); 1993-1994, 1996-1998, 2000 (electricity), 1992-1994, 1996-1998 (bagasse);
Jamaica: 1996-1998;
St. Vincent & the Grenadines: 1991-1994, 1996-1999.

Comments

It should be noted that data from national sources were not requested for energy production but only for energy consumption. Energy consumption depends on population size, transports and industrial needs. The bauxite industry in Jamaica is a high-energy consumer, and this is the reason for Jamaica's high total consumption. The table should give a fairly good picture of primary energy consumed, where data have been provided. However, it does not permit a calculation of the energy reaching final consumers, since information was not requested on energy used for producing the electricity, and for other transformations (such as refining oil). Data for the main consuming sectors are also missing, although some countries have data on electricity consumption by various types of users. Additional data of this kind should, above all, deal with the use of petroleum products in transport, industry, agriculture and other sectors.

Definitions and data origin

The data on energy production and consumption are compiled by UNSD. The totals include solids, liquids, gas and electricity. In order to show the comparison between different fuels, the data are presented in terms of thousand metric tons of oil equivalent on the basis of heat energy, which may be obtained from each of them.

The data on production refer to the first stage of production. The following are included in the production of commercial primary energy:

- solids: hard coal, lignite, peat and oil shale;
- liquids: crude petroleum and natural gas liquids;
- gas: natural gas;
- electricity: primary electricity generation from hydro, nuclear, geothermal, wind, tide, wave and solar sources.

The data on consumption refer to "apparent consumption" and are derived from the formula "production + imports – exports – bunkers +/– stock changes". The following are included in the consumption of commercial energy:

- solids: consumption of primary forms of solid fuels, net imports and changes in stocks of secondary fuels;
- liquids: consumption of energy petroleum products including feedstocks, natural gasoline, condensate, refinery gas and input of crude petroleum to thermal power plants;
- gases: consumption of natural gas, net imports and changes in stocks of gasworks and coke-oven gas;
- electricity: production of primary electricity and net imports of electricity.

Table 11.4. Total primary energy production (1000 metric tons of oil equivalent)

	1950	1960	1970	1980	1990	1995	1996	1997	1998
Antigua & Barbuda	..	..	..	..	..	..	..	..	..
Bahamas	..	..	..	..	..	..	..	..	..
Barbados	2	2	4	54	89	88	77	67	115
Belize	…	…	…	…	…	3	5	6	6
Dominica	0	0	1	1	1	2	2	2	2
Grenada	..	..	..	..	..	..	..	..	..
Guyana	…	…	…	0	0	0	0	0	0
Haiti	…	…	…	19	16	19	22	22	24
Jamaica	4	11	10	10	9	10	11	12	12
Montserrat	..	..	..	..	..	..	..	..	..
St. Kitts & Nevis	..	..	..	..	..	..	..	..	..
St. Lucia	..	..	..	..	..	..	..	..	..
St. Vincent & the Grenadines	0	0	1	1	2	2	2	2	2
Suriname	0	0	86	77	320	385	356	357	360
Trinidad & Tobago	3,381	6,727	8,977	14,488	12,689	13,084	13,829	13,789	14,294

Source: United Nations Statistics Division (UNSD).
Note: The value 0 refers to less than half the unit specified or nil.

Table 11.5. Total energy consumption (1000 metric tons of oil equivalent)

	1950	1960	1970	1980	1990	1995	1996	1997	1998
Antigua & Barbuda	...	12	92	47	101	108	108	113	113
Bahamas	18	136	487	810	645	572	572	577	593
Barbados	26	58	137	220	319	314	318	333	350
Belize	6	14	41	64	107	132	111	139	142
Dominica	0	3	9	13	21	29	29	29	30
Grenada	2	7	15	17	40	57	57	62	62
Guyana	85	216	517	583	373	486	502	527	545
Haiti	38	87	118	228	311	323	371	483	445
Jamaica	93	459	1,585	2,721	2,538	3,092	3,228	3,379	3,484
Montserrat	...	0	5	5	11	14	13	15	15
St. Kitts & Nevis	...	...	...	...	...	32	34	34	34
St. Lucia	1	5	23	37	55	64	64	67	67
St. Vincent & the Grenadines	1	4	10	14	29	45	46	46	57
Suriname	69	142	605	837	550	596	602	608	613
Trinidad & Tobago	657	1,033	3,162	5,227	5,876	7,509	8,490	8,873	9,092

Source: United Nations Statistics Division (UNSD).
Note: The value 0 refers to less than half the unit specified or nil.

Comments

The energy production of most CARICOM Member States is quite small and mainly consists of hydroelectric power. Trinidad & Tobago, as well as Barbados, are oil producers, while Suriname has large hydropower plants. It should be noted, however, that the production figures do not include bagasse (waste from sugarcane), which is an important additional source of energy in the sugar producing countries, and provides an environmentally beneficial method of using waste for obtaining energy. In addition, neither fuelwood nor charcoal is included. These sources of energy are hard to account for and pose potential threats to forests.

The energy consumed is mainly made up of local production plus, the import of petroleum products. Trinidad & Tobago exports a part of their production; otherwise, exports are of minor importance. The consumption should be seen as comprising two parts: the transformation of energy, mainly from oil products to electricity, and from crude to refined oil, and the final consumption. Some energy is inevitably lost in the transformation processes, so that a fairly large part of the energy consumed does not reach the final consumers. The final consumption goes to industries, commercial enterprises, agriculture and households, and not the least to transport.

The high consumption in Trinidad & Tobago and Jamaica goes to electricity production, electricity use and transport for large populations, but also to industry -- particularly the chemical and petrochemical industry in Trinidad & Tobago -- and to agriculture in Jamaica. The consumption in Haiti is very low, despite the large population.

Consumption trends over the period 1990-98 show an increase of four to five percent annually in most of the countries, with a much higher rate only in St. Vincent & the Grenadines (almost nine per cent annually in 1990-98). Antigua & Barbuda, Barbados and Suriname have annual increased figures of slightly over one per cent, while The Bahamas is the only country to have a reduced consumption since 1990.

Data on energy production and consumption for the CARICOM Member States may also be available from the Caribbean Energy Information System (CEIS) in Jamaica.

MOTOR VEHICLES IN USE

Definitions and data origin

The data on motor vehicles in use are compiled by UNSD. For years in which a census or registration took place, the census or registration figure is shown; for other years, unless otherwise indicated, the officially estimated number of vehicles in use is shown. The time of year to which the figures refer varies. Special purpose vehicles, such as two- or three-wheeled cycles and motorcycles, trams, trolley buses, ambulances, hearses and military vehicles operated by police or other governmental security organizations, are excluded. Passenger cars include vehicles seating not more than nine persons (including the driver), such as taxis, jeeps and station wagons. Commercial vehicles include vans, lorries (trucks), buses, tractor and semi-trailer combinations, but exclude trailers and farm tractors.

Table 11.6. Number of passenger cars in use (1000 units)

	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Antigua & Barbuda	...	11.0	18.1	19.2	13.5	14.8	15.0	15.1	21.6[1]	23.7[1]	24.0[1]	...
Bahamas	47.5	54.1	69.0[2]	69.0[2]	44.7[2]	46.1[2]	54.4	67.1	48.6[2]	66.1[2]	...	...
Barbados	...	32.8[3]	41.9[3]	42.5[3]	41.0[3]	45.5[3]	42.6[3]	...	...	...	...	...
Belize	...	...	2.6[4/5]	2.8[4/5]	1.7[6/5]	1.9[6/5]	1.9[6/5]	1.7[6/5]	1.8[6/5]	1.9[6/5]	1.9[6/5]	...
Dominica	2.4	2.8	4.1	4.5	4.8	5.8	7.0	7.4	7.9	8.3	8.7	...
Guyana	...	29.4[2]	24.0[2]	24.0[2]	24.0[2]	9.5[2]	9.5[2]	9.5[2]	9.5[2]	9.5[2]	...	...
Haiti	20.8	26.1	25.8	32.0	32.0	32.0	30.0	49.0	59.0	...	...	93.0
Jamaica	...	42.9	68.5	77.8	73.0	81.1	86.8	104.0	120.7	156.8	...	...
St. Kitts & Nevis	2.3	2.9	4.0	3.9	4.1	4.5	4.8	5.2	5.5	6.3	6.3	7.7
St. Lucia	5.7	5.4	8.1	9.1	9.3	10.1	11.4	12.5	13.5	...	...	...
St. Vincent & the Grenadines	4.2	4.9	5.3	5.3	5.0	5.4	5.7	5.3	6.1	7.4	8.0	8.7
Suriname	26.4	31.6	36.2	38.7	42.6	46.6	42.2	49.3	46.4	50.2	55.4	59.9
Trinidad & Tobago	157.0	...	199.7	162.5	166.7	159.0	162.1	166.8	180.2	194.3	213.4	229.4

Source: United Nations Statistics Division (UNSD).

Key:
[1] Including commercial vehicles.
[2] World Automotive Market Report, Auto and Truck International (Illinois).
[3] Including vehicles operated by police or other governmental security organizations.
[4] Excluding government vehicles.
[5] Number of licensed vehicles.
[6] Including taxis only.

Figure 11.1. No. of passenger cars in 1990 and 1997

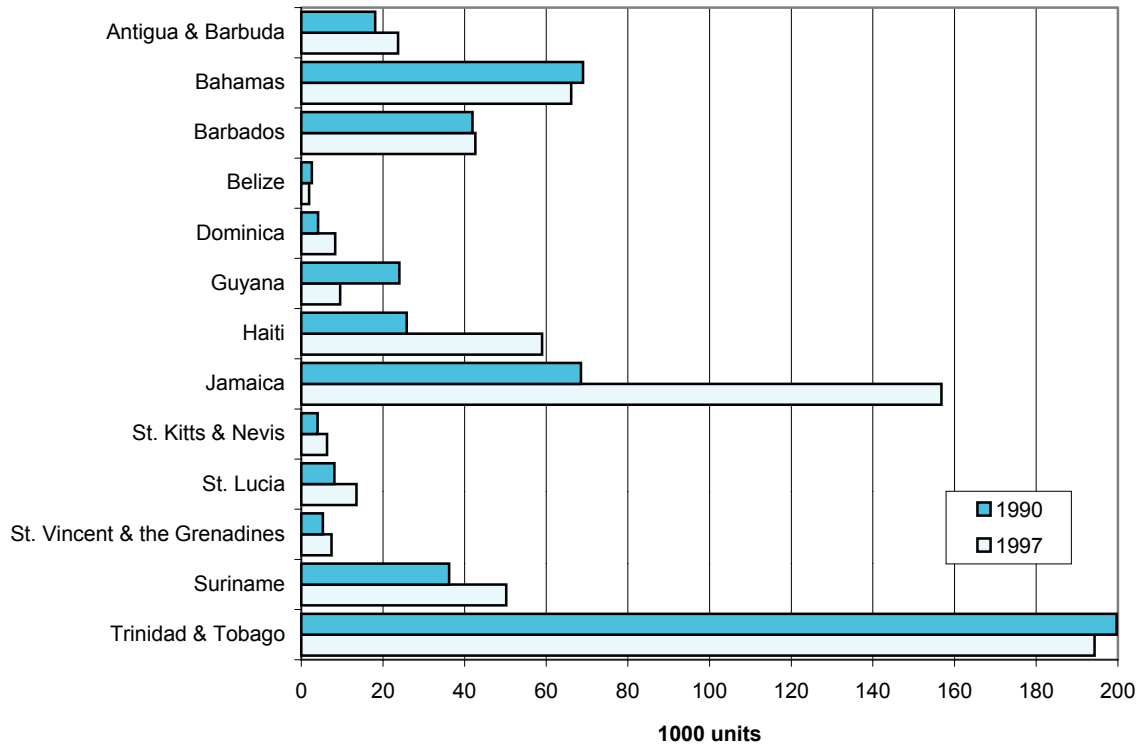


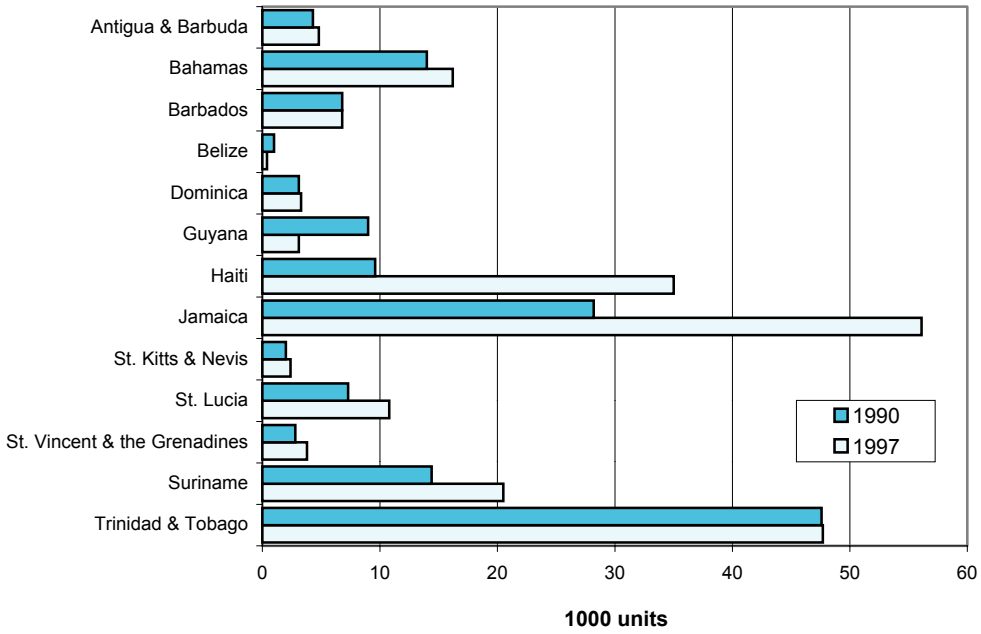
Table 11.7. Number of commercial vehicles in use (1000 units)

	1980	1985	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999
Antigua & Barbuda	...	2.0	4.3	3.8	3.5	4.6	4.8	4.8	...	...	...	...
Bahamas	8.0	8.5	14.0[1]	14.0[1]	11.5[1]	11.9[1]	9.3	13.7	12.7[1]	16.2[1]	...	...
Barbados	...	4.8[2/3]	6.8[2/3]	8.6[2/3]	6.6[2/3]	6.6[2/3]	6.8[2/3]	...	...	...	...	...
Belize	...	...	1.0[4/5]	1.2[4/5]	0.3[6/5]	0.4[6/5]	0.4[6/5]	0.4[6/5]	0.4[6/5]	0.4[6/5]	0.5[6/5]	...
Dominica	0.9[7]	1.0[7]	3.1[7]	3.4[7]	2.8[7]	2.7[7]	2.8[7]	2.9[7]	3.3[7]	3.3[7]	3.4[7]	...
Guyana	...	11.7[1]	9.0[1]	9.0[1]	9.0[1]	2.6[1]	2.7[1]	2.9[1]	3.0[1]	3.1[1]	...	...
Haiti	10.1	10.7	9.6	21.0	21.0	21.0	30.0	29.0	35.0	...	...	61.6
Jamaica	...	26.1	28.2	29.8	30.5	36.2	41.3	49.1	52.8	56.1	...	...
St. Kitts & Nevis	1.0	1.5	2.0	2.7	2.3	2.4	2.4	2.3	2.5	2.4	2.9	3.9
St. Lucia	2.7	3.7	7.3	8.4	9.3	10.5	9.5	...	10.8	...	...	...
St. Vincent & the Grenadines	1.2	2.0	2.8	2.8	2.0	3.1	3.2	3.7	3.2	3.8	4.1	3.9
Suriname	10.8	12.8	14.4	15.5	16.0	18.2	17.9	17.3	19.5	20.5	21.1	22.5
Trinidad & Tobago	49.1	...	47.6	39.4	40.8	39.2	40.2	42.2	44.9	47.7	51.1	53.9

Source: United Nations Statistics Division (UNSD).

Key:
[1] World Automotive Market Report, Auto and Truck International (Illinois).
[2] Including vehicles operated by police or other governmental security organizations.
[3] Including jeeps.
[4] Excluding government vehicles.
[5] Number of licensed vehicles.
[6] Including buses only.
[7] Including large public service excavators and trench diggers.

Figure 11.2. No. of commercial vehicles in 1990 and 1997



Comments

Note that only taxis are included in the passenger car figures given for Belize, while the figures for Guyana appear to be rough estimates, perhaps not based on recent information.

The highest number of motor vehicles is found in populous countries, such as Trinidad & Tobago and Jamaica, as well as in The Bahamas, Barbados, Haiti and Suriname. Haiti and Jamaica show a rapid growth of both private and commercial vehicles in the last ten years.

CHAPTER 12

AIR

OVERVIEW

Air pollution affects both the state of the environment and human health at the local, regional and global level. The most important concerns relate to the greenhouse effect, the depletion of the ozone layer, acidification, the formation of ground level ozone and decreasing local air quality, especially in cities.

Greenhouse gases, such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), have a direct impact on the atmospheric temperature. The emissions of greenhouse gases have significantly increased in recent decades, primarily as a result of human activities. Consequently, the natural temperature has been altered, leading to a slight warming in global climate.

The combustion of fossil fuels and industrial activities are the main sources of CO_2 emissions, while the consumption of natural gas, livestock management (enteric fermentation), rice fields and sewage treatment cause CH_4 emissions. N_2O is released from the combustion of fossil fuels, industrial processes, sewage treatment, and the use of nitrogenous fertilizers.

Although not large contributors to *greenhouse gas emissions*, the CARICOM Member States are impacted by global climate change. Most States are particularly vulnerable to climate change, changing weather conditions and sea level rise. As their population, agricultural land and infrastructure tend to be concentrated in the coastal zone, any sea level rise will have a significant impact on their economies and living conditions. In addition to this, sea level rise can damage infrastructure, human settlements, coral reefs, vegetation, fisheries and freshwater resources.

The United Nations Framework Convention on Climate Change, one of the major outcomes of the Rio conference in 1992, set targets for signatories to stabilize CO_2 emissions to the 1990 level and later on, the Kyoto Protocol agreed to reduce emissions of the greenhouse gases by five per cent by 2008-2012. None of the CARICOM Member States are signatories to the Convention.

The *consumption of ozone depleting substances* (ODS) has a harmful impact on the atmosphere. ODS comprise chlorofluorocarbons (CFCs), bromofluorocarbons (halons), methyl chloroform, carbon tetrachloride, methyl bromide, and hydrochlorofluorocarbons (HFCFCs) and are used mainly in air conditioning, refrigeration equipment, foams, aerosols and fire extinguishers, and as solvents. The release into the atmosphere of ODS destroys the stratospheric ozone layer, which provides a shield against harmful solar ultraviolet radiation (UV-B) by absorbing most of this biologically damaging radiation. Without the filtering action of the ozone layer, more UV-B radiation can penetrate the atmosphere, with profound effects on human health, such as increased sunburn that can lead to skin cancer, depression of the immune system, and an increased risk of developing cataracts.

Under the auspices of UNEP, the Vienna Convention on the Protection of the Ozone Layer was adopted in 1985, and the Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in 1987. The Montreal Protocol aims to reduce and eventually eliminate the emissions of ODS. CFCs and halons were the first ODS to be targeted for elimination, hence they can be

considered most representative of the phase-out process under the Protocol. The phasing out of ODS, and their substitution with less harmful substances, will lead to the use of more sustainable products and the recovery of the ozone layer. Most of the CARICOM Member States are signatories to the Montreal Protocol.

There are several *other air pollutants,* such as sulphur dioxide (SO_2), nitrogen oxides (NO_x), carbon monoxide (CO), non-methane volatile organic compounds (NMVOCs) and particulate matter, which affect human health and the environment. The main sources for SO_2 and NO_x are energy consumption and transformation activities, i.e., energy production plants, industrial processes and transport. NO_x comprises mainly NO and NO_2 and contributes to the eutrophication of water bodies. SO_2 and NO_x cause acidification in the environment by transforming into sulphuric and nitric acid, and have an impact on human health through the escalation of respiratory problems. Plants are damaged by soil acidification, and water acidification impairs aquatic species. Buildings and monuments are also affected by the acid concentration in the atmosphere.

Emissions from hydrocarbons, commonly referred to as NMVOCs, result when fuel molecules in the engine do not burn or burn only partially. NMVOCs react in the presence of NO_x and sunlight to form ground-level ozone, a major component of smog. Ozone irritates the eyes, damages the lungs, and aggravates respiratory problems. A number of exhaust hydrocarbons are also toxic, with the potential to cause cancer.

CO is a product of the incomplete combustion of hydrocarbon-based fuels, and originates primarily from transportation. CO enters the bloodstream through the lungs and forms carboxyhemoglobin, a compound that inhibits the blood's capacity to carry oxygen to organs and tissues.

Particulate matter originates mainly from incomplete combustion and can be accompanied by other pollutants, such as SO_2, NO_x and heavy metals. Emissions of particulate matter affect human health and cause soiling of the material surfaces.

The local *air quality* is a result of local, regional and transboundary emissions of air pollutants. The air quality is greatly affected in congested urban areas by local activities such as transportation, industries and domestic heating. Ozone pollution, SO_x, NO_x and suspended particulate matter (SPM_{10}), with a diameter of less than 10 micrograms, are linked to respiratory diseases such as asthma.

In the CARICOM Member States, air quality is not a significant environmental issue, because of limited industrial development, size of urban areas and energy use. Measurements of air quality do not seem to be undertaken regularly in the region. If the air quality is impaired, which does occur near certain industries, it is usually a phenomenon of small geographical extension and may be evident without data. Such situations are of concern in some Member States, particularly where there are mining operations and cement production. Pollution from traffic, which is a serious problem in many parts of the world, may not be a local problem of much importance; hence it will not require measurements, even in the largest CARICOM cities.

The statistics presented in the following pages present the situation in the CARICOM region with regard to greenhouse gas emissions, consumption of ODS, other air pollutants, as well as air quality.

GREENHOUSE GAS EMISSIONS

Table 12.1. Emissions of carbon dioxide (CO_2) (Gg^1)

Emission sources:	Year	Barbados 1994	Belize 1994	Grenada 1999	Jamaica 1994	St. Lucia 1994	St. Vincent & the Grenadines 1994
1 Total mobile sources:		**257**	**313**	**52**	**1,257**	**105**	…
1.1 Road transport (gasoline, diesel,...)		257	264	…	1,208	105	…
1.2 Other mobile sources		…	38	…	49	…	…
of which: air traffic		…	12	…	8	…	…
2 Total stationary sources:		**1,657**	**225**	**83**	**7,322**	**163**	…
2.1 Public electricity and heat production		1,403	136	62	2,141	121	…
2.2 Fuel combustion		245	60	16	4,802	42	…
of which: by economic activities		193	43	6	4,216	6	…
of which: by households		13	16	10	316	…	…
2.3 Industrial processes		…	…	4	379	…	…
2.4 Use of solvents		–	–	–	–	–	…
2.5 Other stationary sources		9	29	1	–	87	…
TOTAL (mobile and stationary)		**1,914**	**538**	**135**	**8,579**	**355**	**97**

Source: National.
Key: [1] 1 Gg = 1000 metric tons.

Data also available for:
Barbados: 1990, 1997;
St. Vincent & the Grenadines: 1990, 1991, 1997.

Table 12.2. Emissions of methane (CH_4) (Gg^1)

		From mobile sources		From stationary sources			Total
	Year	Total	of which: road transport	Total	of which: energy generation	of which: fuel combustion	
Barbados	1994	…	…	85.07	…	…	85.07[2]
Belize	1994	0.03	0.03	271.48	0.09	0.10	271.51[2]
Grenada	1999	…	…	…	…	0.02	70.02[2]
Jamaica	1994	0.39	-	14.80	0.09	0.19	15.19[2]
St. Lucia	1994	0.03	…	28.64	…	…	28.67[2]
St. Vincent & the Grenadines	1994	…	…	…	…	…	0.01

Source: National.
Key: [1] 1 Gg = 1000 metric tons.
[2] of which 97-99% from waste.

Data also available for:
Barbados: 1990, 1997;
St. Vincent & the Grenadines: 1990, 1991, 1997.

Comments

The national data on the emissions of greenhouse gases show very large differences. Sometimes the actual differences between the countries seem not to explain such diverse emission quantities. Therefore, it must be assumed that the calculation methods differ between countries.

Definitions and data origin

There are two sources for the data on CO_2 emissions in tables 12.3 and 12.4. The first one is the Carbon Dioxide Information Analysis Center (CDIAC) of the Oak Ridge National Laboratory, Oak Ridge, Tennessee, U.S.A. The CDIAC estimates of CO_2 emissions are derived primarily from UNSD energy statistics on the consumption of liquid and solid fuels and gas consumption and flaring, and from cement production estimates from the Bureau of Mines of the U.S. Department of Interior. The emissions presented in the table are in units of 1,000 metric tons of CO_2.

Relative to other industrial sources for which CO_2 emissions are estimated, statistics on gas flaring activities are sparse and sporadic. In countries where gas flaring activities account for a considerable proportion of the total CO_2 emissions, the sporadic nature of gas flaring statistics may produce spurious or misleading trends in national CO_2 emissions over the period covered by the table.

The second source of data is the Latin American Energy Organization (OLADE), based in Quito, Ecuador. The calculation of OLADE's emissions data was based on the IPCC Guidelines on National Greenhouse Gas Inventories."

Table 12.3. Emissions of carbon dioxide (CO_2) (1000 metric tons)

	1981	1983	1985	1987	1989	1991	1993	1995	1997
Antigua & Barbuda	106	66	250	275	286	289	304	322	337
Bahamas	2,804	2,019	1,512	1,424	1,949	1,781	1,715	1,729	1,740
Barbados	686	686	844	943	991	1205	1114	828	898
Belize	184	172	191	228	301	359	377	377	388
Dominica	37	40	48	48	59	59	62	81	81
Grenada	59	62	66	81	110	121	143	169	183
Guyana	1,751	1,218	1,406	1,299	1,185	1,114	1,048	934	1,022
Haiti	767	899	943	914	1,039	997	663	909	1,389
Jamaica	7,421	6,452	5,050	5,384	6,734	8,167	8,413	9,541	10,728
Montserrat	18	22	26	29	33	33	37	44	48
St. Kitts & Nevis	55	51	51	55	66	73	84	95	103
St. Lucia	92	103	125	143	161	161	172	191	198
St. Vincent & the Grenadines	37	40	66	77	77	77	103	128	132
Suriname	2,030	1,376	1,596	1,762	1,857	2,100	2,125	2,147	2,110
Trinidad & Tobago	17,069	16,163	20,680	17,477	16,144	20,574	16,759	20,816	21,966

Source: Carbon Dioxide Information Analysis Center (CDIAC).

Table 12.4. Emissions of carbon dioxide (CO_2) (Gg[1])

	1970	1975	1980	1985	1990	1995	1998	1999
Barbados	329	401	598	685	881	876	978	1,048
Grenada	40	46	52	67	112	158	195	202
Guyana	1,520	1,796	1,781	1,422	1,172	1,518	1,669	1,706
Haiti	403	441	676	859	957	980	1,360	1,456
Jamaica	7,431	7,513	6,819	4,977	7,625	9,383	10,581	10,682
Suriname	1,934	1,942	2,250	1,610	1,756	2,090	2,144	2,158
Trinidad & Tobago	6,726	5,531	7,375	9,708	11,651	13,496	17,600	20,587

Source: Latin American Energy Organization (OLADE).
Key: [1] 1 Gg = 1000 metric tons.

Comments

The emissions of CO_2 and other greenhouse gases from the CARICOM Member States are quite small, and the pressure produced on the global level is small. This is partly the effect of the small populations. Although not reflected in the data, another important factor in this regard is the existence of large forests in Belize, Guyana and Suriname, which absorb CO_2 and more than make up for the emissions. These countries are known as CO_2 sinks and help to improve the global situation. The highest CO_2 emissions come from Trinidad & Tobago and Jamaica; they are mainly the result of oil refining and petrochemical industry in the former, and mining activities in the latter, in addition to high vehicular emissions.

CONSUMPTION OF OZONE DEPLETING SUBSTANCES

NATIONAL DATA ON OZONE DEPLETING SUBSTANCES

Reports received from Barbados, Belize, Jamaica, and St. Vincent & the Grenadines appear to correspond to the data in tables 12.12 and 12.13. In the national reports, the quantities are usually given in metric tons rather than ozone depleting potential (ODP) tons.

Definitions and data origin

Data are provided to UNEP's Ozone Secretariat by the reporting Parties to the Montreal Protocol on Substances that Deplete the Ozone Layer. The data on CFCs and halons in the tables are shown in ODP tons that are calculated by multiplying the quantities in metric tons, reported by the Parties by the ODP of that substance, and added together.

Consumption is defined as production plus imports, minus exports of controlled substances. Feedstocks are exempt and are therefore subtracted from the imports and/or production. Similarly, the destroyed amounts are also subtracted. Negative numbers can occur when destruction and/or exports exceed production plus imports, implying that the destruction and/or exports are from stockpiles.

Table 12.5. Consumption of chlorofluorocarbons (CFCs) (ODP tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Antigua & Barbuda	421	428	429	426	12	12	10	10	26	-2	5
Bahamas	*	*	1	66	68	70	72	53	55	54	66
Barbados	21	25	21	30	35	25	22	17	22	17	8
Belize	*	*	*	*	*	16	11	20	25	25	9
Dominica	*	*	*	1	1	1	2	2	2	1	N.R.
Grenada	*	*	*	4	4	7	5	7	4	N.R.	N.R.
Guyana	19	17	23	59	42	91	41	28	29	40	24
Jamaica	424	350	464	66	49	82	91	107	199	210	60
St. Kitts & Nevis	*	*	6	5	5	4	3	4	2	3	N.R.
St. Lucia	*	*	*	11	8	8	8	8	6	3	N.R.
St. Vincent & the Grenadines	*	*	*	*	*	2	1	2	2	N.R.	N.R.
Trinidad & Tobago	138	116	104	97	109	111	114	135	156	82	101

Source: United Nations Environment Programme (UNEP).
Key: * Parties have not reported and were not required to report data.
N.R. (not reported): Parties are required to report but have not done so.

Table 12.6. Consumption of halons (ODP tons)

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Antigua & Barbuda	2	0	2	0	0	0	0	0	0	0	0
Bahamas	*	*	1	0	0	0	0	0	0	0	0
Barbados	5	3	3	7	0	0	0	0	0	0	0
Belize	*	*	*	*	*	0	0	0	0	26	17
Guyana	0	0	0	0	0	0	0	0	0	0	0
Jamaica	3	13	14	3	32	0	3	0	0	0	0
St. Kitts & Nevis	*	*	0	0	0	0	0	0	0	0	N.R.
St. Lucia	*	*	*	1	1	0	0	0	0	0	N.R.
Trinidad & Tobago	57	51	31	17	45	46	47	47	47	5	N.R.

Source: United Nations Environment Programme (UNEP).
Key: * Parties have not reported and were not required to report data.
N.R. (not reported): Parties are required to report but have not done so.

Comments

The consumption of CFCs shows downward trends in all the CARICOM Member States. In most countries, the decrease is fairly slow. The enormous reductions registered for Antigua & Barbuda, between 1993 and 1994, and for Jamaica, between 1992 and 1993, might be due to a change in technology for refrigerators and air conditioning equipment, although similar changes must have occurred in all the countries.

The reported consumption of halons is nil or less than half an ODP ton in most of the Member States. The only exceptions are Trinidad & Tobago, Jamaica and Belize.

OTHER AIR POLLUTANTS

Table 12.7. Emissions of sulphur dioxide (SO_2) in 1994 (Gg^1)

	From mobile sources		From stationary sources			Total
	Total	of which: road transport	Total	of which: energy generation	of which: fuel combustion	
Barbados	…	…	…	…	…	0.18
Belize	0.31	0.31	0.23	-	0.23	0.54
Jamaica	2.11	1.65	97.57	28.50	68.25	99.70
St. Vincent & the Grenadines	…	…	…	…	…	0.30

Source: National.
Key: [1] 1 Gg = 1000 metric tons.

Data also available for:
Barbados: 1990, 1997:
St. Vincent & the Grenadines: 1990, 1991, 1997.

Table 12.8. Emissions of nitrogen oxides (NO_x) in 1994 (Gg^1)

	From mobile sources		From stationary sources			Total
	Total	of which: road transport	Total	of which: energy generation	of which: fuel combustion	
Barbados	…	…	…	…	…	0.09[2]
Belize	1.58	1.37	4.02	1.10	0.16	5.60
Jamaica	12.13	11.30	18.73	5.66	13.03	30.86
St. Lucia	0.94	0.94	0.47	0.33	0.08	1.41
St. Vincent & the Grenadines	…	…	…	…	…	0.40

Source: National.
Key: [1] 1 Gg = 1000 metric tons.
[2] This figure appears not to include road traffic.

Data also available for:
Barbados: 1990, 1997;
St. Vincent & the Grenadines: 1990, 1991, 1997.

Table 12.9. Emissions of non-methane volatile organic compounds (NMVOCs) in 1994 (Gg^1)

	From mobile sources		From stationary sources			Total
	Total	of which: road transport	Total	of which: energy generation	of which: fuel combustion	
Barbados	…	…	…	…	…	0.83
Belize	2.38	2.09	1.60	0.14	0.00	3.98
Jamaica	20.02	19.90	14.87	0.14	7.26	34.89
St. Lucia	10.84	10.84	2.04	…	…	12.88
St. Vincent & the Grenadines	…	…	…	…	…	0.66

Source: National.
Key: [1] 1 Gg = 1000 metric tons.

Data also available for:
Barbados: 1990, 1997;
St. Vincent & the Grenadines: 1990, 1991, 1997.

Definitions and data origin

The data in tables 12.10 - 12.13 have been compiled by OLADE, based in Quito, Ecuador. The calculation of OLADE's emissions data was based on the "IPCC Guidelines on National Greenhouse Gas Inventories."

Table 12.10. Emissions of sulphur oxides (SO_x) (Gg^1)

	1970	1975	1980	1985	1990	1995	1998	1999
Barbados	1.4	1.2	3.7	4.7	5.9	6.0	6.1	6.3
Grenada	0.1	0.1	0.1	0.1	0.2	0.2	0.3	0.3
Guyana	11.8	12.7	11.7	9.4	6.5	7.3	7.0	7.2
Haiti	1.8	1.7	2.6	3.4	2.9	1.6	3.1	2.7
Jamaica	64.4	63.7	64.2	33.4	63.7	54.6	58.6	58.9
Suriname	14.2	12.5	14.4	11.4	13.3	17.1	17.3	17.4
Trinidad & Tobago	18.9	23.1	26.2	38.6	34.7	39.5	48.8	67.1

Source: Latin American Energy Organization (OLADE).
Key: [1] 1 Gg = 1000 metric tons.

Table 12.11. Emissions of nitrogen oxides (NO_x) (Gg^1)

	1970	1975	1980	1985	1990	1995	1998	1999
Barbados	1.9	2.4	3.2	3.7	4.7	4.8	6.0	6.5
Grenada	0.2	0.2	0.3	0.4	0.6	0.8	1.0	1.1
Guyana	11.3	15.2	15.7	12.4	10.9	15.4	18.0	18.4
Haiti	2.3	2.8	4.2	5.3	6.5	6.7	8.6	9.2
Jamaica	38.0	36.1	26.7	42.0	33.6	93.0	101.5	102.2
Suriname	19.0	20.1	25.0	8.6	8.9	9.9	10.2	10.3
Trinidad & Tobago	34.3	34.7	47.2	59.4	60.0	66.3	81.1	95.9

Source: Latin American Energy Organization (OLADE).
Key: [1] 1 Gg = 1000 metric tons.

Table 12.12. Emissions of non-methane volatile organic compounds (NMVOCs) (Gg^1)

	1970	1975	1980	1985	1990	1995	1998	1999
Barbados	0.76	2.71	7.89	8.49	3.36	2.08	0.86	0.88
Grenada	0.01	0.01	0.04	0.02	0.04	0.06	0.08	0.09
Guyana	0.49	0.53	0.59	0.45	0.45	0.54	0.56	0.58
Haiti	0.05	0.07	0.10	0.56	0.19	0.15	0.32	0.27
Jamaica	1.09	1.49	0.85	2.04	4.60	5.58	6.21	6.26
Suriname	1.09	1.04	1.40	0.31	0.53	0.55	0.58	0.59
Trinidad & Tobago	50.22	29.29	43.34	74.6	79.13	118.18	111.49	12.07

Source: Latin American Energy Organization (OLADE).
Key: [1] 1 Gg = 1000 metric tons.

Table 12.13. Emissions of carbon monoxide (CO) (Gg^1)

	1970	1975	1980	1985	1990	1995	1998	1999
Barbados	11	12	15	16	21	22	26	28
Grenada	2	2	3	3	4	6	8	9
Guyana	18	23	24	21	22	30	34	35
Haiti	9	12	17	16	23	25	35	35
Jamaica	71	86	67	71	90	143	178	180
Suriname	14	15	21	21	26	25	27	27
Trinidad & Tobago	61	76	113	143	128	111	128	137

Source: Latin American Energy Organization (OLADE).
Key: [1] 1 Gg = 1000 metric tons.

Comments

NO_X is the most difficult pollutant to reduce in air emissions. Its main sources in the CARICOM Member States are various kinds of combustion: oil refining, electricity production from petroleum products and emissions from vehicles. Jamaica and Trinidad & Tobago have the highest emissions of NO_X.

The emissions of SO_2 show a declining trend in several countries. The reason may well be the decreasing amount of sulphur in petroleum products. However, the increase in Trinidad & Tobago is caused by the expansion of the oil industry.

NMVOCs are the common names of a large number of pollutants with varying toxic effects. Some of them are carcinogenous, and most can produce ozone in favourable conditions that may harm human beings, animals and plants. The data show a dramatic reduction in the emissions of hydrocarbons for Barbados and Trinidad & Tobago. Jamaica shows a growth, albeit on a fairly low level.

The CO emissions show an increasing pattern in all the countries represented. This indicates that the combustion of vehicle fuel, as well as fuelwood and charcoal, is increasing.

AIR QUALITY

AIR QUALITY MEASUREMENTS

Air quality data were only received from ***Jamaica*** which reports data from a series of measurements made during five months in 1998 at 19 stations in the Kingston area. The average of 8-hour values for CO concentration was 0.98 $\mu g/m^3$. For SO_2, the average of 8-hour values from the same stations was 39 $\mu g/m^3$, and for SPM_{10}, 69 $\mu g/m^3$.

CHAPTER 13

WASTE

OVERVIEW

The generation of waste is intimately linked to the level of economic activity in a country where wealthier economies tend to produce more waste. As economies in the CARICOM region grow and prosper, there will be an increase in the amount of waste that is generated and that needs to be disposed. The shortage of land areas and resources available for the safe disposal of wastes, population growth, the growing tourism industry, and the increase in imports of polluting and hazardous substances combine to make pollution prevention and waste management a critical issue in most of the Member States of the region. Point source pollution from industrial wastes and sewage, inappropriately located and poorly managed solid waste disposal sites, and the inadequate disposal of toxic chemicals are significant contributors to marine pollution and coastal degradation.

Given that long-term disposal options are limited and will constrain sustainable development, the Member States need to expand the amount of waste disposed of through alternative ways, such as reuse and recycling. Although small islands in the region need to recycle as much of their waste as possible, most of them do not produce enough plastic, glass or paper to run an economic recycling facility. Some companies import waste from other countries in the region, for example, Carib Glassworks in Trinidad, which started recycling 51 years ago. It imports broken glass or cullet from several CARICOM Member States, as well as some from the United States.

The generation of hazardous wastes, including wastes that are toxic, poisonous, explosive, corrosive, flammable, ecotoxic and infectious, is an important concern worldwide. When such wastes are dumped indiscriminately, spilled accidentally or managed improperly, they can cause health problems to humans, plants or animals, or poison water and land. The Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal was adopted in 1989, and entered into force on May fifth, 1992. This global environmental treaty strictly regulates the transboundary movements of hazardous wastes. It provides obligations to its Parties to ensure that such wastes are managed and disposed of in an environmentally sound manner.

In the CARICOM region, there is growing concern about the transboundary movement of toxic and hazardous waste, including the use of some Member States for the disposal of waste generated by other countries. Most of the Member States depend on a marine and limited terrestrial resource base that makes them highly vulnerable to contamination by toxic and hazardous wastes and chemicals, and radioactive materials. Although most of the CARICOM Member States are parties to the Basel Convention, data on the generation, exports and imports of hazardous wastes were not available from the Convention. The passage of ships carrying toxic and hazardous wastes, chemicals and radioactive materials is of international concern and of priority concern for the CARICOM region.

Although difficult to obtain full regional coverage, the most important indicators to measure waste issues presented in the following table include the generation of waste by type and sector, as well as the disposal of waste by type of method.

Table 13.1. Waste generation (weight or volume)

			Waste generated by:			Disposal method			
	Year	Unit (000)	economic activities	house-holds	total	Landfill	Incineration	Recycling	Hazardous waste
Belize[1]	1997	metric tons	524	39	563	334	36	192	…
	1998	metric tons	525	…	…	287	38	200	…
	1999	metric tons	561	…	…	236	63	262	0.7
Grenada[2]	2000	metric tons	…	24	…	…	…	…	…
Guyana[3]	1995	metric tons	12	31	43	60	1	0	…
	1998	metric tons	13	34	47	67	1	0	…
	2000	metric tons	16	41	57	81	1	1	…
Jamaica	1995	metric tons	239	358	597	…	…	…	0.4
	1999	metric tons	…	…	945	…	…	…	0.2
St. Lucia	1998	cu. m.	59	114	202[4]	…	…	…	…
	1999	cu. m.	98	138	260[4]	…	…	…	…
	2000	cu. m.	107	135	263[4]	…	…	…	…
St. Vincent & the Grenadines	2000	cu. m.	16	11	27	…	…	…	…

Source: National.
Key: [1] 76% of the industrial waste comes from the sugar industry, 22% from the citrus industry.
[2] Generated waste does not include construction and demolition waste, etc., while disposal figures may include such waste.
[3] Totals include green waste: 29,000 cu. m. (1998), 24,000 cu. m. (1999) and 21,000 cu. m. (2000).

Data also available for Guyana: 1996, 1997, 1999.

Comments

If the waste quantity is calculated per person and day, the household waste generation in Belize is found to be about 0.45 kg/day per person in 1997. Grenada reports 0.7 kg/day per person (2000), Jamaica 0.38 kg/day per person (1995), and St. Vincent & the Grenadines 0.27 litres/day per person. The quantities are given as volumes in the data from St. Vincent & the Grenadines.

The generation rate in comparable countries is about 0.6-1.2 kg/day per person of household waste, with more affluent countries generating more waste. The reported amounts are considerably below this rate.

A considerable amount of agricultural waste is generated, for example in the case of Belize, but can often be used for energy production or compost.

CHAPTER 14

NATURAL AND ENVIRONMENTAL DISASTERS

OVERVIEW

The CARICOM region is prone to both natural and environmental disasters. *Natural disasters* are those which impact negatively on man and are caused by the physical environment, that is, extraneous to human action. Specific hazards that may result in natural disaster include atmospheric, seismic, volcanic, geologic and hydrological hazards. *Environmental disasters* are those caused by man-made phenomena and include oil spills, pollution and chemical contamination. In this publication, the distinction between natural and environmental disasters is recognized. Data on environmental disasters were not available, however, so the chapter focuses on data on natural disasters.

The region has had a long history of natural disaster experience associated with hazards, such as hurricanes, floods, earthquakes, volcanic eruptions, landslides and droughts. In the period 1910-1930, north Atlantic hurricanes averaged 3.5 per year, increasing to an average of 6.0 per year during the period 1944-1980. Within recent times, some of the more severe hurricanes have been experienced, including Hurricanes Frederick, Gilbert and Andrew. Earthquakes and volcanic activity have also been a historical feature within the region, exampled by the Jamaica earthquakes (1692, 1907), and volcanic eruptions in St. Vincent & the Grenadines (1812, 1902, 1979).

Disasters occur frequently and are extremely detrimental; hence, they are among the main causes of environmental degradation in the CARICOM region. Likewise, poor environmental management practice is a significant factor, contributing to disasters, particularly in the case of removal of vegetation cover and its exacerbation of flood events. Natural hazards affecting the region are mainly geological and hydro-meteorological.

Geological hazards are prevalent along the margins of the Caribbean plate that renders many territories susceptible to seismic hazards. These include earthquakes, volcanic activity and possible tsunami threats from the underwater volcano, Kick-em-Jenny. Located nine kilometres north of the island of Grenada and approximately 150 metres beneath the sea surface, a tsunami generated by Kick-em-Jenny could affect many nearby islands, since travel times are estimated at less than ten minutes.

Of the hydro-meteorological hazards, hurricanes have the potential to be the most devastating, but floods are the most commonly occurring hazard. Most of the Member States in the region lie within the hurricane belt and are particularly vulnerable to such disasters. Hurricanes are expected every year, usually during the months of June to October, and the accompanying floods and landslides will often cause more damage than the winds and waves brought by the hurricane. Floods and landslides also occur without storms. Drought has emerged as a hazard, particularly in association with the El-Nino phenomenon, and has significant impacts on agriculture, the economic base of many of the region's countries. As a result of small size, narrow resource bases and limited diversification of economies, very large segments of the population may be affected by natural disasters.

In 1991, the Caribbean Disaster Emergency Response Agency (CDERA), an inter-governmental regional disaster management

organisation, was established, with its headquarters in Barbados. CDERA is the central disaster management organization within the region, and its main function is to make an immediate and coordinated response to any disastrous event affecting any participating Member State, once the State requests such assistance. While CDERA's mandate originally focussed primarily on disaster response, much of its day-to-day work embraces all aspects of the Disaster Management Cycle (prevention, preparedness, mitigation, response, recovery and restoration). Through a Comprehensive Disaster Management (CDM) strategy, attempts are currently being made to formalise this work by strengthening CDERA to fulfil a broadened CDM mandate.

CDM is the integrated management of all natural and human-induced hazards, involving management through all phases of the Disaster Management Cycle. CDM engages the public and private sectors, civil society, urban and rural communities, and the general population in hazard-prone areas. Therefore, it is multi-hazard and multi-sectoral in its application and is concerned primarily with integrating vulnerability assessment and risk reduction into development planning and management. As such, a natural linkage exists between CDM and environmental issues; therefore, environmental assessments, which are increasingly the norm for development activities of all sectors, should incorporate hazard and risk considerations.

NATURAL DISASTERS

Natural disasters since 1990

BARBADOS reports over 20 events since 1990. The most common are floodings and tropical storms and waves. Hurricane Marilyn struck in September 1995.
BELIZE reports hurricane Keith in September 2000, with 2 persons dead, over 57,000 persons affected and damages estimated at 280 million US$.
GRENADA reports a tropical storm in 1990, and a storm surge in 1999. For the latter, the damages are estimated at 5.5 million US$.
JAMAICA has had 16 major flooding events since 1994. The biggest damage at one event was estimated at almost 10 million US$ (on 1st January 1998). The average damage is 1.2 million US$. Two drought episodes and two large landslides are also reported, all in 1997-1999.
ST. VINCENT & THE GRENADINES reports rains and storms during most of the years 1990-1996, with the heaviest damage estimated at 0.3 million US$. Hurricane Lenny in 1999 caused damages for over 3.5 million US$. There have not been any casualties in the time covered.

Definitions and data origin

The data in table 14.1 have been obtained from the Centre for Research on the Epidemiology of Disasters (CRED), which was established in 1973, as a non-profit institution in Belgium. CRED became a WHO Collaborating Centre in 1980, and has expanded its support of the WHO Global Programme for Emergency Preparedness and Response.

The definitions of terms used in the table are from the International Agreed Glossary of Basic Terms Related to Disaster Management (1992) United Nations Department of Humanitarian Affairs (UN-DHA), International Decade for Natural Disaster Reduction (IDNDR), Geneva, and are as follows: **Disaster**: a situation or event which overwhelms local capacity, necessitating a request to national or international level for external assistance. **Killed**: persons confirmed as dead, and persons missing and presumed dead. **Injured**: people suffering from physical injuries, trauma or an illness requiring medical treatment as a direct result of a disaster. **Homeless**: people needing immediate assistance in the form of shelter. **Affected people**: people requiring immediate assistance during a period of emergency, i.e., requiring basic survival needs such as food, water, shelter, sanitation and immediate medical assistance. **Total affected**: people that have been injured, affected and left homeless after a disaster.

Table 14.1. Natural disasters (1990 - 1999)

	Type of disaster	Name of disaster	Year	Killed	Injured	Homeless	Affected people	Total affected	Damage US$ ('000s)
Antigua & Barbuda	Hurricane	Gustav	1990	…	…	…	…	...	…
	Hurricane	Luis	1995	2	165	3,537	65,000	68,702	500,000[1]
	Hurricane	Georges	1998	2	25	2,000	…	2,025	…
	Hurricane	Jose	1999	1	18	516	2,000	2,534	…
	Hurricane	Lenny	1999	...	...	923	2,500	3,423	…
Bahamas	Tropical storm	Arthur	1990	…	…	…	…	...	…
	Hurricane	Andrew	1992	4	…	1,700	…	1,700	250,000
	Hurricane	Floyd	1999	1	...	1,500	...	1,500	…
Barbados	Hurricane	Marylin	1995	...	…	…	…	…	…
Belize	Cold wave		1990	…	…	…	…	…	2,250
	Flood		1990	…	…	…	…	…	2,200
	Flood		1995	...	...	...	2,600	2,600	500
	Hurricane	Mitch	1998	...	…	…	60,000	60,000	…
Dominica	Hurricane	Luis	1995	1	1		3,000	3,001	64,815[1]
	Hurricane	Lenny	1999	...	...	315	400	715	…
Grenada	Tropical storm	Arthur	1990	…	…	…	1,000	1,000	…
	Hurricane	Lenny	1999	...	...	...	210	210	5,500
Haiti	Tropical storm	Arthur	1990	…	…	…	…	...	…
	Flood		1993	13	…	…	5,000	5,000	…
	Storm	Gordon	1994	1,122	…	87,000	1,500,000	1,587,000	…
	Flood		1996	...	…	…	…	…	…
	Storm		1996	40	…	115	…	115	…
	Hurricane	Georges	1998	190	29	…	12,000	12,029	80,000
	Flood		1999	13	...	50	...	50	…
Jamaica	Flood		1991	...	...	1,340	550,000	551,340	30,000
	Flood		1993	9	...	82	4,290	4,372	11,000
	Storm	Gordon	1994	4	…	…	…	…	…
	Tropical storm	Marco	1996	...	…	800	…	800	3,000
Montserrat	Hurricane	Gustav	1990	…	…	…	…	...	…
	Volcano	Chance's Peak	1995	...	…	…	5,000	5,000	…
	Volcano	Soufrière	1996	...	…	…	4,000	4,000	…
	Volcano	Soufriere	1997	32	…	…	4,000	4,000	8,000
St. Kitts & Nevis	Hurricane	Gustav	1990	…	…	…	…	...	…
	Hurricane	Luis	1995	...	...	…	1,800	1,800	197,000
	Hurricane	Georges	1998	5	…	…	10,000	10,000	…
	Hurricane	Lenny	1999	...	...	100	1,080	1,180	41,400
St. Lucia	Tropical storm	Debby	1994	4	…	150	600	750	…
	Landslide		1996	...	…	…	175	175	…
	Hurricane	Lenny	1999	...	...	200	...	200	…
St. Vincent & the Grenadines	Flood		1992	3	…	…	200	200	…
	Hurricane	Lenny	1999	...	...	...	100	100	…
Trinidad & Tobago	Tropical storm	Arthur	1990	…	…	…	1,000	1,000	…
	Tropical storm	Bret	1993	...	...	…	…	…	57
	Flood		1993	5	…	10	…	10	70
	Flood		1996	...	…	…	200	200	…
	Volcano		1997	...	…	200	…	200	…

Source: Centre for Research on the Epidemiology of Disasters (CRED).
Key: [1] Data submitted by CDERA.

Comments

All of the CARICOM Member States are vulnerable to natural disasters of many kinds, as the table shows very clearly. For every year in the 1990s, several disasters are listed. The violent volcanic eruptions in Montserrat that have occurred from 1995 to the present have crippled that country, causing an exodus of over 50 per cent of its population. It is only in the late 1990s that there has been an increase in the population to over 20 per cent, a result of returning citizens. Even though Hurricane Mitch did not pass Belize directly, a quarter of the population was still affected, mainly by flooding and damage-causing waves. The numbers become particularly large in Haiti, the most populous country in the region; but everywhere, the proportion of the population that is affected is high. Material damages are hard to estimate, particularly since many buildings are not insured, and the figures provided are unlikely to cover the full extent of the damages. In addition, true cost of damage to the country is often not assessed because of limited capacity for economic valuation of environmental and natural resources.

One caution with respect to data on damages: the time frame for data collection is important and should be indicated. Often, preliminary estimates are given very soon after the event, and then revised later after a detailed investigation. These later damage estimates are usually higher. In addition to collecting data on the type of disaster, year, affected people, etc., damage value could be broken down into productive sectors, such as tourism and agriculture.

An example of disaggregated damage value using the Economic Commission for Latin America and the Caribbean (ECLAC) Methodology for Assessing the Macroeconomic, Social and Environmental Impact of Natural Disasters, is provided in box 14.1 below for the case of Belize. Direct damage refers to damages sustained by immovable assets and inventories (damages to property, infrastructure, buildings, installations, machinery, equipment, means of transport, damage to cropland, among others). Indirect damage refers to effects on goods and services, production flows that cease to be produced or services that cease to be provided, immediately after the disaster, extending to the rehabilitation and reconstruction phase.

Box 14.1. Damage assessment of hurricane Keith by sector and damage type ('000 Bz$)[1]

Sector	Direct Damage	Indirect Damage	Total
SOCIAL SECTOR	**733,08**	**2,239**	**75,547**
Housing	68,461	160	68,621
Health	2,558	1,330	3,888
Education	2,289	749	3,038
INFRASTRUCTURE	**53,042**	**35,837**	**88,879**
Transport	46,736	33,634	80,369
Telecommunication	1,536	886	2,422
Energy & Electricity	3,115	1,117	4,233
Water and Sewerage	1,655	200	1,855
ECONOMIC SECTOR	**232,222**	**98,358**	**330,580**
Tourism	124,094	36,299	160,393
Agriculture, Livestock & Fisheries	77,469	46,889	124,358
Industry & Commerce	30,659	15,170	45,829
ENVIRONMENT	**49,051**	-	**49,051**
MISCELLANEOUS	**10,483**	**378**	**10,860**
Emergency Expenditure	-	378	378
Cost of Food	1,845	-	1,845
Cost of Services	8,581	-	8,581
Cost of Services Interrupted	58	-	58
FOREIGN ASSISTANCE	**5,176**	-	**5,176**
TOTAL	**423,281**	**136,812**	**560,094**

Source: ECLAC Estimates.
Key: [1] US$ 1 = Bz$ 2

ANNEX I

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(San Ignacio, Belize, 2 to 11 August 2000)

ANTIGUA AND BARBUDA

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GLOSSARY

Aerosol: system of solid or liquid particles suspended in a gaseous medium, having a negligible falling velocity.

Algae: simple rootless plants that grow in sunlit waters. The decomposition/breakdown of dead algae generally affects water quality adversely by reducing levels of dissolved oxygen. Algae serve as food for fish and small aquatic animals.

Apparent consumption: proxy measure for consumption of a product or material, defined as production plus imports minus exports of the product or material.

Biochemical oxygen demand (BOD): dissolved oxygen required by organisms for the aerobic decomposition of organic matter present in water.

Biodiversity: the range of genetic differences, species differences and ecosystem differences in a given area.

Biomass: total living weight (generally in dry weight) of all living organisms in a particular area or habitat. It is sometimes expressed as weight per unit area of land or per unit volume of water.

Biota: living component of an ecosystem.

Bunkers: amount of fuels delivered to ocean-going ships or aircraft of all flags engaged in international traffic. Deliveries to ships engaged in transport in inland and coastal waters, or to aircraft engaged in domestic flights, are not included.

Carbon sink: pool (reservoir) that absorbs or takes up released carbon from another part of the carbon cycle. For example, if the net exchange between the biosphere and the atmosphere is towards the atmosphere, the biosphere is the source and the atmosphere is the sink.

Carcinogen: agent that can cause or aggravate cancer, including chemicals, radiation and viruses.

Chemical oxygen demand (COD): index of water pollution measuring the mass concentration of oxygen consumed by the chemical breakdown of organic and inorganic matter.

Chlorofluorocarbons (CFCs): inert, non-toxic and easily liquefied chemicals used in refrigeration, air-conditioning, packaging and insulation, or as solvents and aerosol propellants. Because CFCs are not destroyed in the lower atmosphere, they drift into the upper atmosphere where their chlorine components destroy ozone. They are also among the greenhouse gases that may affect climate change.

Climate change: term frequently used in reference to global warming due to greenhouse gas emissions from human activities.

Coliform organism: micro-organism found in the intestinal tract of human beings and animals. Its presence in water indicates faecal pollution and potentially dangerous bacterial contamination.

Dissolved oxygen (DO): amount of gaseous oxygen (O_2) actually present in water expressed in terms

either of its presence in the volume of water (milligrams of O_2 per litre) or of its share in saturated water (percentage).

Ecosystem: system in which the interaction between different organisms and their environment generates a cyclic interchange of materials and energy.

Ecotourism: travel undertaken to witness the unique natural or ecological quality of particular sites or regions, including the provision of services to facilitate such travel.

Effluent: liquid waste product (whether treated or untreated) discharged from an industrial process or human activity that is discharged into the environment.

Endangered species: taxa in danger of extinction and whose survival is unlikely if causal factors continue operating. Included are taxa whose numbers have been drastically reduced to a critical level or whose habitats have been so drastically impaired that they are deemed to be in immediate danger of extinction. Also included are those that possibly are already extinct, in so far as they definitely have not been seen in the wild in the past 50 years.

Endemic species: species restricted to a specified region or locality.

Eutrophication: slow ageing process during which a lake or estuary evolves into a bog or marsh and eventually disappears. During eutrophication, the lake becomes so rich in nutritive compounds (especially nitrogen and phosphorus) that algae and other microscopic plant life become superabundant, thereby choking the lake and causing it to eventually dry up. Eutrophication is accelerated by discharges of nutrients in the form of sewage, detergents and fertilizers into the ecosystem.

Extinct species: species not definitely located in the wild during the past 50 years.

Feedstock: substance used for the production of other chemicals. Substances so used are completely transformed in the manufacturing process of the new chemical.

Fossil fuels: coal, oil and natural gas. They are derived from the remains of ancient plant and animal life.

Fungicide: pesticide that is used to control, prevent and destroy fungi.

Habitat: place where an organism or population (human, animal, plant, micro-organism) lives.

Hazard: threatening event, or probability of occurrence of a potentially damaging phenomenon within a given time period and area.

Hazardous wastes: wastes that, owing to their toxic, infectious, radioactive or flammable properties pose a substantial actual or potential hazard to the health of humans and other living organisms and the environment.

Herbicide: substance used to control weeds or the growth of undesirable grass or plants.

Hydrochlorofluorocarbons (HCFCs): compounds used as replacements for chlorofluorocarbons (CFCs) in refrigeration because they are less active ozone depleters.

Insecticide: substance that destroys or controls insect pests.

Mariculture: harvesting of marine organisms through ocean farming.

Methane (CH_4): colourless, non-poisonous and flammable gaseous hydrocarbon created by anaerobic decomposition of organic compounds. Methane is a potent greenhouse gas.

Nitrogen oxide (NO_x): product of combustion from transportation and stationary sources. It is a major contributor to acid depositions and the formation of ground-level ozone in the troposphere.

Nitrous oxide (N_2O): relatively inert oxide of nitrogen produced as a result of microbial action in the soil, use of fertilizers containing nitrogen, burning of timber, and so forth. This nitrogen compound may contribute to greenhouse and ozone-depleting effects.

Organic farming: farming system that avoids the use of artificial fertilizers, pesticides or herbicides and uses organic manures and organic methods of crop rotation.

Ozonosphere: lower region of the stratosphere, 15-25 kilometres above the earth's surface, in which there is an appreciable ozone concentration. It is also termed the ozone layer.

Pathogen: micro-organism that can cause disease in other organisms. It may be present in sewage, run-off from animal farms, swimming pools, contaminated shellfish and so forth.

Protected area: legally established land or water area under either public or private ownership that is regulated and managed to achieve specific conservation objectives.

Suspended particulate matter: finely divided solids or liquids that may be dispersed through the air from combustion processes.

Taxonomy: classification of fossil and living organisms according to their evolutionary relationships.

Volatile organic compounds (VOCs): organic compounds that evaporate readily and contribute to air pollution mainly through the production of photochemical oxidants.

Waste: materials that are not prime products (that is, products produced for the market) for which the generator has no further use in terms of his/her own purposes of production, transformation or consumption, and of which he/she wants to dispose. Wastes may be generated during the extraction of raw materials, the processing of raw materials into intermediate and final products, the consumption of final products, and other human activities. Residuals recycled or reused at the place of generation are excluded. *See also* biological waste, solid waste, industrial wastes *and* household waste.

Waste management: characteristic activities include (a) collection, transport, treatment and disposal of waste, (b) control, monitoring and regulation of the production, collection, transport, treatment and disposal of waste and (c) prevention of waste production through in-process modifications, reuse and recycling.

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