

# GEO

## *Latin America and the Caribbean*

### Environment Outlook

# 2000





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Produced by UNEP's GEO-LAC team (Regional Office for Latin America and the Caribbean, regional Collaborating Centres and regional Associated Centres)

United Nations Environment Programme  
Regional Office for Latin America and the Caribbean  
Division of Environmental Information, Assessment and Early Warning (DEIA&EW)  
Boulevard de los Virreyes #155, Colonia Lomas Virreyes  
11000, México DF, México

Tel.: (52) 5202-6394 y 5202-4841 - Fax: (52) 5202-0950  
E-mail: [evaluamb@rolac.unep.mx](mailto:evaluamb@rolac.unep.mx)  
Web Site: <http://www.rolac.unep.mx/evaluamb/esp/start.htm>



Editorial supervision and production:  
Development Observatory (University of Costa Rica)  
Design and publishing: Roberto and Roxana de Burgos, San José, Costa Rica  
Cover design: Adapted from Paul Sands (for the original *GEO 2000* global report)  
by Roberto and Roxana de Burgos  
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# Foreword

*At the start of the 21st century we live in a world in which much of the environment continues to be polluted, degraded and destroyed. The number of poor people is increasing in most parts of the world, including here in Latin America and the Caribbean, as is inequality both within and between countries. At the same time, there is a pattern of excessive consumption by the minority, contrasting sharply with the abject poverty of the majority.*

*The challenge that lies ahead – to put the region back on the path of sustainable development – should not be underestimated. It will require political determination, financial resources, and the full involvement and participation of all stakeholders, from large business and industrial concerns to community and neighbourhood organizations. It is a challenge that we must take up without hesitation, because to carry on with business as usual is no longer an option if we want to begin this new millennium with some hope for our children and their children.*

*Fortunately, it is not all bad news. A great deal has been achieved in the last few decades. As the Latin America and the Caribbean Environment Outlook points out, concern for the environment has grown markedly and many environmental institutions and policies have been put in place. The environment is very much on the global and national agendas, albeit only as a side issue accompanying the main agenda items of economy and development. Governments have strengthened environmental policies through institutional changes and legislation. The number of global and regional environmental agreements has increased sharply, bringing greater awareness of environmental issues. There is now more public participation than ever before in environmental management and decision-making, with citizen's groups and NGOs playing a more significant and influential role in development and conservation activities in the region.*

*Encouraging as these signs are, not enough has been achieved. The changes that have been put in place have not significantly improved the environment or slowed the pace of degradation. While policies for environmental protection and management are moving in the right direction, the pace is slow and their impact isolated. Environmental issues are still far from being integrated into mainstream thinking and policy-making. The time for treating the environment as an add-on is long gone. Better integration of environmental thinking into decision-making about the economy, agriculture, urban management and all other sectors is of the utmost importance.*

*In reaction to the steps that are still needed for the promotion of more comprehensive decision-making in the region, the Forum of Ministers of the Environment of Latin America and the Caribbean has called for support to help define a regional environmental vision and to set up the harmonized information systems needed to support decision-making. The Latin America and the Caribbean Environment Outlook report is the first step in responding to this request.*

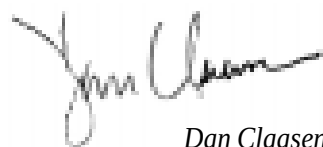
*The United Nations Environment Programme will continue to provide leadership in the region for the preparation of integrated environmental assessment reports, regional assessment information systems, and the capacity-building necessary to support these activities within the framework of the GEO process and methodology.*

*The Latin America and the Caribbean Environment Outlook report shows us that we have come a long way – but also that we still have a long way to go. UNEP will continue to work with governments and other partners in Latin America and the Caribbean to promote sustainable development and the integration of the environment into the mainstream of policy-making and action, thereby facilitating the conservation of the region's remarkable natural resources.*

*Latin America and the Caribbean Environment Outlook points the way forward. It is now up to all of us to take up the challenge and ensure that the 21st century is one in which the principle of environmental sustainability and development becomes enshrined as a mainstay of the quality of life in Latin America and the Caribbean.*

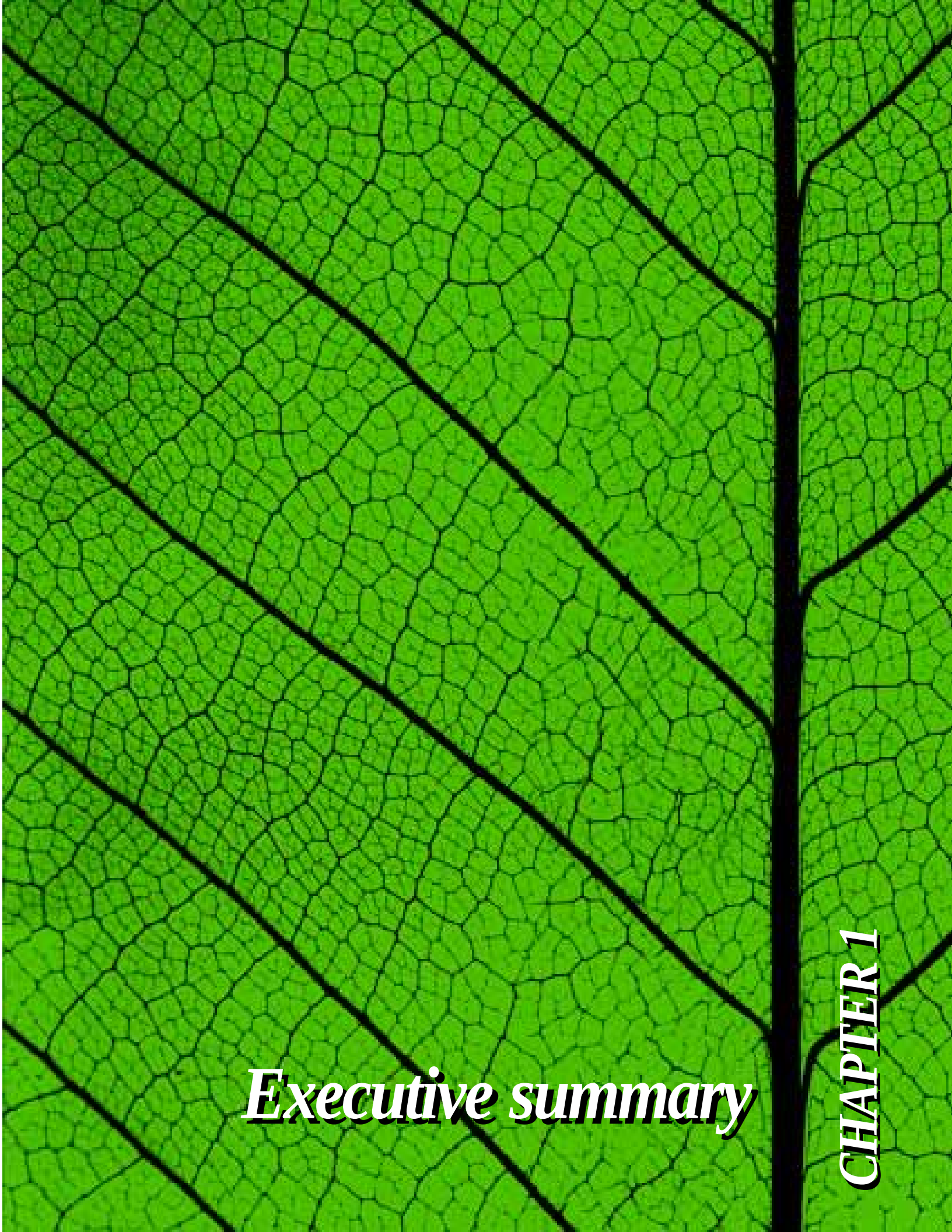


*Ricardo Sánchez  
Director  
Regional Office for Latin America  
and the Caribbean*



*Dan Claasen  
Acting Director  
Division of Environmental Information,  
Assessment and Early Warning*



A close-up photograph of a green leaf, showing a dense network of veins. The veins are dark green and form a complex, branching pattern across the lighter green leaf surface. The lighting is even, highlighting the texture of the leaf.

# ***Executive summary***

## ***CHAPTER 1***





# Executive summary

The two major causes of global environmental degradation are the continuing poverty of the majority of the planet's inhabitants and excessive consumption by the minority (UNEP 1999a). In Latin America and the Caribbean – as in other regions of the world – many socio-economic pressures have an impact on the environment. Poverty and inequality of income are doubtless among the leading ones. Others are unsustainable agriculture, industrial development and tourism, unplanned urbanization, demographic growth, and population density. Nevertheless, the countries in the region have important climatic, biophysical, geomorphological and socio-economic differences, and this diversity makes generalized environmental policy application difficult.

Three major environmental issues stand out in the region. The first concerns the region's urban areas: three-quarters of the population live in large cities where air quality threatens human health and water shortage is common. The second problem is the depletion and destruction of forest resources, mainly in the Amazon Basin, and the threat this implies in terms of biodiversity. The third issue relates to the possible regional impact of global climate change, as reflected in phenomena such as forest fires, natural disasters such as hurricanes and floods, and the rise of sea level which threatens many coastal cities in the region and productive land on island states.

During the past decade, concern for environmental issues has increased markedly and many environmental institutions and policies have been created. Nevertheless, these changes have not improved environmental stewardship significantly. Environmental management continues to concentrate on sectoral perspectives without coherent and explicit integration with economic and social strategies. The lack of financing, technology, personnel and training, and – in some cases – excessively large and complex legal frameworks, are the most common problems. Increasing environmental awareness must be reinforced through a process of environmental education and information dissemination.

Economic growth of countries in the region still relies on export growth and foreign capital inflows, regardless of the consequences for the environment and with no internalization of the environmental costs of this type of policy.

## The state of the environment

Latin America and the Caribbean have the world's largest reserves of cultivable land, but soil degradation is threatening much cultivated land and causing major productivity losses. In the worst cases, land degradation results in desertification. Total losses from desertification may be as much as US\$1 billion a year. Intensive agriculture in other areas has led to an increase in the use of agrochemicals which have major impacts on the environment.

Much of the remaining natural forest in the world is located in the region, but logging, mining and other large-scale development projects are causing increasing loss of forest cover in all countries. In the Brazilian Amazon, for example, forest fires have contributed significantly to deforestation, aggravated by severe seasonal droughts associated with the *El Niño* effect. Forest loss and biomass combustion add to carbon dioxide emissions and hence may accelerate climate change and global warming. None the less, many countries have substantial potential for curbing their contributions to the build-up of greenhouse gases, given the region's renewable energy resources and the potential of forest conservation and reforestation programmes to provide valuable carbon sinks.

The region contains 40 per cent of the plant and animal species on the planet, and is considered to have the highest diversity of flora in the world. None the less, habitat destruction is causing the extinction of many species, many of which have not yet been described by science. No systematic evaluation of habitat turnover and species depletion has been attempted, but those figures that are available suggest

a significant impact. As a whole, Latin America and the Caribbean have the second-highest number of threatened bird species (after Asia and the Pacific), the third-highest number of threatened mammal species (after Asia and the Pacific and Africa), and are ranked third in threatened marine species (after Asia and the Pacific and North America), second in threatened reptiles (after Asia and the Pacific), and second in threatened amphibians (after Asia and the Pacific). The amount of land under some kind of conservation or protection is growing, although many types of ecosystem are still under-represented or not represented at all in protected areas, and many formally protected areas lack effective mechanisms for preventing degradation.

The region is also extremely rich in water resources. With 12 per cent of the world's land area and 6 per cent of its population, Latin America and the Caribbean have around 27 per cent of the total water supply, most of it located in the Amazon Basin. However, two-thirds of the region's land is in arid or semi-arid areas. Demand for water is growing rapidly as populations and industrial activity expand and irrigated agriculture (the largest use) continues to increase. Despite the advances of the past ten years, access to safe water remains an important issue. More than 25 per cent of the population still lack an adequate water supply and sewage system. The quantity of heavy metals, synthetic chemicals and hazardous wastes from waste dumps and other sources (including river flow and seepage in agricultural areas) that percolate into the ground water appears

to be doubling every 15 years in Latin America. Using polluted water for drinking and bathing spreads infectious diseases such as cholera, typhoid and gastroenteritis.

Sixty per cent of the population in Latin America and the Caribbean live within 100 kilometres of a seashore, and 60 of the largest 77 cities lie on the coast. The marine and coastal systems of the region support a complex interaction of distinct ecosystems, with an enormous biodiversity, and are among the most productive in the world. They serve as hatcheries for commercially important fish, crustaceans and other species, they generate income from tourism, and they help protect marine species. However, the impacts of fisheries on marine biodiversity and resource sustainability are a major concern, since 80 per cent of the commercially-exploitable stocks in the south-western Atlantic and 40 per cent of those in the south-eastern Pacific are now fully fished, over-fished or depleted. In addition, land conversion for agriculture, urban development and tourism is causing degradation of coastal habitats, including mangroves, estuaries and coral reefs. Accidental spillage of hazardous materials, including oil, from ships is another major concern in this field.

The region is responsible for 4.3 per cent of the world's total carbon dioxide emissions from industrial processes, and for 48.3 per cent of emissions from land use changes. Methane emissions from anthropogenic sources represent 9.3 per cent of the world's total. The main anthropogenic source of emissions is deforestation, and Amazonia is an important natural source of methane and nitrogen oxides. In the Amazon Basin, which covers nearly 7 million square kilometres, biomass burning and the establishment of new types of vegetation cover will have significant ecological implications for the region, the continent and the planet. The production of chlorofluorocarbons (CFCs), one of the main groups of ozone depleting substances, reached 14.9 per cent of global production in 1996. Brazil, Mexico and Venezuela are among the leading developing countries in the production of CFCs.

With nearly three-quarters of the total population living in a few large cities, unplanned urbanization is generating much pressure on the region's environment, potentially worsening the general environmen-



tal problems associated with land use, marine and coastal deterioration, air quality, water use and contamination, and disposal of solid and hazardous waste. Unplanned urban growth has led to the development of outer and inner city slums, many of which lack basic services. Growing population density and economic activity have increased air pollution in cities such as Santiago, Mexico City, São Paulo and Bogotá. Treatment of water and solid waste is also problematical: less than 2 per cent of waste water is treated; 35 per cent of the treatment facilities in the region consist of sanitary landfills; 25 per cent consist of semi-controlled landfills, and 40 per cent do not comply with minimum requirements.

The two leading natural causes of disasters in Latin America and the Caribbean are tectonic activity such as earthquakes, seaquakes, and volcanic eruptions, and climatic phenomena such as hurricanes, floods, droughts and fires. However, the environmental and social impacts of these natural disasters are aggravated by a number of important anthropogenic factors – notably patterns of land use change such as deforestation, urbanization in vulnerable areas, and soil impermeability, and the weak regulatory and monitoring capacities of the institutional environment. The most severe impacts have been in countries in Meso-America and the Greater Caribbean: since 1983, these sub-regions have experienced hurricanes, volcanic eruptions, severe droughts and major floods caused by *El Niño*. Hurricanes Georges and Mitch, and recent floods in Venezuela, caused damage running into thousands of millions of dollars and the loss of thousands of lives.

## Policy responses

During the past 25 years, and especially over the past decade, domestic and international pressures have created a fight-back against environmental degradation. Environmental issues are now dealt with in the broader context of the development process and policies. Two important landmarks in this process were the United Nations Conference on the Human Environment, held in Stockholm in 1972, and the United Nations Conference on Environment and Development, held in Rio de Janeiro 20 years later. These key conferences established a body of inter-



national fora and agreements on environmental and natural resources issues, and a new approach to North–South differences. On the other hand, continuing and increasingly profound economic globalization has generated new international trading practices that have significant environmental implications.

In Latin America and the Caribbean, this process of globalization has led to the ratification and adoption of several international legal instruments and actions to strengthen environmental policies through institutional change and legal, technical and economic initiatives, both at the domestic level – governmental and non-governmental – and through sub-regional and sometimes regional co-operation agreements.

Global multilateral environmental agreements (MEAs) and non-binding instruments have increased public awareness of environmental issues and have contributed to an environmental conscience in the public and private sectors that would have been unimaginable a quarter of a century ago.

Few national institutional structures have been created specifically for the implementation of global MEAs: most countries absorb the new functions associated with implementation into existing national structures. Implementation of global MEAs at the national level has been carried out through a variety of instruments, including especially a number of specific programmes and funds that have been developed recently. A common problem with the im-

## GEO Latin America and the Caribbean and the GEO process

UNEP launched the Global Environment Outlook (GEO) Project in 1995. It has two components:

- ◆ A global environmental assessment process, the GEO process, which is cross-sectoral and participatory. It incorporates regional views and perceptions, and builds consensus on priority issues and actions through dialogue among policy-makers and scientists at regional and global levels.
- ◆ GEO outputs, in printed and electronic formats, including the GEO Report series. This series makes periodic reviews of the state of the world's environment, and provides guidance for decision-making processes such as the formulation of environmental policies, action planning and resource allocation. Other outputs include technical reports, a web site, and a publication for young people. The GEO project has published two world reports, the first in 1997 (*GEO-1*) and the second in September 1999 (*GEO-2000*). For Latin America and the Caribbean specifically, the project has published a national report on Panama (August 1999), a sub-regional report on the Caribbean (*Caribbean Environment Outlook*, September 1999) and the regional report presented in this publication.

A co-ordinated network of Collaborating Centres forms the core of the GEO process. These Centres are multidisciplinary institutions with a regional outlook, qualified for research in policy formulation. They undertake studies with the dual aims of reviewing the state of the regional and world environments and of providing guidance on planning regional and world policies and assessing progress towards sustainable development. The Centres work with a network of institutions in their region to bring together the expertise needed to cover all environmental sectors relevant to sustainable development.

The Centres in Latin America and the Caribbean that collaborate with the GEO process are:

- ◆ The Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA)
- ◆ The University of Chile (Centre for the Analysis of Public Policies)
- ◆ The University of Costa Rica (Development Observatory)
- ◆ The University of the West Indies (Centre for Environment and Development)

These Collaborating Centres are co-ordinated by UNEP's Regional Office for Latin America and the Caribbean, located in Mexico.

As the GEO process has progressed, the Collaborating Centres have played an increasingly important role in preparing regional inputs for the global GEO reports. They are currently in charge of almost all regional data, thus combining top-down integrated assessment and bottom-up environmental reporting. To promote these activities and

improve regional capacities, a training component on integrated environmental assessment and reporting has been developed within the GEO process.

A number of Associated Centres also participate in the GEO process, providing specific input to reports on the global environment and related products according to their specialized areas of expertise. The *GEO-2000* Associated Centres in Latin America and the Caribbean are:

- ◆ The Latin American Association for Environmental Law (ALDA, Mexico)
- ◆ The Earth Council (Costa Rica)
- ◆ The International Centre for Tropical Agriculture (CIAT, Colombia)

A crucial component of the GEO process is the participation of environmental policy-makers at the government level, of specialized environmental scientists, and of non-governmental representatives. Regional consultations and other consultative mechanisms are used to promote and contribute to a regular dialogue between them. These consultations help to guide the GEO process and, in the framework of the global reports on the environment, are used to review draft material and ensure that each report is geared towards policy formulation and action planning.

The two regional consultations for *GEO-2000* in Latin America and the Caribbean were:

- ◆ The regional consultation for Latin America, held in Santiago, Chile, in May 1998. The request to produce a report for the region came from this consultation, and suggested the inclusion of new issues such as environmental emergencies and natural phenomena, and their impact on the region.
- ◆ The regional consultation for the Caribbean, held in Kingston, Jamaica, in January 1999. Drafts of the first *Caribbean Environment Outlook* report (published nine months later) were reviewed in this consultation.

Specialized groups that provide advice and support also contribute directly to the GEO process. For *GEO-1* and *GEO-2000*, four working groups composed of experts from around the world helped produce reports on modelling, scenarios, policy and data.

Other United Nations agencies contribute to the GEO process by providing data and basic information on diverse environment-related issues that fall under their mandates. They do so through Earthwatch, the United Nations System-wide Programme, co-ordinated by UNEP, that articulates the United Nations system of environmental monitoring. They also help review the drafts of various GEO products.

plementation of global MEAs is the lack of adequate international financing to ensure compliance and to complement national financial efforts. In many cases, environmental programmes receive more support from bilateral or multilateral financial arrangements – which vary from country to country – than they do from the obligations established in the agreements as such.

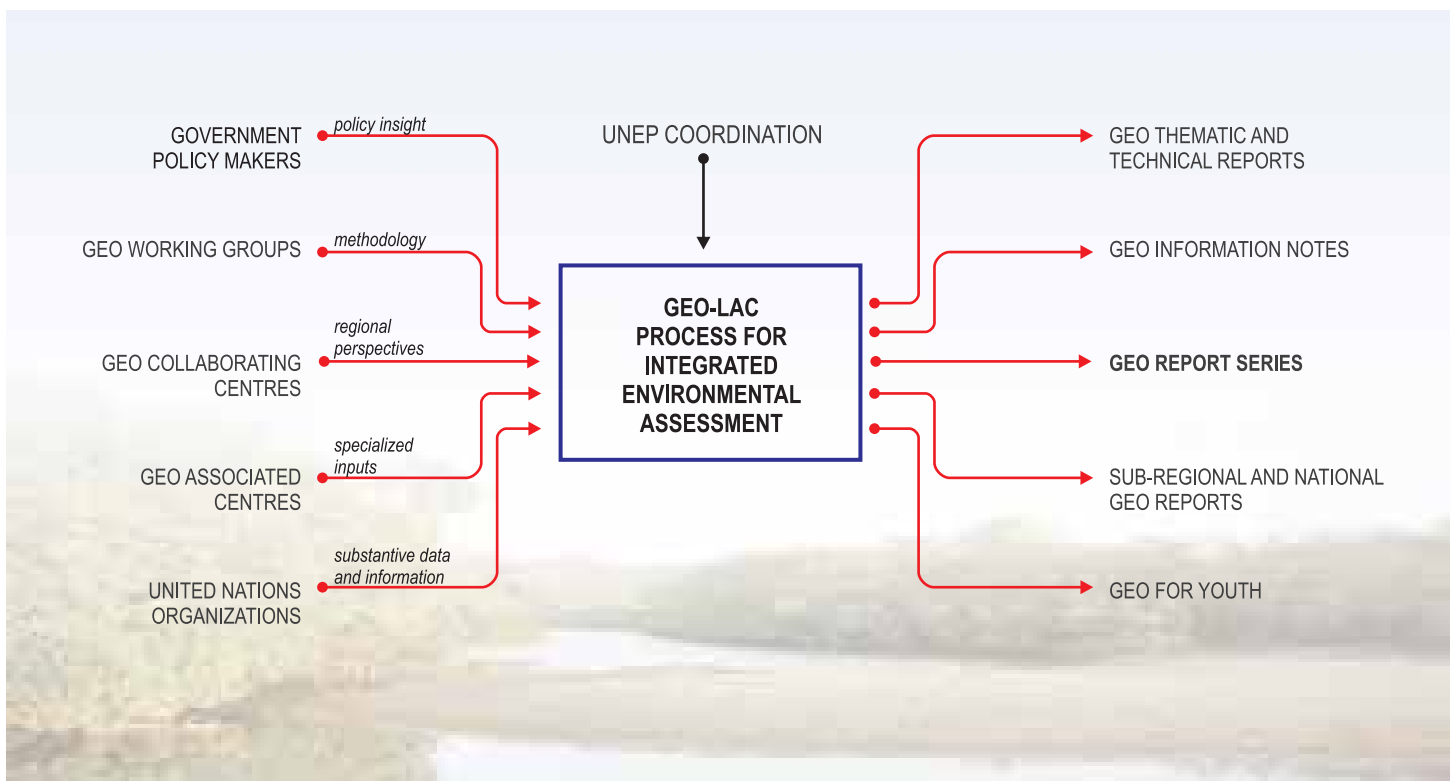
At the regional level, regional agreements often have a greater impact than global MEAs. At present, environmental agreements with a regional framework are more likely to be sub-regional and limited to a group of countries (Central America), certain regional seas (the South-east Pacific or the Greater Caribbean) or a group of ecosystems (the Amazon or Rio de la Plata river basins).

Non-binding instruments are often forerunners of binding policy instruments and have at times had a more profound effect on environmental policy than binding ones. In the context of non-binding instruments of great international significance, such as the *Rio Declaration* and *Agenda 21*, several high-level regional meetings have been held in Latin America

and the Caribbean during the past few years, mainly to review development topics, including environmental issues, from a sustainable development perspective. The Latin America and the Caribbean Forum of Environment Ministers is one of the leading regional conferences of this type. As the region's highest-ranking assembly for environmental policy-making, it plays a key role in building regional consensus on the top issues of the international environmental agenda.

Countries throughout the region have begun to adapt their legal and institutional frameworks to the new paradigm of sustainable development. A major feature is that the right to a healthy environment and the duty of environmental protection have been enshrined in constitutional law, through different processes in the different countries. Twenty out of 33 countries have enshrined the environmental issue in constitutional law. This process of constitutional and legal development has generated an important body of preventive and corrective rules and regulations as well as new institutions responsible for implementing the legislation. Among others, preventive rules and regulations include provisions on land use

## GEO-LAC project organization and outputs





zoning, assessment of environmental impact, environmental standards and audits, voluntary agreements and economic instruments. Corrective rules and regulations include administrative, civil and criminal sanctions. The Venezuelan and Brazilian environmental crimes laws, passed in 1992 and 1998 respectively, are leading examples.

Legal environmental instruments have been criticized for their lack of enforcement and compliance. In fact, rules and regulations are difficult to enforce because many institutions are unable to monitor compliance, and because systematic enforcement can have negative economic effects.

During the past five years most governments in the region have acknowledged the need to use economic environmental instruments, in part due to interest in their possible impact on sustainable development and in part due to the need to generate additional financial resources. However, the use of economic incentives is still limited, and has been directed mainly at controlling pollution and access to certain natural resources. Subsidies and tax exemptions are the most common instruments used (except in the Caribbean where the use of incentives and subsidies has not been widespread). Other successful fiscal tools include reforestation subsidies. Green taxes have also been used recently in support of environmental policies.

Systems based on fees and tariffs are more widely used as charges for the use of natural resources and for the release of contaminating emissions. Though the implementation of market instruments is often

difficult, certification and environmental auditing processes, such as ISO 14000 and agricultural and forestry 'ecolabelling', have gained importance.

Economic globalization and the development of markets sensitive to environmental issues are helping to improve the environmental quality of products and promote cleaner industrial processes. However, even if there has been a noticeable increase in the development of clean technologies in the industrialized world, transferral to the region is hindered by several barriers, including the lack of adaptation to local conditions, lack of adequate scientific and technological expertise, fear of increased competition by industrial companies in the North, and lack of funds in the South.

The lack of policy co-ordination and slow progress of economic growth and investment in the region are additional obstacles. In most countries, the environmental sector is subsidized by government funds. In recent years there has also been important support from international aid and bilateral technical co-operation programmes, aimed mainly at setting up and strengthening environmental institutions.

Despite these difficulties, public participation has grown over the past few years, reflecting the increased public awareness of the threats to the quality of life and the restoration of democracy in some countries. In many countries the new perception of the role of civil society in achieving the objectives of the Earth Summit (1992) has resulted in a close collaboration between governments, NGOs, community organizations and the private sector in setting standards and preparing environmental policies and action plans. A significant field of institutional development for public participation relates to the formation of National Sustainable Development Councils throughout the region, following recommendations of the Earth Summit. There are currently 20 of these officially formed multistakeholder councils, and the numbers are growing.

In the Summit of the Americas on Sustainable Development (Bolivia 1996), the governments of the region agreed to create an interamerican strategy for sustainable development, furthering other regional initiatives in this area.





***The state of the  
environment***

**CHAPTER 2**





# The state of the environment

## Key facts

Three major environmental issues stand out as priorities in the region. The first is to find solutions to the problems of the urban environment, which now contains nearly three-quarters of the region's population; the second is to find ways of promoting the sustainable use of tropical forests and biodiversity; and the third is the impact of climate change and the increasing frequency and severity of natural disasters.

- ◆ The income of the richest 20 per cent of the region's population is 19 times greater than that of the poorest 20 per cent, compared with a figure of just 7 for the world's industrialized countries.
- ◆ The environmental costs of improved farm technologies have been very high. During the 1980s, Central America increased production of pesticides by 32 per cent, but doubled its consumption.
- ◆ Losses caused by soil degradation due to the region's agricultural productivity are estimated at 37 per cent for Central America and almost 14 per cent for South America.
- ◆ In the region, 46 per cent of the land is either desert (13 per cent of the total), arid or semi-arid. Desertification losses could amount to US\$975 million a year.
- ◆ Natural forest cover continues to decrease in all countries. A total of 5.8 million hectares a year was lost during 1990–1995, resulting in a 3 per cent total loss for the period.
- ◆ A combination of logging activities and drought – particularly during *El Niño* events – is increasing the flammability of Amazonia's forests. The 1997 and 1998 fires were far more extensive than those that followed the *El Niño* event of 1982, and coincided with an even more severe *El Niño*. Most forests in eastern and southern Amazonia are subject to severe dry seasons each year, particularly during *El Niño* events. These forests are on the edge of the rainfall regime that is necessary for them to resist fire.
- ◆ It is estimated that 822 vertebrate species are now threatened with extinction in Latin America and the Caribbean. Habitat con-

version has been severe in the Central American forests, the *chaco* forest, the savannah ecosystems of the Brazilian *cerrado* – which houses the largest diversity of all savannah floras in the world – and the Mediterranean-type shrublands of the Pacific Coast.

- ◆ Probably as a result of the 1997–1998 *El Niño* event, there has been a large decrease in the marine fisheries catch of Peru and Chile, the largest exporters in the region.
- ◆ Around 29 per cent of reef areas in the Caribbean are considered to be at significant risk from run-off and sedimentation caused by deforestation, from nutrients coming from hotel and vessel sewage, from construction projects along the coast, and from mining activities. Reef survival is threatened by extensive and protracted coral bleaching events, such as those that occurred throughout the Caribbean in 1998 due to *El Niño* warming of surface sea waters.
- ◆ Many countries have substantial potential for curbing carbon emissions, given the region's renewable energy sources and the potential of forest conservation and reforestation programmes to provide valuable carbon sinks.
- ◆ Nearly three-quarters of the total population live in a few large cities, overcrowded and with a severe lack of basic services. This unplanned urbanization is aggravating existing problems of land use, marine and coastal deterioration, air quality, water use and contamination, and disposal of solid and hazardous wastes.
- ◆ The amount of heavy metals, synthetic chemicals and hazardous wastes from waste dumps and other sources (run-off and seepage in agricultural areas) that leaches into underground water seems to double every 15 years in Latin America.
- ◆ Since 1983, there have been many disasters of natural origin in the region, including hurricanes, floods, volcanic eruptions, and severe droughts related to *El Niño* events. Hurricanes Georges and Mitch and recent floods in Venezuela have caused the loss of thousands of lives and damage estimated at thousands of millions of dollars.

## Social and economic background

In Latin American and Caribbean countries – as in other regions of the world – there are many socio-economic pressures that can have an impact on the environment. Among them are demographic growth, population density, unplanned urbanization, unequal income and poverty, and unsustainable industrial development, agriculture and tourism. However, the

countries in the region have an important climatic, biophysical, geomorphological and socio-economic diversity, and this diversity makes generalized environmental policy application difficult.

The Latin American region contains 15 per cent of the world's land area (around 20 million km<sup>2</sup>): according to 1997 estimates it has 8.5 per cent of the world's population (494 million); and in 1998 it generated approximately 6.9 per cent of the world's gross domestic product (World Bank 1999a, 1999b). Bra-

zil is the largest country (8.5 million km<sup>2</sup> and 171 million people), followed by Argentina (2.8 million km<sup>2</sup> and 37 million people) and Mexico (1.9 million km<sup>2</sup> and 99 million people) (CELADE 1998).

The existence of extensive uninhabited territories, such as the Andes mountain range and the Amazon Basin, hinders human activity. As a direct consequence, 60 per cent of the population and an even higher proportion of total economic activity are concentrated in the coastal areas, except in Meso-America (Mexico and Central America), Bolivia and Paraguay.

In the period 1940–95, the region's population grew considerably, from 160 million to 480 million people, and estimates indicate that it reached 520 million in 2000 (CEPAL 1996; CELADE 1998, 1999). The countries in the region are characterized by a strong socio-demographic diversity in terms of population number, age composition, urban–rural distribution, ethnic composition, population density, and the stage of their demographic transition dynamics (CEPAL 1993). With the exception of countries such as El Salvador and some Caribbean island states, the region has a relatively low but growing population density (CEPAL 1993).

Regional economies are also very diverse in size and development, as reflected in their average per capita incomes and productive structures. Countries in the region show great internal disparity both between industry and agriculture and among large, medium-sized, small and micro enterprises. As a result, there is an extremely unequal income distribution and there are wide sectors where poverty prevails.

Regardless of these disparities, common patterns in the historical evolution of the Latin American and Caribbean countries have imprinted enough similar characteristics to allow the area to be treated as a region. The fundamental aspects of these characteristics lasted until the middle of the 20th century, and some of their traits still survive today.

After severe political and economic problems in the region during the 1970s and 1980s, the 1990s showed a relative recovery in economic growth. Following an average rate of just over 1 per cent during the

'lost decade' of the 1980s, economic growth in the 1990s averaged 3.5 per cent. This, however, is clearly insufficient – both in terms of the levels reached in the past and in terms of the growth required for a significant improvement in living standards and a reduction in unemployment, underemployment, poverty and social inequality (Ocampo 1998). Growth perspectives do not seem promising either, since investment rates are still much lower than in the period after World War II.

There has been remarkable progress in terms of macro-economic actions, resulting in an unseen price stability. Three-digit inflation rates at the beginning of the 1990s were reduced to approximately 26 per cent by the mid-1990s and to an average of 10 per cent by the end of the decade. This was made possible by reducing fiscal deficits to relatively modest rates of 1 and 2 per cent of the gross domestic product (CEPAL 1998).

Changes in export behaviour have also been crucial. Export volume reached annual growth rates of over 10 per cent during the 1990s, compared with 1.8 per cent in the mid-1980s (CEPAL 1996, 1999b). Mostly, this was due to a renewed vigour in regional trade through market integrating processes such as NAFTA, MERCOSUR and the Central American Common Market. Export diversification has also contributed, showing a significant increase of manufactured and non-traditional agricultural and fish farming products, plus *maquila* (offshore assembly) activities in Mexico, Central America and the Caribbean. Regional trade has been another important factor, with 'open regionalism' granting reduced intra-regional taxes and tariffs (CEPAL 1994). Tourism has been a particularly dynamic sector in the Caribbean and in other countries.

The export sector in many countries relies basically on the exploitation of renewable and non-renewable resources. In this respect, the region's traditional vulnerability and external dependence have recently deteriorated even further due to the problems derived from these activities' long-term environmental sustainability, both from a standpoint of market access and of long-lasting availability of natural resources, especially renewable resources. In addition, most exported industrial goods in the countries of

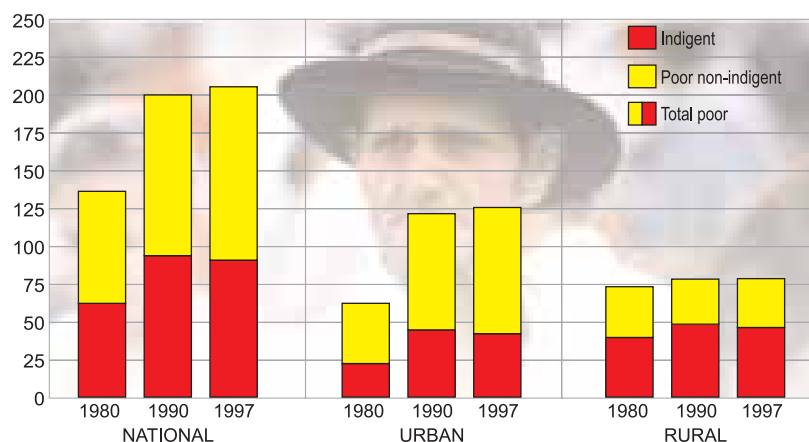
the region come directly from natural resources (such as petrochemicals, pulp and paper). The same is true of tourism, which also depends on the conservation of natural resources such as water, forests and coastal areas.

However, the unstable contemporary international economy has affected the economic recuperation of the 1990s. This is due to greatly speculative financial flows, insufficient macro-economic co-ordination between market-leading countries, and a lack of international public institutions to regulate international financial markets. This remarkable financial instability has produced the recent Asian crisis, the 1994–95 ‘tequila effect’ (spreading from Mexico to other Latin American and Asian markets), and the crisis of the European monetary system – three crises in one decade.

This situation restrains long-term investment and growth expectations; reasonable levels of social public expenditure to prevent a fall back into poverty; and sustainable development expenditures and investments such as those related to the environment and to scientific and technological research, which do not seem to be a short-term priority.

The external debt crisis at the beginning of the 1980s, and subsequent policies on structural adjustments and reforms, had unfavourable effects in terms of poverty and social inequality. During the period of accelerated growth after World War II, poverty levels had been reduced from 51 per cent in 1960 to 35 per cent in 1980 (Tokman 1991). In 1990, the percentage of poor homes increased again to 41 per cent. Even if this percentage was then reduced to 36 per cent in 1997 (reaching the level prior to the 1980s ‘lost decade’), the number of poor people increased to 200 million in 1990 and 224 million by 1999, reaching over 40 per cent of the region’s total population (Ocampo 1998; CEPAL 1999b, 1999c; CELADE 1998; ECLAC 2000). Income distribution also deteriorated in 1980, and presently the levels of inequality are higher than those prior to the debt crisis (Thorpe 1998; BID 1997; CEPAL 1999b). According to recent estimates, the income of the richest 20 per cent of the population is 19 times more than that of the poorest 20 per cent, compared to a figure of just 7 in the industrial countries (UNDP 1997).

**Latin America: Poor and indigent people 1980-1997 (millions)**



Source: CEPAL, 1999c.

In the 1990s, two trends in the labour market indicate that these negative characteristics will become even worse. The first relates to the scarce generation of formal labour in high-productivity sectors: most jobs in the growing labour force are in low-productivity informal activities. According to the International Labour Organization (OIT 1997), two out of ten new jobs belong to the first category, while more than eight fall in the second. This leads to the second trend, which is a growing disparity between the salaries of better-qualified workers and those of less well qualified workers. The origins of these tendencies are related to an increase in international competitiveness, technological innovation intensity and orientations, new economic policies, and a reduction in social expenditure (BID 1997; Sunkel 1999). Education, the most critical component from this point of view, has recuperated in recent years in some countries, but still lags far behind in most cases.

Poverty levels and the impact of the development process itself are affecting the population’s health. Indigenous and other marginalized groups often suffer from a lack of basic services (notably potable water and sanitation) and social discrimination which further exacerbates the situation. Problems such as malnutrition and iodine deficiency are more serious among these groups (as high as 47 and 20 per cent respectively in Bolivia), as are diseases such as cholera that also stem from lack of potable water and sewage treatment systems (PAHO 1994). Despite the endemic presence of Chagas’ disease, malaria and

The number of poor people has grown.

dengue fever, life expectancy increased by 28 per cent during 1960–94 (UNDP 1997), and infant mortality decreased by 45 per cent during 1980–90 (PAHO 1994). Vaccine-preventable diseases also declined. Although infectious diseases are still a significant cause of mortality in the region, the most common causes of death are cardiovascular disease and malignant neoplasms. However, deaths due to violence, accidents and AIDS are increasing in many countries (PAHO 1994).

In contrast with these negative economic and social trends, the region has made important progress on political and environmental issues. Undoubted progress has been made in the restoration and generalization of democratic regimes, the acknowledgement of the importance of human rights, the emergence of new opportunities for decentralization, local life and the exercise of citizenship, and in a more positive appraisal of ethnic diversity. But none of this is obstacle-free, especially with regard to the fragility of democracy. Among its weaknesses are deficiencies in the structures and procedures of political parties; the limited legitimacy of representative institutions; unequal access to justice; corruption; the political and financial difficulties inherent in the transfer of power to regions and municipalities; and socio-cultural and political conflicts related to the acknowledgement of ethnic rights.

Prior to the 1980s, environmental aspects of development and long-term sustainability concerns were either non-existent or extremely weakly represented in the public agenda of societies and governments in the region. This situation changed in the 1990s for several reasons – the seriousness of contamination and urban congestion problems, threats to the survival of renewable natural resources such as native forests and marine biomass, the environmental restrictions posed by market access in developed countries, a variety of international environmental conventions and agreements subscribed by governments, and the dramatic world-wide cultural change, mainly of the younger generations, with regard to their relationship with nature (Gligo 1995).

This has resulted in the development of governmental institutions, strategies and policies to protect the environment, and in a gradual penetration of the



concept of sustainable development in the culture, education system, social demands and entrepreneurial practices of many countries (Chapter 3). The region's central challenge now is to build a political consensus that will maintain stability and economic growth while addressing the growing social and environmental problems.

## Land and food

The Earth could, in theory, support far more than its present population, but the distribution of good soils and favourable growing conditions does not match that of the population. The problem is being exacerbated by increasing land degradation all over the world. The problem is particularly serious where – due to environmental and socio-political factors – local food production cannot provide an adequate diet or even enough for bare survival.

Of a total of 1 900 million hectares of degraded land on the planet (UNEP-ISRIC 1991), the most serious problems occur in Asia and the Pacific (with 29 per cent of the world's total degraded land) and Africa (with slightly more than 26 per cent). Latin America and the Caribbean take third place, with approximately 16 per cent, followed by Europe (slightly more than 8 per cent) and North America (5 per cent) (UNEP-ISRIC 1991).

Latin America and the Caribbean have the world's largest reserves of cultivable land. The agricultural

potential of the region is estimated at 576 million hectares (Gómez and Gallopín 1995; UNEP-ISRIC 1991). During 1980–94, the area under cultivation and permanent pasture increased and the forested area decreased (FAO 1997a, 1997b).

However, land degradation in Latin America and the Caribbean affects 16 per cent of the land area. The impact is higher in Meso-America (reaching 26 per cent of the total, or 63 million hectares) than in South America (where it affects 14 per cent of the total, or almost 250 million hectares) (UNEP-ISRIC 1991).

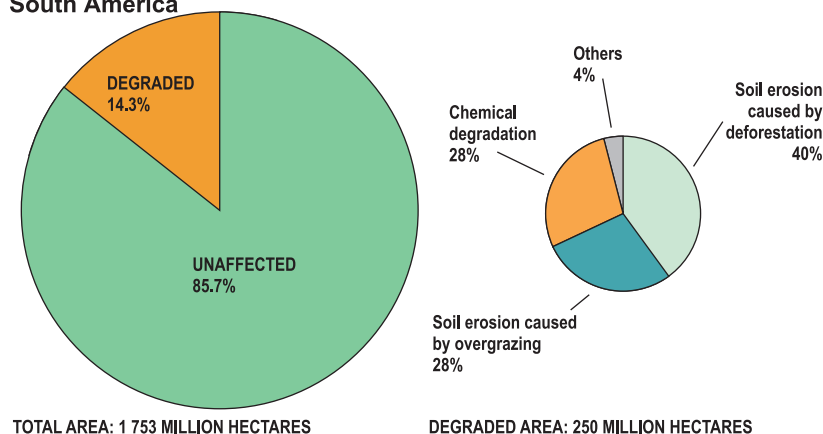
Soil degradation varies according to land use and location, but is more severe in cultivable land than in pastures or forests (Oldeman 1994). In South America, soil degradation affects 45 per cent of cropland, 14 per cent of pastures and 13 per cent of forests and woodlands. In Meso-America it affects 74 per cent of cropland, 11 per cent of permanent pastures and 38 per cent of forests. In general, soil degradation is more severe in arid lands under agricultural use. An estimated 70 per cent of these particularly vulnerable lands in Latin America and the Caribbean suffer from moderate to extreme degradation (UNEP 1997).

Original agricultural productivity losses caused by soil degradation also vary according to sub-regions. Recent estimates indicate that soil degradation in Central America is responsible for 37 per cent of losses, while global losses in South America have almost reached 14 per cent, slightly higher than losses in Asia (Oldeman 1998, quoted by Scherr 1999).

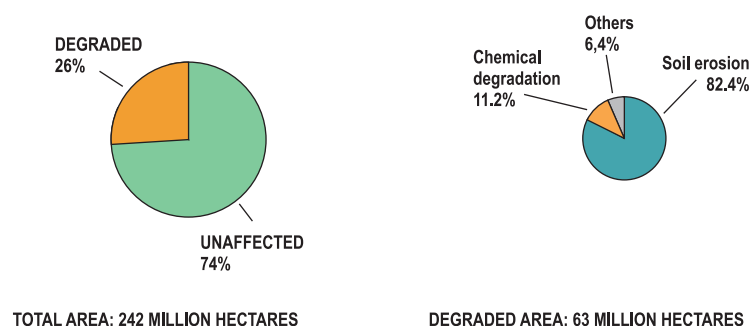
Erosion – by deforestation or overgrazing – and chemical degradation are among the main causes of soil degradation. In general, erosion is the main threat. Estimates indicate that there are 170 million hectares of eroded land in South America (68 per cent of the total affected land) and approximately 52 million hectares in Meso-America (82 per cent of the total affected land). Chemical degradation (basically loss of nutrients), on the other hand, affects 70 million hectares in South America and 7 million hectares in Meso-America (28 and 11 per cent of affected land respectively) (UNEP-ISRIC 1991).

## Land areas and degradation

### South America



### Meso-America



Source: UNEP / ISRIC, 1990 and Oldeman, 1994.

In South America, the principal cause of erosion is deforestation (affecting approximately 100 million hectares, or 40 per cent of the total affected land). Second in importance is overgrazing (70 million hectares, or 28 per cent of the total affected land). On the other hand, the main cause of soil degradation in Meso-America is poor agricultural practices.

Expansion of permanent pastures into previously forested areas is still the main cause of deforestation in the Brazilian Amazon (Nepstad *et al.* 1997) although much of this land is initially used as cropland. Soybean production, mainly for export, has been the main driving force of the agricultural frontier expansion in northern Argentina, eastern Paraguay and central Brazil (Klink *et al.* 1995). Farming technology has improved agricultural yields throughout the region, but the environmental costs have been very high. The impact of agrochemical contamination on



soil and water and, as a consequence, on human health, is a major concern. For example, during the 1980s Central America increased production by 32 per cent and its cultivated area by 13 per cent, but doubled its consumption of pesticides (FAO 1997a), which casts doubt on the efficiency of such an effort.

In addition, stock farming (basically cattle and sheep) has led to overgrazing and subsequent desertification, particularly in Argentinian Patagonia where an estimated 35 per cent of the total area (80 million hectares; almost 5 per cent of the South American territory) suffers from desertification (Winograd 1995).

In Central America, steep slopes, intense rainfall and poor agricultural practices have made erosion the principal cause of the loss of agricultural potential. Severe inequality in land distribution associated with insecure land tenure is also leading to the over-exploitation of resources for short-term benefits (Fearnside 1993; Jones 1990).

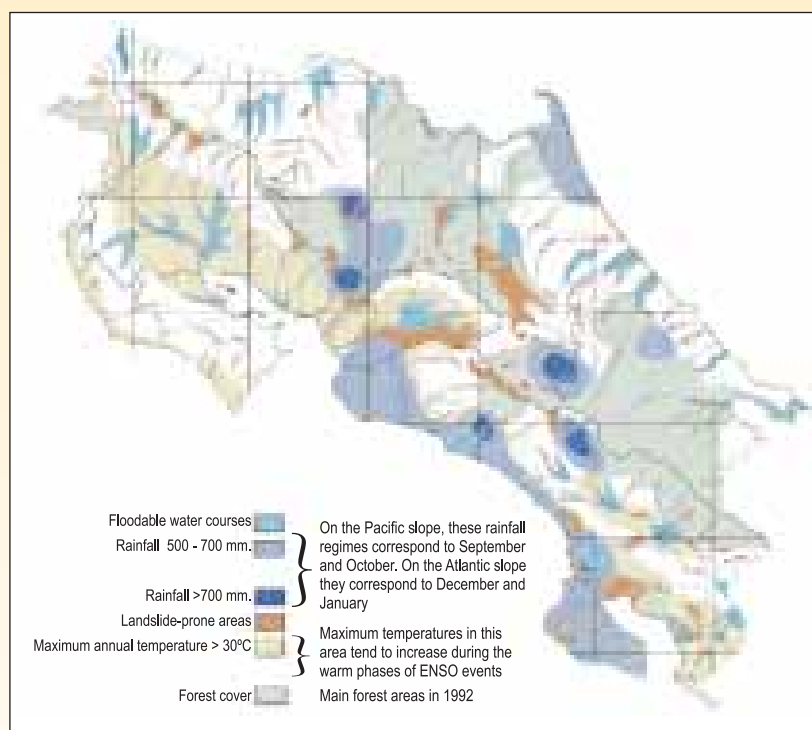
In general, if appropriate soil conservation measures are not adopted (including the implementation of new criteria for crop selection), the degradation of arable land will continue, endangering food production, affecting food security, and producing still other important environmental and economic impacts.

### Soil degradation factors in Costa Rica

Excess precipitation and surface run-off are important factors in the transportation and loss of fertile soil material. Surface run-off is influenced by orography, and river beds are the first natural channels to receive excess water not absorbed by the soil. As river volumes rise there is an increased risk of spillage overflow, especially in short watersheds with steep inclines.

Steep mountain slopes are also very susceptible to landslides caused by excessive rainfall. Soil erosion results from landslides and from gullies that develop when the ground cover on slopes is removed or degraded by over-grazing, wildfires or earthquakes. Gullies vary in size according to soil type, land gradient and the volume of water scouring their channels deeper.

Alterations in the ground cover, or lack of it, affect the capacity of the soil to retain water, which translates into an increase in surface run-off. Causes of alterations to the ground cover include the use of land for cultivation and cattle raising, the growth of urban areas and the pressure caused by increasing population.



High environmental temperatures may be another important element in the soil degradation process. High temperatures exacerbate the drying of vegetation in areas without forest cover, or with sparse ground cover or low moisture retention capacity. In these cases, the soil is more exposed to other weather factors such as solar radiation and winds, which contribute to the drying of the soil surface. Wind erosion compounds the problem by physically removing soil material. In addition, should environmental temperatures rise to unusually high levels, as is the case during some warm phases of ENSO (*El Niño* Southern Oscillation) events, the impact of this element may increase even further.

In several areas of the Central American Pacific Watershed, the combination of these factors determines the severity of soil degradation. The accompanying map shows these risk factors (flood-prone rivers, high precipitation, landslide areas, high temperatures and forest cover) for Costa Rica.

Source: CADETI-MINAE 1999.

Since 1994, FAO has carried out an action programme in 83 low-income countries with food deficits (FAO 1999a). These countries are home to nearly 824 million people – almost 14 per cent of the world's population – who suffer chronic food insecurity (that is, have insufficient calorie intake to satisfy their basic energy needs) (FAO 1999b). The group comprises 42 African countries, 24 from Asia, 7 from Latin America and the Caribbean, 7 from Australasia and the Pacific, and 3 from Europe (FAO 1999a).

According to a recent FAO study (FAO 1999b), between one-fifth and one-third of the population in five countries of the region suffer from inadequate

food intake. In ascending order they are Honduras, Bolivia, Dominican Republic, Nicaragua and Haiti. In Haiti, the proportion exceeds 60 per cent of the population. With the exception of Nicaragua, the situation improved in all these countries between 1990–92 and 1995–97. However, these numbers conceal significant local disparities between countries. In Venezuela, for example, the national average of food insufficiency does not exceed 15 per cent of the population, but in some eastern and southern states of the country the proportion of children suffering from inadequate nutrition reaches, respectively, 20 per cent and 36 per cent of the total.

### Risks of intensive use of agrochemicals

Intensive use of agrochemicals – particularly nitrogenous fertilizers and pesticides containing environmentally persistent organic compounds – generate not yet fully understood but potentially very serious risks of soil degradation and environmental pollution.

Increased use of nitrogenous fertilizers in agriculture, in combination with extensive farming of legume species, causes the deposition of additional quantities of nitrogen into land and water ecosystems. If we include the impact of fossil fuels, human activities are currently making a larger contribution of fixed nitrogen to the global supply than natural processes and have at least doubled the amount of nitrogen available for absorption by plants. The increase in the use of nitrogenous fertilizers world-wide is causing a dramatic rise in the nitrogen levels in potable water sources, run-off water and agricultural waste, which in turn generates more eutrophication in water bodies (unusual plant growth and subsequent oxygen deprivation for other species). One consequence of this process is a loss of biodiversity as a result of some species adapting more rapidly than others to this new environment, to the detriment of less adaptable species.

A major problem is that persistent organic compounds do not degrade easily and last for many years in the environment. They have a tendency to accumulate at the higher levels of the food chain, in animal and human tissue, often a long way from their sources of origin. These compounds interact with hormones and the endocrine system, affecting reproductive and developmental processes and damaging the nervous and immune systems of humans and other animal species.

Brazil is one of the world's four biggest users of agrochemicals, consuming 2.33 kilograms of active ingredients per hectare in 1997, with a total consumption of 117 000 tonnes of active ingredients in 1998 and total billings of US\$2.18 billion in 1997. In 1997, areas in south and south-eastern Brazil used the largest amount of agrochemicals, with 33 per cent of total consumption concentrated in the state of São Paulo. Figures for that year indicate that herbicides contained the greatest amount of active ingredients (48 per cent), followed by fungicides (26 per cent), insecticides (15 per cent) and acaricides (9 per cent).

Source: UNEP 1999a; IBAMA 1999a.



## Losses due to desertification

Desertification is caused by climate variation and human activities, which upset the balance of soil, vegetation, air and water. This rupture causes the reduction, or even destruction, of the biological potential of soils, the degradation of living conditions and the expansion of deserts. Desertification is a particularly significant threat to arid, semi-arid and sub-humid dry areas of the world, where social and economic pressures, ignorance, wars and droughts lead to over-exploitation of the land (UNSCDD 1999; UNEP 1999a). Arid soils are especially vulnerable because of their very slow rate of recovery from disturbances. Because water availability is limited in arid climates, soil formation is slow and at the same time highly susceptible to erosion processes.

In Latin America and the Caribbean, soil degradation attains the category of desertification mainly in Chile, Peru and Mexico. According to some estimates, desert areas in those countries cover a total of about 252 million hectares (1.3 per cent of the region's territory) (Brzovic 1996). But arid and semi-arid areas also occur in Argentina, Brazil and Bolivia, and together with Chile, Peru and Mexico, represent 97.3 per cent of the total area in this condition – 457 million hectares, equivalent to 23 per cent of the region's territory.

By the mid 1990s, it was estimated that 20 per cent of the agricultural land in South America was threatened by desertification (INTA-GTZ 1995). Around 70 per cent of Argentina's land (some 200 million hectares) is in arid and semi-arid regions, and at risk of desertification. Estimates indicate that desertification covers an area of more than 21.5 million hectares (7.5 per cent of the total territory) (SAGyP-CFA 1995; INTA-GTZ 1995). In Chile, the desertification process is esti-

mated to affect about 47.3 million hectares, equivalent to 62.6 per cent of the national territory. The areas worst affected are those with the greatest flora and fauna conservation problems, where about 1.5 million people (13 per cent of the national population) live in rural poverty (CONAF 1999).

It has been estimated that total losses due to desertification in Latin America and the Caribbean could approach US\$975 million per year. If losses caused by drought are added to those of desertification, annual losses could exceed US\$4.8 billion (FGEB 1994). About US\$13 billion could be needed to restore degraded soils in order prevent these losses (FGEB 1994). However, given the lack of comparability in the current data, and existing doubts about the socio-economic benefits of initiatives against desertification, many policy-makers are reluctant to allocate funds for land restoration work.

The social cost of desertification may be even higher. Desertification and its disruption of agricultural production destroy the social fabric of a country. Millions of people are forced to migrate in search of better job opportunities and living conditions. This migration from the country to the cities (in many cases, to other countries) often leads them to settle on the fringes of urban areas, thus perpetuating and aggravating the urban poverty cycle. When only the men migrate, leaving their wives and children behind, the latter become even more vulnerable, since community and government authorities often do not recognize women as legitimate counterparts. Therefore, desertification not only exacerbates poverty but also aggravates social disruption and political instability.



According to FAO, food insecurity in these and other countries is caused (among others) by environmental factors that generate a poor capacity to produce food reserves or a variable production capacity that does not guarantee food on a regular basis. Environmental factors include dry or cold weather, poor soils, erratic rainfall patterns, steep slopes and severe land degradation (FAO 1999b). Low agricultural productivity due to limitations of institutional, technologic and sectoral policies, and scarce and insecure income in rural and urban areas, are other contributing factors (FAO 1999a).

In addition to its impact on food security, land degradation has other important environmental and economic effects that produce insecurity problems (Scherr 1999). In economic terms, land degradation

affects agricultural value added, stability and prices. In turn, this can have a negative impact on agricultural income and on economic growth as a whole, where the economy depends on agriculture to a significant extent. Where degraded land is a critical asset for subsistence-level producers, the social consequences can be very severe, especially for those who have no other productive options. Finally, a nation's long-term wealth and productivity options can be affected, threatening the resources and food security of future generations.

Sedimentation and the release of greenhouse gases are two of the environmental consequences of land degradation (Scherr 1999). According to several estimates, the release of carbon dioxide due to land degradation in particular corresponds to 10–30 per

### Large and small farmsteads in Panama: their role in soil degradation

Degraded surfaces have increased at an alarming rate in Panama. Between 1970 and 1987, the increase was close to 60 per cent, its impact covering 27 per cent of the country's total land area. This trend continues, and is particularly acute in the highly eroded area of eastern Chiriqui, the northern area of Veraguas y Cocolé and the extreme west of the province of Panama.

Land tenure is the main factor in soil degradation. In Panama, as in many other countries in the region, unequal soil distribution and shortcomings in the ownership regime prevail. About 46 per cent of land users (mainly in the provinces of Veraguas, Panama and Darién) do not have deeds, 19 per cent are under a mixed regime, and approximately 1 per cent lease their land, while only 34 per cent have any form of ownership title.

Plots of less than five hectares – *minifundia* – occupy only 4.2 per cent of the land available for agriculture and cattle-raising, but represent 71.5 per cent of the total agricultural and cattle-raising activities in the country. Given their intrinsic limitations (poor soil quality, lack of working capital, and inappropriate technologies), small farmsteads do not yield sufficient quantity or quality of produce to provide a dignified livelihood. This forces producers to over-exploit the land in certain regions, causing rapid soil deterioration and the opening of new satellite farms (*trabajaderos*) in mountainous or marginal areas. At the same time, many farmers are forced to look for temporary employment or enter into share-cropping contracts. When these possibilities yield no results, farmers migrate to the cities or the agricultural frontier. Exploitation of new croplands generates further deforestation, erosion and loss of fertile soils, as well as a greater need for new agricultural and cattle raising land, thus aggravating the poverty cycle.

In 1990, large-scale farming units – *latifundia* – with areas of 200 hectares or more, represented 37 per cent of the land being used for agriculture and cattle-raising, while only contributing 0.98 per cent of the total farming and cattle-raising benefits to the country. Among these are the few agro-industrial production centres linked to high-technology agricultural production and cattle-raising activities: the rest have



little or no production due to the low level of land utilization, inadequate local labour availability, and reduced financial resources (as is the case of extensive cattle-raising ventures and barren areas surrounding cities and towns in the countryside). Deforestation in these areas, and poor management practices (planting pastures and using slash-and-burn techniques to affirm the existence of an owner), turn these farms (deprived of the benefits of national economic growth) into a direct contributor to the gradual degradation of the country's natural resources.

Significant numbers of *minifundia* subsistence farms, as well as some extensive cattle-raising ventures, operate on land that should be used for protection instead of production. When the intensity of use exceeds the land's productive potential, these lands are over-exploited and the resource is placed under pressure. The result is deterioration and degradation of the physical and chemical properties of the soil, with accelerated compaction and erosion. Subsequent pollution and sedimentation of waterways and water bodies compromises the water regulation capacity of drainage basins, which in turn produces flooding and worsens seasonal droughts.

Source: ANAM 1999a.

cent of emissions produced by fossil fuels, while the release of nitrous oxide (N<sub>2</sub>O) due to land degradation is among the main causes of greenhouse gas accumulation and stratospheric ozone depletion. Greenhouse gas emissions and ozone depletion have a negative effect on the process of climate change, thus increasing the threats to long-term food security. In addition, land degradation reduces protection and generates habitat changes, provoking genetic and biodiversity losses and aggravating other factors of food insecurity.

## Forests

Eighty per cent of the forests that originally covered the Earth have been cleared, fragmented or otherwise degraded (WRI 1997). Most of the remaining

forest is located in just a few places, mostly in the Amazon Basin, Canada, Central Africa, South-east Asia and the Russian Federation. These large blocks of ecologically-intact natural forest are valuable because they house indigenous cultures, shelter global biodiversity, provide ecosystem services, store carbon, contribute to local and national economic growth, and meet diverse recreational and spiritual needs. Yet logging, mining and other large-scale development projects threaten 39 per cent of the remaining natural forests, with those in South and Central America, western North America, and the boreal regions of the Russian Federation most at risk.

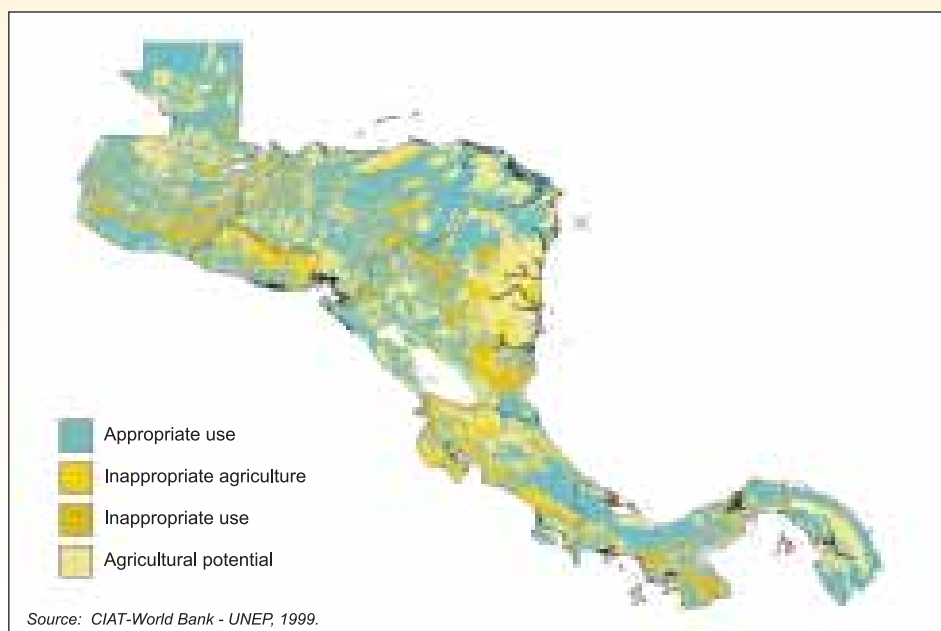
Natural forest covers 47 per cent of the Caribbean and Latin America region's total land area (according to the latest available estimates for 1995). Al-

### A Land Use Index for Central America

Decision-making and planning for sustainable development assume the design of strategies, the definition and implementation of policies, and the execution of actions. For this, it is necessary to use assessment and performance indicators to gain knowledge about the current situation and the direction in which the processes must go. It is essential therefore that the information tools used by planners and policy-makers take into consideration the spatial (where) and temporal (when) dimensions of the situation, as well as the process components (economic, social and environmental) and their interactions (why, who, how and how much).

The CIAT–World Bank–UNEP joint project on rural sustainability indicators seeks to develop and apply environmental, land quality and other indicators, and information tools, to allow the integration of environmental and sustainability considerations into planning and decision-making processes. By developing geo-referenced indicators and user-friendly interfaces, this project helps improve environmental management in the Central American countries.

Land use is one of the main factors related to development and the environment. The Land Use Index, applied in Central America as shown in the accompanying map, combines two indicators: current production systems (how land is being used) and 'potential' production systems (how land should be used in a technically advisable manner). According to the Index, almost half the land in the region (46 per cent) is being inadequately used. Approximately 25 per cent of the surface has a specific agricultural potential, but is being used for other purposes, while 14 per cent of the land has agricultural use but should be destined for other uses, such as forestry. Also, 7.5 per cent of the territory is being used inadequately (for example, as pasture rather than coffee plantations).



most all (95 per cent) is tropical forest (852 million hectares), located in Central America, the Caribbean and the South American tropics (FAO 1997b). The remaining resources, covering approximately 43 million hectares, are located in temperate South America, mainly in Argentina, Chile and Uruguay (FAO 1997b). The largest untouched forest area is located in the northern Amazon Basin and Guyana (WRI 1997). The Amazon Basin is also important in terms of global metabolism since it generates approximately 10 per cent of the net terrestrial primary production (LBA 1996). Of the eight countries of the world that still have more than 70 per cent of original forest cover, six are located in South America (Brazil, Colombia, French Guiana, Guyana, Suriname and Venezuela).

However, during 1980–90 alone, the region lost 61 million hectares (6 per cent) of its forest cover, the largest loss in the world during those years (although existing calculations may underestimate total deforestation by 50 per cent) (Monastersky 1999).

Natural forest cover continues to decrease in all countries. A total of 5.8 million hectares a year was lost during 1990–95, resulting in a 3 per cent total loss for the period (FAO 1997b). The highest average annual rate of deforestation was in Central America (2.1 per cent), while Bolivia, Ecuador, Paraguay and Venezuela all had annual deforestation rates greater than 1 per cent for the same period (FAO 1997b).

In Paraguay, for example, forest cover in the eastern region decreased from 8.8 million hectares (55 per cent cover) in 1945 to 2.9 million hectares (18 per cent cover) in 1991. The decrease in the western region was from 16.8 million hectares (70 per cent cover) to 0.8 million hectares (45 per cent cover). Estimates indicate that the forest loss for 1992 was 200 000 hectares (Stöhr 1994).

Brazil lost approximately 15 million hectares of forest in the period 1988–97. Though deforestation in the Brazilian Amazon nearly doubled in 1994 and 1995, with 2.9 million hectares of forest cleared in 1995 (the greatest extent in recorded history) there have since been substantial declines – to about 1.8 million hectares in 1996 and an estimated 1.3 million hectares in 1997 (INPE/IBAMA 1998). Due to

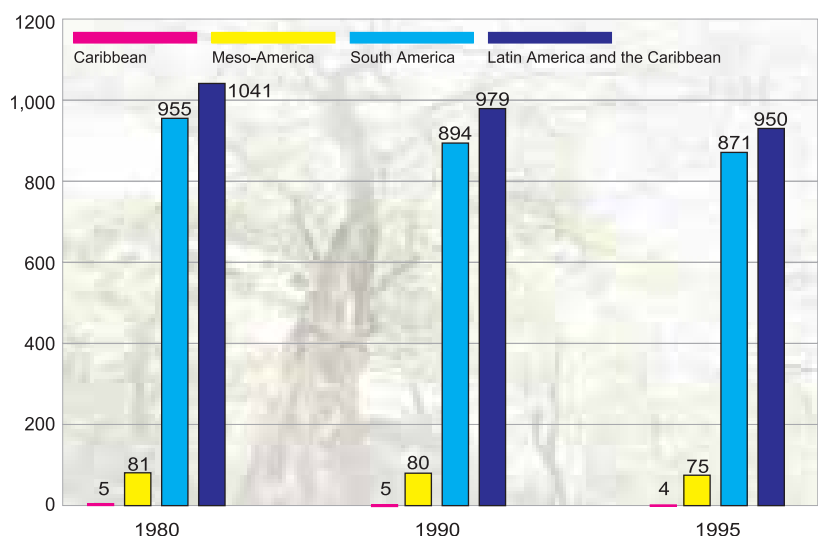
forest depletion in other areas, in the last two decades, the forest products industry in Amazonia has increased from 14 per cent to 85 per cent of the national production, and the percentage could be even higher. Government sources estimate that 80 per cent of Brazilian Amazon production is illegal (Câmara 2000). Only 15 per cent of production is exported, mainly to the United States of America, the European Union, Japan, the Philippines, the Caribbean and Argentina (Câmara 2000). The Asian crisis and the 80 per cent devaluation of the Brazilian real against the United States dollar have increased the competitiveness of Brazilian production and the number of foreign production companies in the country. In 1999, these foreign companies led the country's export production: eight multinational companies own approximately 2.4 million hectares in Amazonia (Câmara 2000).

Natural forest cover continues to decrease due to clearance for cropland and stock farming; construction of roads, dams and other infrastructure; and mining. Forest fires are particularly crucial factors in this process (FAO 1997b; see also 'Forest fires' section).

The expansion of the agricultural frontier has been one of the main causes of deforestation. High population densities generate greater demands for agricultural land: if the forest is considered a territorial

*The extent of natural forest cover continues to decrease in all sub-regions. More than 90 million ha were lost during 1980–95, resulting in an 8.7 per cent total loss for the period.*

**Forest extent 1980, 1990 and 1995 (million hectares)**



Source: Compiled by UNEP GRID, Geneva, from WRI, UNEP, UNDP and WB 1988 and FAO 1997a and 1997b.



reserve, it is often occupied by invaders. Uncertainty of land tenure in turn provokes poor land management practices, thus increasing forest clearings. Traditional slash-and-burn practices have been the principal means of advancing the agricultural frontier in many countries. However, modern agriculture, mining and the need for new roads and settlements are responsible for the largest forest clearances. In the case of agriculture, banana expansion in Meso-America, Colombia, Ecuador and some Caribbean countries, and coffee and sugar production in Brazil, have been major pressure factors.

Other factors that are becoming important threats include logging for the forest products industry, the pressures exerted by exotic species on native species and their habitats, and fires caused by drought and human carelessness. In Bolivia, Guyana and Suriname, a drive to exploit natural resources, mainly brought about by an economic crisis, has accelerated the fragmentation of pristine forests over the past decade. Selective logging has changed the structure and composition of many of the remaining forested areas, particularly in south-eastern Amazonia and along river courses, leading to irreversible losses in biodiversity (WRI 1997). Even modest deforestation and the increase of exotic species plantations can produce significant species and habitat loss (UNEP 1999b). In Chile, for example, substitution of native species by exotic species has

been one of the main causes of native forest destruction and deterioration, estimated to represent a yearly average proportion of 19–30 per cent of the total affected area during 1991–94. Other causes are stock farming (10–15 per cent) and forest fires (3 per cent). Estimates indicate that native forest reduction in Chile varies from 7 per cent to 43 per cent (Lara *et al.* 1995; Emanuelli 1996).

Another important related problem is that an increasing number of countries are considering granting extensive forest concessions to forestry companies. In Guyana, one company has been granted nearly 6 million hectares, and countries such as Suriname, Bolivia and Venezuela are following suit by opening up large areas of primary forest to forest harvesting (Bryant *et al.* 1997). Increasing pressures for forest concessions in South America are likely to exacerbate deforestation and forest degradation throughout the region.

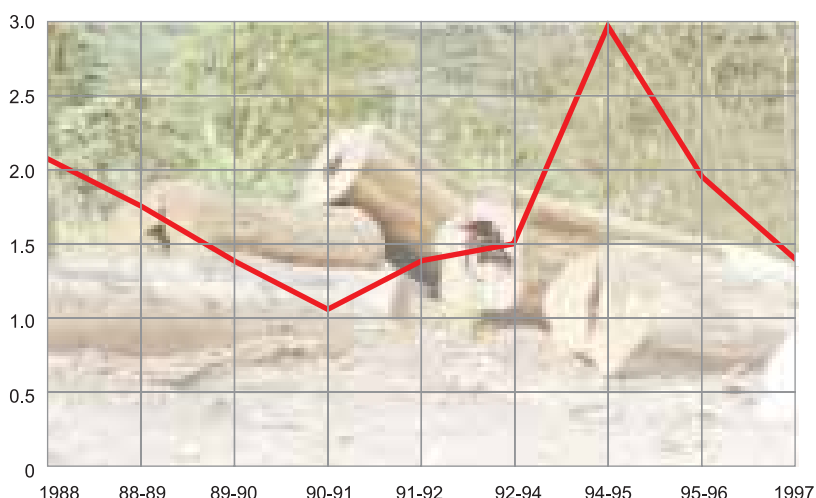
In the Caribbean, large tracts of forest have been lost because of direct forest exploitation, as well as through the conversion of forested areas to cropland and permanent pasture. Historically, forest clearance for sugar and banana plantations affected nearly all Caribbean countries. Fragmentation has also affected many of the natural forests.

Production and trade of forest products vary widely across the region. Fuelwood accounts for 78 per cent of the region's production, and industrial roundwood for 16 per cent. However, the trade in products from natural forests may be affected as major importing countries insist on timber certification. The focus on endangered species can also affect trade: Brazil, for example, has placed a ban on mahogany harvesting (IBAMA 1998). Non-timber forest products, and non-timber gathering, still constitute the main source of cash income for many poor farmers throughout tropical South America.

The need for forest conservation has been placed high on the political agenda in many countries. Another positive development is the use of incentives for promoting the establishment of forest plantations. Recent policy reforms in Costa Rica, Guatemala, Paraguay and Uruguay are expected to stimulate the reforestation of thousands of hectares.

Latest figures on deforestation in the Brazilian Amazon show a substantial decline from the all-time high of 1994–95.

**Annual deforestation rates in the Brazilian Amazon (million hectares per year)**



Note: Data for 1993 and 1994 are estimates based on the mean rate of deforestation during 1992–94. The 1997 rate is estimated from an analysis of 47 Landsat images.

Source: INPE/IBAMA 1998

Despite all these efforts, the region's forest resources remain under extreme and competing pressures. Even where large population groups are heavily dependent on forests for food, especially in tropical South America (FAO 1997b), there has been heavy encroachment into forests by the rural poor in their search for land for agricultural use, and now also by large agro-exporters and logging consortiums. At the same time, strong external and internal pressures are being put on countries with extensive tropical forests in an attempt to ensure the conservation and protection of these unique ecosystems.

## Forest fires

During 1995–98, fire swept through forests in Australia, Brazil, Canada, China, France, Greece, Indonesia, Italy, Mexico and several other countries in Latin America, the Russian Federation, Turkey and the United States. More than 3 million hectares of forest in Mongolia were burnt in 1996. Forest fires in South-east Asia in 1997 were the worst in 15 years,

with at least 4.5 million hectares burnt, and smoke and haze affecting some 70 million people (UNEP 1999a).

The forests of South-east Asia and Brazilian Amazonia were especially vulnerable to fire in 1997 and 1998 because of a severe drought, probably related to the strong *El Niño* of the same period and changing global weather patterns. The 1997 and 1998 fires were far more extensive in these regions than fires after the *El Niño* event of 1982, and coincided with an even more severe *El Niño*.

Forest fires can destroy up to 50 per cent of the forest's surface biomass, with severe but still unknown effects on the forest fauna. In addition, since forest fires can liberate significant amounts of carbon into the atmosphere, the potential impact on global atmospheric problems, including climate change, is another important consequence. Finally, the direct impact of forest fires on neighbouring local and regional human groups has also increased: forest fires

## Extraction reserves in Brazil

In the 1970s and 1980s, the Brazilian Government encouraged the establishment of agricultural settlements in the Amazon forests for people originally from the south and south-east of the country. Many of these people migrated because of the unemployment generated by automation of agricultural practices, and excessive increases in the price of land, in their areas of origin. The settlements caused large-scale deforestation in sensitive areas, particularly in the state of Rondonia, and subsequent migration to cities in the Amazon region. The consequence of this process was the loss of social structure and marginalization of many human groups – known as *seringueiros* – who made a living from extracting timber and non-timber products from the Amazon forests.

The struggle of the *seringueiros* and the murder of 'Chico' Mendes – their union leader – raised the awareness of the federal government, in the late 1980s and early 1990s, of the need to create a new category of protected area. These so-called 'extraction reserves' would strive to achieve compatibility between the expectations of these social groups and the sustainable exploitation of the forest. The reserves were defined as large extensions of federal property, with joint management by the resident population and the government, by means of a free concession agreement for sustainable land use. Currently, these reserves comprise about 3.2 million hectares, located in new areas under the administrative responsibility of the Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA).

Extractive activities to be fostered in these reserves include agriculture, forestry and cattle-raising with appropriate technologies, as well as associated processing and marketing activities. Of a total of ap-

proximately 200 000 families involved, around 15 600 people live within the reserves. Sustainability of the activities within the reserves is sought through joint management by the population and the state, which provides health, transportation, demarcation and oversight services, promoting income generation together with the communities.

The Resex Project was created in order to implement these actions. For a period of four years, almost US\$8 million were invested in four extraction reserves. The project's results include the implementation of programmes in co-management, parcelling, environmental education, community stores, promotion of fertilization techniques, small product processing centres, ecotourism, production and marketing of non-timber forest products, and the provision of drinking water wells. In addition, the project allowed the construction of 48 bridges and 2 000 kilometres of roads.

In the two reserves in which participatory monitoring plans were developed, it was shown that the deforestation index was lower than that of the federal state in which the reserves were located. Given these good results, the Brazilian federal government is planning to increase the number of extraction reserves in the coming years in order to strengthen the rational use of the Amazon forests.

Sources: CNPT-IBAMA-PNUD 1999; Pinzón Rueda 1997, 1998, 1999.

have caused great economic losses to Central American (CCAD and IUCN 1996) and South American (Nepstad *et al.* 1997) countries.

The health impacts of forest fires can be serious and widespread. Estimates for the fall-out from fires in South-east Asia suggest that 20 million people were in danger from respiratory problems. In 1997, smoke and air pollution from fires in Guatemala, Honduras and Mexico drifted across much of the south-eastern United States, prompting Texas officials to issue a health warning to residents. Smoke from fires in Mato Grosso, Brazil, contaminated the air in Paraguay, and the smoke produced by fires in Paraguay polluted the air in Argentina. These problems reveal the transboundary dimension of contamination caused by forest fires and demonstrate the need for a regional action plan on fire control and response in Latin America and the Caribbean.

A combination of logging activities and drought is increasing the flammability of Amazonian forests.

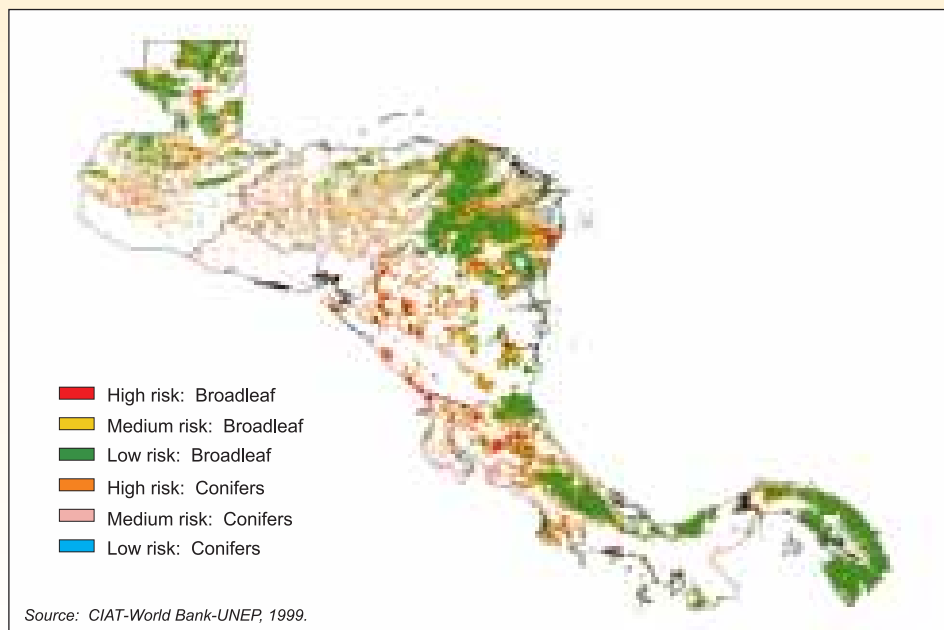
Selective logging increases flammability by opening up the leaf canopy, allowing sunlight to penetrate to the fuel layer on the ground, and by increasing the fuel load through the production of woody debris. Surface fires also increase the forest's flammability, thus producing a very dangerous positive feedback effect by which regional forests – particularly in Amazonia – are becoming progressively more flammable with each new fire season. Fires are generally not included in deforestation monitoring programmes, even though they can increase the forest area affected by human activity by 60 per cent.

Even virgin forests become flammable when drought is severe. More forests in eastern and southern Amazonia (half of the 400 million hectares of closed canopy forest in Brazilian Amazonia) are subject to severe dry seasons each year, more particularly during *El Niño* events. These forests are on the margins of the rainfall regime that is necessary for them to resist fire (Nepstad *et al.* 1997).

### A Forest Risk Index for Central America

A Forest Risk Index for Central America has been developed as part of a CIAT–World Bank–UNEP joint project on rural sustainability indicators. Deforestation and forest fragmentation are two of the most important consequences of the development process in the region. This index rates the areas with forest cover on the basis of their proximity to markets, that is to say, their 'accessibility'. Thus, a high-risk (forested) area is one located less than one hour away from a market; areas at intermediate risk are located between one and two hours away; low risk areas are those located more than two hours away. The map also distinguishes between broad-leaf and coniferous forests.

According to this index, 29 per cent of the forest is at a high risk of being lost, 21 per cent is at intermediate risk and 50 per cent is at low risk. Nevertheless, coniferous forests (55 per cent at high risk) are at a greater risk of disappearing than broadleaf forests (23 per cent at high risk). It must be taken into account that in developing indices, certain assumptions must be made. In this case, it is assumed that the risk of exploitation of a forest is greater if it is located closer to a market. Dividing this time/distance variable into periods of one hour was done arbitrarily.



Because of the role forest clearance plays in forest fires, much of the blame for starting fires has fallen on small farmers. However, only 12 per cent of the forest cleared in the Amazon is actually used for arable farming; the remaining 88 per cent is used for pasture (Nepstad *et al.* 1997). Other pressures on natural resources must also be taken into account. These include technological factors, such as slash-and-burn practices, and other more complex factors, related to the expansion and depletion of the agricultural frontier, where small farmers – if they intervene – represent just the first stage in the progressive colonization of virgin territories that later will be intensively exploited by stock farming concerns, agro-industrial companies (banana, pineapple, coffee) or forestry companies (Bryant *et al.* 1997; O'Brien 1998; Pasos *et al.* 1994).

All countries in Latin America and the Caribbean develop forest fire monitoring, control and response actions and policies to support the rational and sustainable use of forests. Actions vary according to available technology, expertise and institutional and human capacities, and the accompanying table shows some of the current institutions and programmes in the region. In general, these institutions promote regulatory, monitoring, control and research activities on forest fires, and actions to promote the controlled use of fires by farmers.

According to several current studies on fire behaviour and potential fire risks in Latin America and the Caribbean, these risks are generally associated with farming and arise from the use of fire for soil preparation, as a means of removing economically useless plant debris.

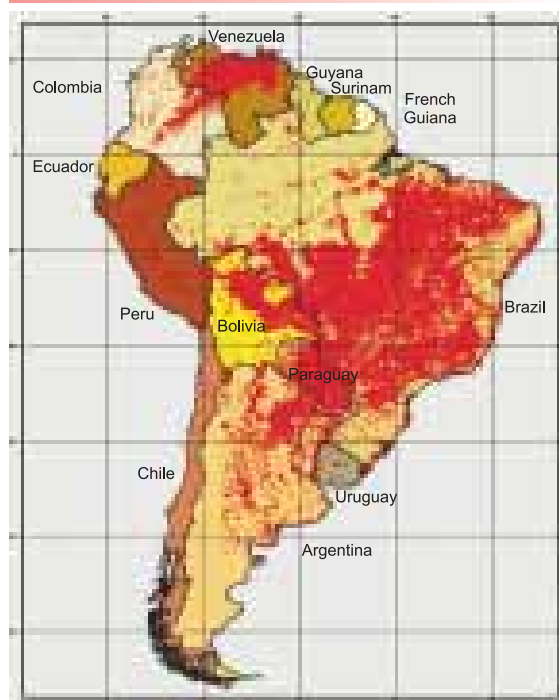
Seasonal droughts are another important factor. In direct association with *El Niño* events, Mexico, Central America and the northern part of South America suffered prolonged seasonal droughts in 1997, 1998 and 1999. It is most likely that these droughts facilitated the large-scale fires that swept Bolivia, Brazil, Mexico, Paraguay and Venezuela during 1998.

Using satellite images, 219 401 heat sources were identified in 1999. These heat sources represent the incidence of forest fires or the use of fire for soil preparation during that period. The term 'heat source' is used for the interpretation of surface tem-



perature records above 47 degrees Celsius registered by AVHRR sensors on NOAA satellites. According to this information, Brazil – with approximately 48 per cent of the total area of South America – had 66.4 per cent of recorded heat sources in 1999. Three other South American countries registered important numbers of heat sources in that period: Bolivia and Argentina, with almost 11 per cent each, and

**Forest fires or use of fires in agriculture in South America, 1999**



Source: Night images from NOAA satellites, Nov 01, 98 and Oct 31, 99, <http://www.ibama.gov.br/~hmafra>

## Forest fire monitoring, control and combat programmes and institutions in Latin America and the Caribbean (1999)

| Country            | Programmes and institutions                                                                                                                           |
|--------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------|
| Argentina          | National Fire Management Plan                                                                                                                         |
| Brazil             | National System for the Prevention and Combat of Forest Fires – PREVFOGO (Brazilian Institute of Environment and Renewable Natural Resources – IBAMA) |
| Colombia           | National Centre for the Prevention and Mitigation of Forest Fires                                                                                     |
| Cuba               | Forestry Research Institute                                                                                                                           |
| Chile              | National Program for the Prevention of Forest Fires (National Forestry Corporation – CONAF)                                                           |
| Guatemala          | Forest Fires Project (National Institute of Forestry)                                                                                                 |
| Honduras           | Co-ordination for the Protection of Forest Fires (Honduran Forestry Development Corporation)                                                          |
| Mexico             | Project on the Prevention, Combat and Control of Forest Fires (Environment, Natural Resources and Fisheries Secretariat – SMEARNAP)                   |
| Dominican Republic | Division for the Prevention and Control of Forest Fires                                                                                               |
| Uruguay            | Fire Department                                                                                                                                       |
| Paraguay           | Fire Department                                                                                                                                       |
| Venezuela          | Department of Prevention and Extinction of Forest Fires (Ministry of Environment and Renewable Natural Resources – MARNR)                             |

Paraguay, with 8.2 per cent. The table below lists the principal subnational regions and local areas affected.

The use of fire in farming and forestry practices is deeply rooted in the culture of the region. Therefore, institutions charged with controlling and monitoring fire for agricultural purposes must concentrate on training rural farmers in fire management techniques, and on appropriate licences and fire-fighting mechanisms – linking these initiatives with the intervention of fire departments and the support

of fire fighting teams, often with volunteers and temporary workers, during critical seasons of forest fire occurrence.

## Biodiversity

All species – as well as all individuals – have a finite life span and therefore changes in biodiversity are inevitable. Accelerated and enhanced reduction in diversity at gene, species and ecosystem level, however, is not only intrinsically undesirable but also a significant threat to human material welfare be-

### Incidence of forest fires at the sub-national level

| Countries | Affected areas                                                                                                                                                                                                                                                                                                                                              |
|-----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Argentina | Northern region (Provinces of Corrientes, Formosa, Chaco, Santiago del Estero, Santa Fe, Iguazú-Misiones, Entre Ríos, Gran Chaco, Jujuy and Bariloche).                                                                                                                                                                                                     |
| Bolivia   | Northern and eastern regions (Departments of Santa Cruz de la Sierra, Trinidad, San Ignacio, San José de Chiquitos, Santa Rosa and San Joaquín).                                                                                                                                                                                                            |
| Brazil    | North-eastern, central western and south-eastern regions (with the highest concentrations in coastal areas and in the far northern part of the north-eastern region, and northern part of the southern region, and in the southern part of Amazonia, more severely in the states of Rondonia, Acre and Para, with isolated areas in the state of Amazonas). |
| Chile     | Central region (Provinces of Concepción, Bio-Bio, Temuco).                                                                                                                                                                                                                                                                                                  |
| Colombia  | Central and eastern regions (Aruca, Santa Fe de Bogotá, Bucaramanga).                                                                                                                                                                                                                                                                                       |
| Paraguay  | Almost all the country's territory except for the departments in the farther north and north-western regions.                                                                                                                                                                                                                                               |
| Peru      | Provinces in the central and central southern regions (Cerro de Pazco, Machu Picchu, Cuzco, Puerto Maldonado).                                                                                                                                                                                                                                              |
| Venezuela | Central north region (north of Orinoco River, Porto Cabello, Valencia, Caracas, Cumaná, Guanare, Barquisimeto)                                                                                                                                                                                                                                              |



cause it implies a reduced ability of ecosystems to provide key products and services (UNEP 1999a).

The total number of species on Earth is very large: around 1.7 million have been described but many more are believed to exist, with estimates ranging from 5 million to nearly 100 million. A figure of 12.5 million has been proposed as a reasonable working estimate (WCMC 1992). The most species-rich environments on Earth are moist tropical forests which extend over some 8 per cent of the world's land surface and probably hold more than 90 per cent of the world's species. Overall, the regions richest in biodiversity are Africa, Asia and the Pacific, and Latin America and the Caribbean.

The tropical, subtropical and temperate habitats of the region are exceptionally rich in biodiversity. The neotropical ecological zone contains 68 per cent of the world's tropical rain forests (FAO 1997b). The region contains 40 per cent of the plant and animal species of the planet, and is considered to have the highest floristic diversity in the world (Heywood 1995). The warm Amazonian valleys, the high, cold Andean mountains, the Brazilian Atlantic forest, and the dry forests of Meso-America are home to some of the world's richest ecosystems. Arid and semi-arid vegetation occurs in the mountainous areas running from southern Ecuador to Chile, in northern Colombia, and in Venezuela, Argentina and north-eastern Brazil. Brazil, Paraguay and Bolivia also share some of the world's most important continental wetlands, including 400 000 km<sup>2</sup> of marshlands (the *pantanal* and *chaco*) which are renowned for their diversity.

In recent years an important international debate has developed about 'biosecurity' and the possible negative impact of genetic modification of living organisms ('biotechnology') on human health and species diversity – especially the diversity of food and commercial non-food species. Latin America and the Caribbean are rich in native species, such as cocoa, corn, beans, tomatoes and potatoes, but they are also important exporters of exotic species such as Argentinian wheat and Chilean grapes. The debate addresses the establishment of warning mechanisms to avoid risks associated with the trade of genetically modified living organisms that could initiate a

'contamination' or genetic 'erosion' effect. The United States, Canada, Australia, Argentina, Chile and Uruguay object to these mechanisms if they are 'barriers' to international trade. Finally adopted in January 2000, the Cartagena Protocol on Biosecurity establishes warning, information and prior agreement mechanisms for the safe transfer, management and use of genetically modified living organisms.

Despite the possible risks involved in biotechnology, the main problem in biodiversity protection is how to avoid habitat destruction and the consequent extinction of species, many of which are not yet described by science. The expansion of agriculture into tropical and semi-arid regions, forest cutting, and the depletion of wetlands have reduced the populations of many species. Loss of habitat has been the greatest threat. Habitat conversion has been severe in the Central American forests, the *chaco* forest, the savannah ecosystems of the Brazilian *cerrado* – which houses the largest diversity of all savannah floras in the world – and the Mediterranean-type shrublands of the Pacific Coast (Dinerstein *et al.* 1995). Mexico hosts 51 per cent of all migratory bird species from its northern neighbours, and the loss of critical overwintering sites due to deforestation and other land use changes may threaten the survival of these populations (Robinson 1997; Greenberg 1990).

Levels of endemism for selected Caribbean countries (for selected taxa)

|                                         | Birds | Mammals | Amphibians and reptiles | Higher plants |
|-----------------------------------------|-------|---------|-------------------------|---------------|
| Antigua and Barbuda                     |       | 0       | 0                       |               |
| Bahamas                                 | 3     | 4       |                         |               |
| Barbados                                |       | 0       | 0                       |               |
| Cuba                                    | 22    | 15      | 43+91                   | 3 475         |
| Dominica                                |       | 1       | 0                       |               |
| Eastern Caribbean                       | 38    | 11      |                         | 68            |
| Guadeloupe/Marie Galante                |       | 2       | 2                       |               |
| Hispaniola (Haiti/ Dominican Rep.)      | 34    | 3       | 47                      | 1 800         |
| Jamaica                                 | 34    | 5       | 47                      | 830           |
| Martinique                              |       | 0       | 0                       |               |
| Montserrat                              |       | 0       | 5                       |               |
| Puerto Rico                             | 26    | 1       | 42                      | 234           |
| St. Kitts, St. Eustatius and Nevis      |       | 0       | 1                       |               |
| Sta. Lucia                              |       | 0       | 2                       |               |
| St Martin, Anguilla and St. Bartholemey |       |         | 0                       | 0             |
| St. Vincent and the Grenadines          |       | 0       | 2                       |               |

Source: UNEP 1999b.



## The Cartagena Protocol on Biosafety

The Protocol on Biosafety of the Convention on Biological Diversity (CBD) was adopted on 29 January 2000 in Montreal, Canada, after more than four years of intensive international negotiation. The agreement is known as the 'Cartagena Protocol' by decision of the extraordinary meeting of the parties to the CBD meeting at the Colombian port of that name at the beginning of 1999 when a first – unsuccessful – attempt was made to adopt the instrument.

The Cartagena Protocol establishes procedures for the safe movement, handling and utilization of genetically modified living organisms (GMOs) that may have an adverse effect on biodiversity, with emphasis on cross-border movements. It establishes a procedure to import GMOs by Advanced Informed Agreement (AIA) and incorporates the precautionary principle. Provisions are set forth for documentation, confidential and shared information, training, and financial resources, which pay special attention to the situation of developing countries and others without adequate national regulatory systems.

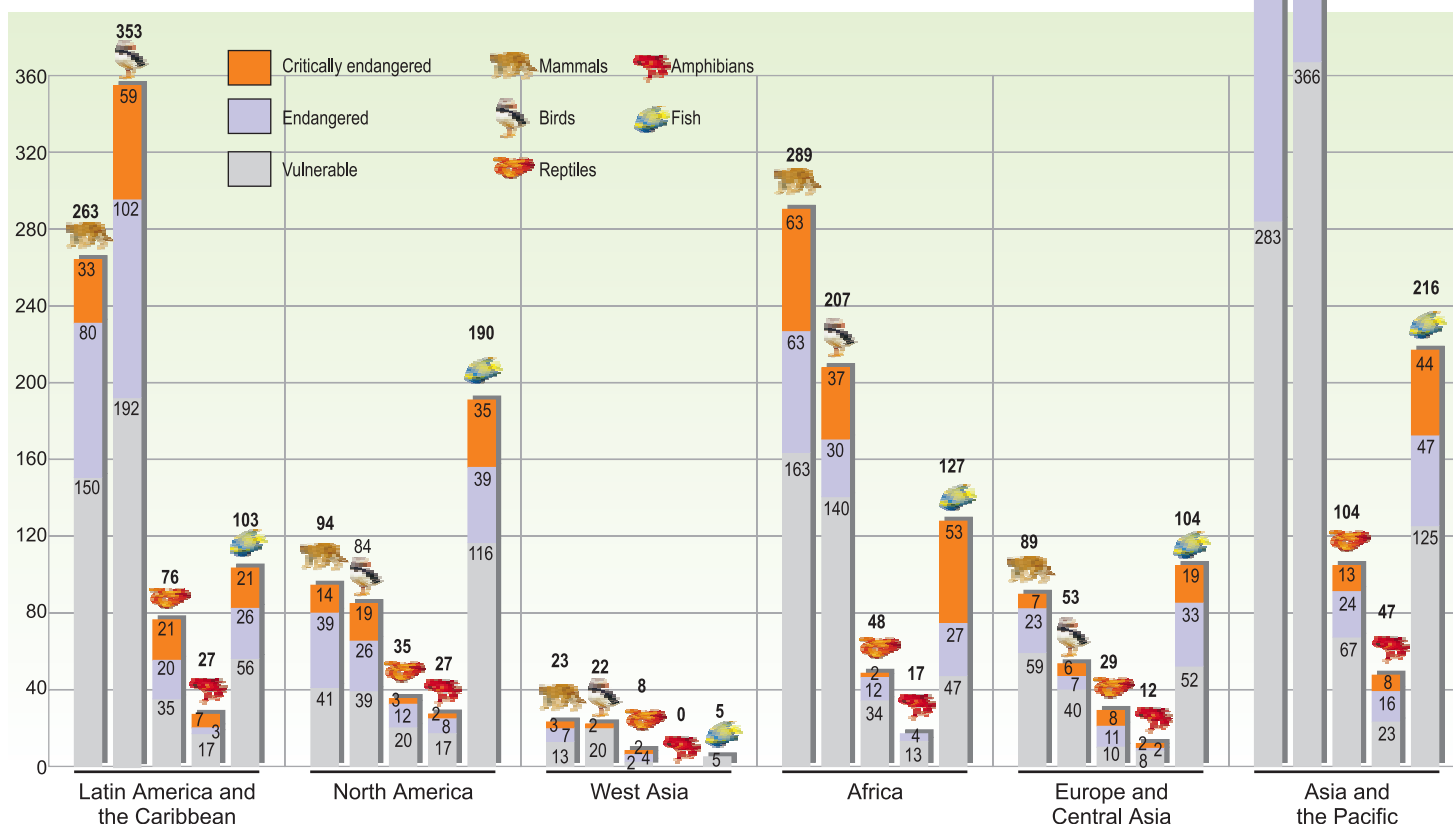
The Protocol was adopted by 133 delegations from governments, non-governmental organizations, industrial sectors and the international scientific community. The Third World Network, on behalf of most of the non-governmental organizations with delegates at the conference, applauded the agreement for putting environmental considerations before commercial interests. The Global Coalition for Industry stated that the Protocol would serve to protect biodiversity and share its benefits at a global scale.

Source: IISD 2000.

No systematic evaluation of habitat turnover and species depletion has been attempted, but those figures that are available suggest a significant impact: several hundred vertebrate species are now threatened with extinction (Baillie *et al.* 1996). The intensification of agricultural practices, replacement of natural forest with plantations, new technologies for cultivating dry lands (a major reservoir of biodiversity) and the modification of coastlines suggest that these trends may worsen in the near future.

Many of the region's animal species are now vulnerable, endangered or critically endangered.

## Threatened animal species (number of species)



Source: WCMC/IUCN 1998

Overall, Latin America and the Caribbean rank second in the world in terms of threatened bird species (after Asia and the Pacific); third in terms of threatened mammals (after Asia and the Pacific and Africa); third in terms of threatened marine species (after Asia and the Pacific and North America); second place in terms of threatened reptiles (after Asia and the Pacific), and second in terms of threatened amphibian species (after Asia and the Pacific) (WCMC-IUCN 1998).

The biota of all countries are threatened. Brazil has the second-largest number of threatened bird species (103) in the world, and Peru and Colombia occupy fifth place with 64 species each (Baillie *et al.* 1996). Brazil also has 71 threatened mammal species (the fourth-highest in the world). More than 50 per cent of Argentinian mammals and birds are also threatened. Areas with large numbers of threatened birds tend also to have large numbers of threatened mammals, suggesting that the two groups may be susceptible to similar threats.

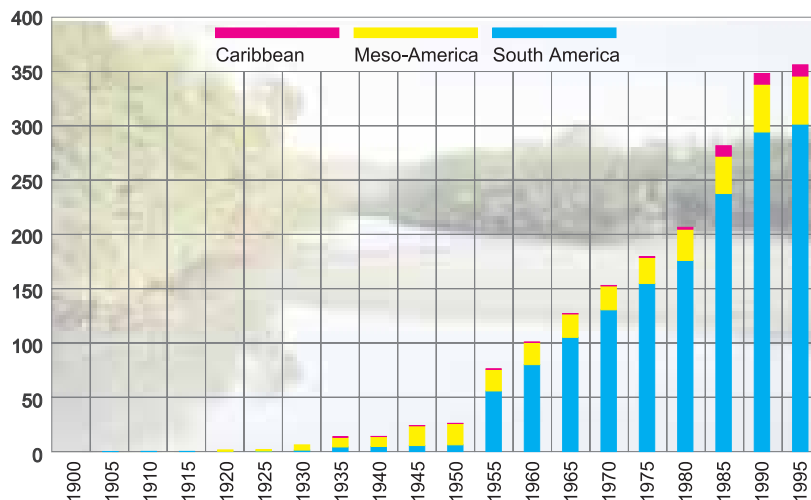
Ecosystems and their vegetation are similarly threatened. In central Chile, for example, it is estimated that 30 per cent of the *maulino* forest in the Cordillera de la Costa was replaced by pine plantations during 1978–87 (CODEFF 1987). In the Caribbean, environmental vulnerability is further accentuated by factors such as steep slopes and rapid topographic changes which fragment the ecosystems; the growing concentration of human populations and activities; and the high frequency and diversity of natural disasters.

The amount of land under some form of conservation and protection is continuing to rise, with some 6.6 per cent of the region's land under various categories of strict protection. However, many types of ecosystem are still under-represented or not represented in protected areas (Dinerstein *et al.* 1995). Furthermore, many protected areas, despite their declared legal status, are really only protected on paper, and lack any real means of preventing degradation. Central America is recognizing the social value of biodiversity for local communities as it re-evaluates its biodiversity and natural resources as the basis for the generation of new products and hence socio-economic development (CCAD and IUCN 1996).

Despite the growing support for biodiversity conservation, various governmental and institutional weaknesses – basically related to research and development – suggest that the current trends of declining biological diversity will continue unabated over the next decades.

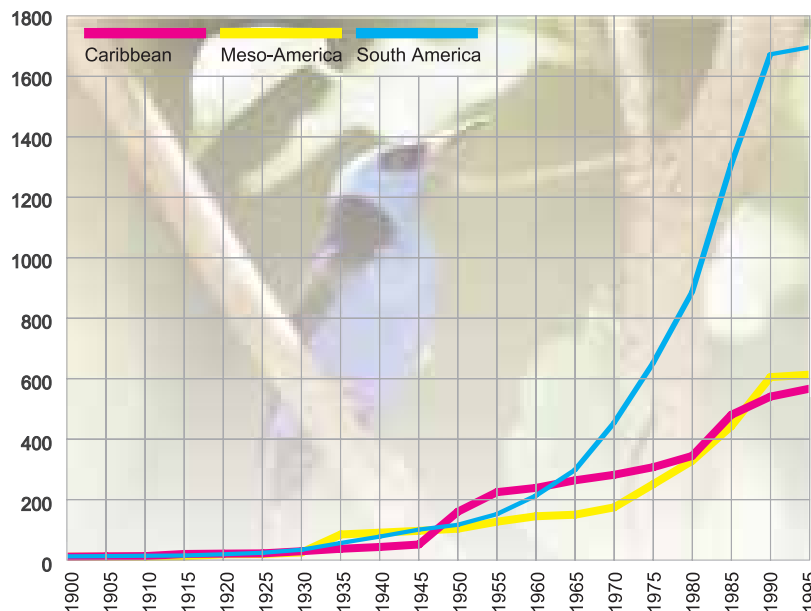
While the number and area of protected sites in Latin America continue to grow, many are protected only on paper and have no real resistance to degradation.

**Size of protected areas, 1900-1995**  
(million hectares)



Source : World Conservation Monitoring Centre (WCMC), 1998: Protected Areas Database: [http://www.wcmc.org.uk/protected\\_areas/data](http://www.wcmc.org.uk/protected_areas/data), downloaded January 31, 2000.

**Number of protected areas**  
**1900-1995**



Source : World Conservation Monitoring Centre (WCMC), 1998: Protected Areas Database: [http://www.wcmc.org.uk/protected\\_areas/data](http://www.wcmc.org.uk/protected_areas/data), downloaded January 31, 2000.

### Chilean biodiversity in danger

In Chile, it is estimated that 35 per cent of the 684 terrestrial vertebrate species face conservation problems. The proportion increases to 51 per cent for mammals, to 58 per cent for reptiles, to 79 per cent for amphibians and to 100 per cent for fish.

In addition, one-third of all fern species in continental Chile (40 per cent of which are endemic to Chile) face significant threats. Six of these species have been declared to be endangered and six more are considered vulnerable. In the case of arboreal and shrub-like dicotyledons in continental Chile, although only 6 per cent of them suffer conservation problems, 11 species are considered endangered and 20 are classified as vulnerable – and most of them are endemic species. Out of a total of 167 cactaceous taxa analysed, 21 per cent of the species are endangered and 53 per cent are vulnerable.

Sources: Glade 1988; Hoffmann and Flores 1989; Simonetti *et al.* 1995; Marticorena *et al.* 1998; Rodríguez 1989.

## Fresh water

Global fresh water consumption rose sixfold between 1900 and 1995 – more than twice the rate of population growth. About one-third of the world's population already lives in countries with moderate to high water stress (that is, where water consumption is more than 10 per cent of the renewable fresh water supply). The problems are most acute in Africa and West Asia, but lack of water is already a major constraint to industrial and socio-economic growth in many other areas (UNEP 1999a).

The Latin American region is extremely rich in water resources: the Amazon, Orinoco, São Francisco, Paraná, Paraguay and Magdalena rivers carry more than 30 per cent of the world's continental surface water. With 12 per cent of the world's territory and 6 per cent of the world's population, the region has around 27 per cent of the total water supply, most of it located in the Amazon Basin (Cunningham and Saigo 1999). However, regional water supply varies significantly in terms of sub-regions, localities and seasons.

Two-thirds of the region's land is in arid or semi-arid areas. As mentioned in 'Land and Food' above, these areas include large parts of central and northern Mexico, north-eastern Brazil, Argentina, Chile, Bolivia and Peru (UNEP-ISRIC 1991). The Carib-

bean island of Barbados is among the ten most arid countries in the world, and the island nations in this sub-region have per capita water resources that are considerably lower than those in other island groups in the world: just 13.3 per cent of the Indian Ocean's existing resources and 1.7 per cent of the South Pacific's (UNEP 1999b).

Even countries located in the humid tropics and the Amazon Basin, such as Colombia, have a significant variability (IDEAM 1998). Total water supply in Colombia is estimated at more than 2 000 cubic kilometres per year: that is, an average of 1.76 million cubic metres per square kilometre. Allowing for quality and natural regulation variations, this water supply corresponds to 34 000 cubic metres per capita annually. Colombia's supply corresponds to the region's average, which is five times larger than the world average (in North America the average is 16 300 cubic metres, in Europe 4 700, in Africa 6 500 and in Asia 3 400). However, in dry years average water availability can decrease to 26 700 cubic metres per capita, and in 9 of 32 departments (Boyaca, César, La Guajira, Magdalena, Norte de Santander, Risaralda, San Andrés, Sucre and Valle del Cauca), average water supply is less than 60 000 cubic metres per square kilometre (29 per cent of the country's average).

In addition, regional water availability problems are increasing, mainly in countries with a large proportion of arid territories. In 1995, Mexico was the only country in the continent with a consumption of more than 10 per cent of the available fresh water, but at present, Mexico and Peru use more than 15 per cent of their total fresh water reserves each year, thus falling into the category of countries suffering 'moderate' pressures on water availability (WMO *et al.* 1996; UNEP 1999a).

Demand for water is growing rapidly as populations and industrial activity expand and irrigated agriculture (the largest use) continues to increase (WRI, UNEP, UNDP and WB 1996). In Brazil, for example, with estimates indicating that irrigation consumption is currently 60 per cent of the total water extraction, irrigated areas increased from 64 000 hectares in 1950 to 2.87 million hectares in 1998 (a growth of almost 4 500 per cent) and the irrigation quotient (irrigated area as a proportion of total farmed

area) has been increasing during recent years – from 4.8 per cent in 1996 to 6.2 per cent in 1998, despite an annual decrease of 9 per cent in farmed areas (ANEEL-SRH-OMM 1999).

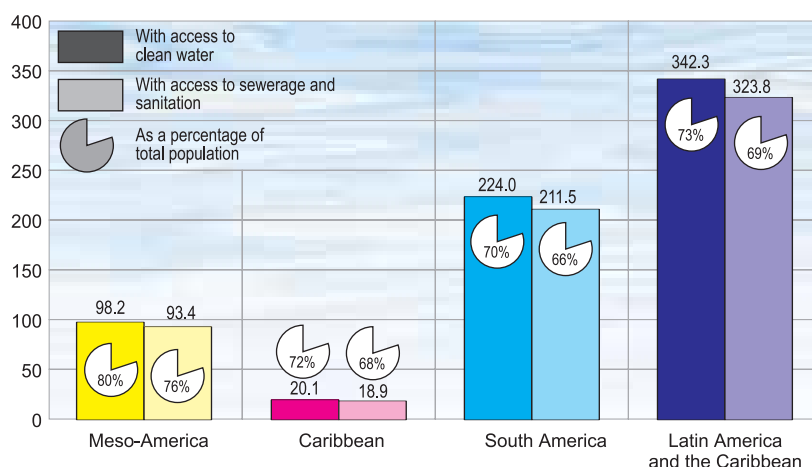
Many current patterns of water withdrawals are clearly unsustainable, thus compounding the pressures on water supply. Pumping from aquifers at rates far greater than those at which they are recharged is a particularly important aggravating factor, and the natural limits are unknown. In addition, increasing deforestation rates could also contribute to the severe annual flood and drought cycles.

Despite the advances of the past ten years, access to safe water remains a serious issue. Estimates for 1995 indicate that 26 per cent of the population in the region did not have access to potable water and 31 per cent lacked sewerage and sanitary services. In addition, the maintenance of existing systems is poor, and the existence of sewerage systems does not necessarily imply sanitary treatment of waste waters. In Costa Rica, experts suggest that – despite reported coverage of 97 per cent of sewage – no more than 35 per cent of waste water receives adequate treatment (Fernández and Gutiérrez 2000). Estimates indicate that in Latin America as a whole, only 2 per cent of waste water is treated (UNEP 1999a).

The main cause of water pollution is the direct discharge of untreated domestic and industrial wastes to surface water bodies, which contaminates not only the water bodies themselves but also adjacent ground water aquifers. The expansion of industry, mining and the use of agrochemicals has contaminated rivers and aquifers with organic solids, toxic chemicals and heavy metals. Underground aquifers in Merida, Mexico, have been severely affected by the influx of storm water and sewage, and there is a risk that the contamination will spread to the wells that supply the city (UNEP 1999a). In the Caribbean, only 39 per cent of 140 surveyed small industries in 1995 applied some kind of waste water treatment (UNEP 1999b).

The geographical distribution of water pollution in the region is dominated by flows from large metropolitan areas. In addition to population concentration and industrial production in these areas, other important contributing factors are: growth in con-

#### Population with access to clean water, sewerage and sanitation (millions)



Source: CEPIS-OPS, 1999 (from OPS: *Health in the Americas*, 1998; with 1995 data), and 1995 population data from CELADE, 1998.

ventional sewerage systems which has not been accompanied by corresponding treatment facilities; intensification of agricultural land use close to metropolitan areas; changes in economic structure, with increased emphasis on manufacture; concentrated run-off from paved areas in the growing cities; and the need for artificial regulation of stream flows. As a result, the quality of water bodies near large metropolitan areas has been seriously compromised.

Artisanal mining is another important source of contamination: gold mining in particular generates important mercury emissions. Almost all countries in Latin America practice gold mining activities, and estimates indicate that one million miners produce approximately 200 tonnes of minerals per year (Veiga 1997). However, mercury emissions have dropped from the high levels reached at the end of the 1980s because of the reduction in informal mining activities due to a scarcity of easily exploitable veins, improved organization of mining activities (basically by NGOs), and the high cost of mercury which has led many miners to practise recycling. Despite this, there is probably as much mercury emission as gold production. Approximately 5 000 tonnes of mercury have been deposited in the forests and urban environment since the onset of the new gold expansion in Latin America in the late 1970s (Veiga 1997).

Leaching of heavy metals, synthetic chemicals and hazardous wastes due to inappropriate use and disposal is another major cause of underground water

Access to sewerage and sanitation does not guarantee that residual waters are adequately treated.



contamination. The amount of polluting material that seeps into underground water from waste dumps and other sources (such as run-off in agricultural areas) seems to double every 15 years in Latin America (UNEP 1999a). Depletion of aquifers and sea-water intrusion are also important sources of underwater contamination. Salt water intrusion is of particular concern in small island states, where the limited ground water supply is surrounded by salt water.

Sediments produced by erosion and by domestic, industrial and agrochemical disposal, are among the main causes of water quality deterioration. The Alcehuate in El Salvador and the Virilla in Costa Rica are only two examples of rivers that are highly contaminated due to industrial and agricultural activities and metropolitan development.

As industry, irrigation and population grow, so do the environmental and economic costs of additional water supplies. The costs of supplying water to the cities are continually rising, with dramatic examples in large and growing urban areas. In Mexico City, water is pumped over elevations exceeding 1 000 metres into the Valley of Mexico, and in Lima upstream pollution has increased treatment costs by about 30 per cent (World Bank 1997a). Water desalinization processes in the Caribbean also have a very high cost (UNEP 1999b).

Investment in sanitation and water offer high economic, social and environmental returns, but the next four decades will see urban population rise three-fold and the domestic demand for water increase fivefold in Latin America (WRI, UNEP, UNDP and WB 1994). At this point it is important to consider the possible impact of tourism growth, since water

consumption in this sector can be five or ten times higher than in other residential sectors.

Water availability has been a fundamental factor in the development of irrigation throughout the region. An area of 697 000 km<sup>2</sup> is currently irrigated, corresponding to 3.4 per cent of the region's territory (World Bank 1996) but salinization and waterlogging are eating away the productivity of 40 years of irrigation investment in countries such as Mexico, Chile and Argentina (Winograd 1995). In many cases, agricultural diversification requires more irrigation, thus increasing the pressure on available water resources.

After the hydroelectric projects that dominated the region in the 1970s, such as Itaipu, Salto Grande and Yaciretá in the River Plate Basin, and Tucuruf and Balbina in the Amazon Basin, the current trend in South America is the construction of *hidrovías* or waterways. Two ambitious projects are under way in the region, the Paraná-Paraguay and the Araguaia-Tocantins waterways, which are planned to harness five river systems over a total length of 8 000 kilometres to improve navigation networks.

During the past decade, environmental problems related to water have affected both urban and rural areas. Housing developments continue to be sited in sensitive areas such as on steep hill slopes in the upper parts of water catchment areas, or too close to sensitive ground water aquifers. Fresh water resources are thus being damaged at the same time as demand for water is increasing. In the arid and semi-arid areas there has been increased competition for scarce water resources. Using polluted water for drinking and bathing spreads infectious diseases such as cholera, typhoid and gastroenteritis. Several countries have had recent outbreaks of these diseases, which affect the urban poor in particular.

## Marine and coastal areas

The oceans are the largest ecosystems on the planet. They are as rich and diverse as any land ecosystem, but remain practically unexplored. Although the deep seas are still, in general terms, unpolluted, there is already evidence of environmental degradation in some areas as well as deterioration of many marine species.



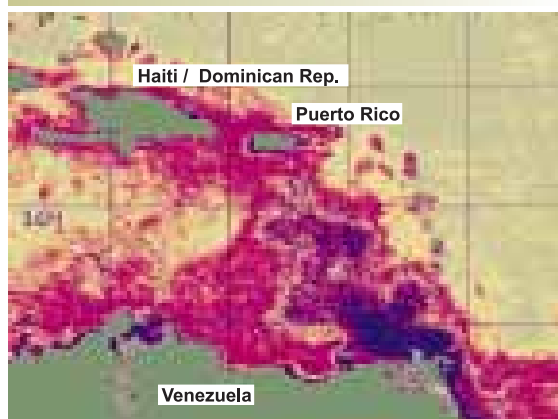
The marine coastal environment, by contrast, has clearly been significantly affected by habitat transformation and destruction, by over-fishing, and by pollution, mostly resulting from land-based activities far away from the sea.

More than one-third of the world population lives less than 100 kilometres from the coast (Cohen *et al.* 1997). In Latin America and the Caribbean, where 60 of the 77 largest cities are on the coast, that figure jumps to 60 per cent.

Marine and coastal systems in the region support the complex interactions of diverse ecosystems, with great biodiversity, and are among the most productive in the world: they are the breeding grounds for commercial species, they generate revenue from tourism, and they act as protectors. Several of the largest and most productive estuaries in the world are located in this region, namely the Amazon and Plate rivers on the Atlantic coast and the Guayaquil and Fonseca on the Pacific coast. The coast of Belize has the second-largest coral reef in the world. The waters off the coasts of Chile and Peru contain one of the five largest fisheries in the world, and the fastest-growing fisheries in the world can be found near the coast of Argentina and Uruguay (IDB 1995).

The region's coast is 64 000 kilometres long and includes 16 million square kilometres of maritime territory. This area plays a key role in the diverse sub-regional and intra-regional dynamics. The coastal areas of the Greater Caribbean, for example, receive sediment from, in order of importance, the Mississippi River (United States of America), the Magdalena River (Colombia), the Orinoco River (Venezuela) and other rivers in Mexico, Central America, the Antilles, Colombia and Venezuela (PNUMA 1999b). The Gulf of Fonseca, in Central America, is the setting for productive relations in the fishing activities of Guatemala, El Salvador and Nicaragua. Significant sedimentation has been detected in the Caribbean Basin and in the Orinoco and Amazon River basins. Also relevant are the climatic relations that exist between the coasts of the Eastern and Western Pacific, such as those seen in the *El Niño* condition (see section 'Climate change' below). Lastly, it is important to stress that for countries like the island states of the Caribbean, Panama and Costa Rica, territorial waters represent more than 50 per cent of their total area.

### Large-scale sediment flows into the Caribbean



Source: University of South Florida (USF) <http://usfweb.esf.edu/>

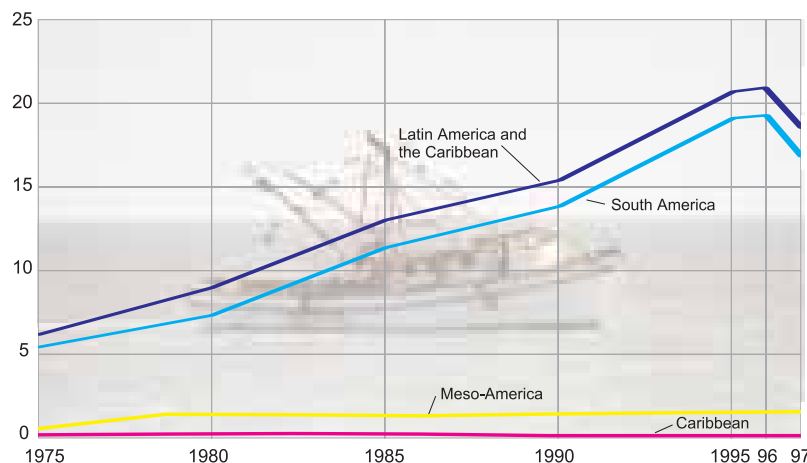
## Marine fisheries

The total marine catch in the region reached a peak of 21 million tonnes in 1995 (about 20 per cent of the world catch). From 1985 to 1995, many South American countries doubled or tripled their catch, while Colombia increased its catch fivefold. However, the catch in later years has dropped considerably. For 1997, the decrease was around 14 per cent (FAO 2000).

The biggest decreases in catch occurred in Peru and Chile: for 1993 this represented around 80 per cent of the total catch and around 30 per cent of the total income, which was US\$4.5 billion that year (Lemay 1998). Two important reasons for this are the *El Niño*

The marine fishery catch grew four-fold between 1975 and 1995, but has decreased since then because of over-exploitation and the *El Niño* phenomenon.

### Marine fish catch, 1975-1997 (million tonnes/year)



Source: United Nations Food and Agriculture Organization (FAO): FAOSTAT (<http://apps.fao.org/fishery/fprod1-s.htm>, downloaded February 18, 2000).



phenomenon and the over-exploitation of the fisheries resource.

Between 1970 and 1983, the catch in Peru plummeted from 12 million to 2 million tonnes due to the *El Niño* events. Although in the following decade the catch volume increased significantly, reaching 8.9 million tonnes in 1995, it then dropped again to 7.8 million tonnes in 1997 (IDB 1995; FAO 2000). It is likely that this latest decrease was caused by the 1997–1998 *El Niño*.

The other key factor is over-exploitation of fishery resources: 80 per cent of the commercially exploitable stocks in the south-western Atlantic and 40 per cent of those in the south-eastern Pacific are now fully exploited, over-exploited or depleted (FAO 1997c).

The Chilean case is a good example of this. The country witnessed a steady increase in its catch over the past few decades. In the period from 1990 to 1998, the GDP of the Chilean fishing industry grew at an average annual rate of 10.7 per cent, while exports grew 5.5 per cent from 1990 to 1996 (Chile, Central Bank 1998). However, the average catch in 1998 decreased more than 43 per cent compared with 1997, reaching its lowest point in the decade at 3.6 million tonnes. Fish product exports dropped 31 per cent compared with 1997, and the returns decreased 10.6 per cent (Chile, Ministerio de Economía, Subsecretaría de Pesca 1998).

The dramatic fall in the Chilean catch is directly related to a decrease in landings of yellow tail jack (*Trachurus symmetricus murphy*) and anchovy (*Engraulis ringens*), the major components of the

#### The impact of Chilean fisheries on exploited species\*

| Species                                                                | Abundance <sup>(1)</sup> |                   | Total biomass <sup>(1)</sup> | Exploitation rate <sup>(2)</sup> | Over-exploitation                                                                                                                    |
|------------------------------------------------------------------------|--------------------------|-------------------|------------------------------|----------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|
|                                                                        | Juveniles                | Adults            |                              |                                  |                                                                                                                                      |
| Groundfish species (from deep waters)                                  |                          |                   |                              |                                  |                                                                                                                                      |
| <b>Southern Hake</b><br>( <i>Merluccius australis</i> )                | 19 %                     | 24 %              | 29 %                         | —                                | Severe                                                                                                                               |
| <b>Golden Conger Eel</b><br>( <i>Genypterus blacodes</i> )             | —                        | 40 %<br>(females) | 30 %                         | —                                | Severe                                                                                                                               |
| <b>Nailon Shrimp</b><br>( <i>Heterocarpus reedi</i> )                  | —                        | —                 | —                            | —                                | Catch smaller<br>than authorized                                                                                                     |
| Pelagic species (feeding in surface waters)                            |                          |                   |                              |                                  |                                                                                                                                      |
| <b>Sardine</b><br>( <i>Sardinops sagax</i> )                           | —                        | —                 | —                            | 80%<br>(1994)                    | Extensive<br>depletion                                                                                                               |
| <b>Common Sardine</b><br>( <i>Clupea Strangomera<br/>benticki</i> )    | —                        | —                 | —                            | 58 %<br>(1998)                   | Significant biomass<br>and recruitment<br>decrease since 1996                                                                        |
| <b>Anchoveta</b><br>( <i>Engraulis ringens</i> )                       | 30 %                     | —                 | —                            | —                                | Over-exploitation<br>because of recruitment<br>(southern Peru and<br>northern Chile, possibly<br>also central and<br>southern Chile) |
| <b>Yellow Tail Jack</b><br>( <i>Trachurus symmetricus<br/>murphy</i> ) | —                        | —                 | —                            | 22 to 32 %<br>(1993-1996)        | Severe crisis: total<br>allowable catch has<br>not been reached                                                                      |

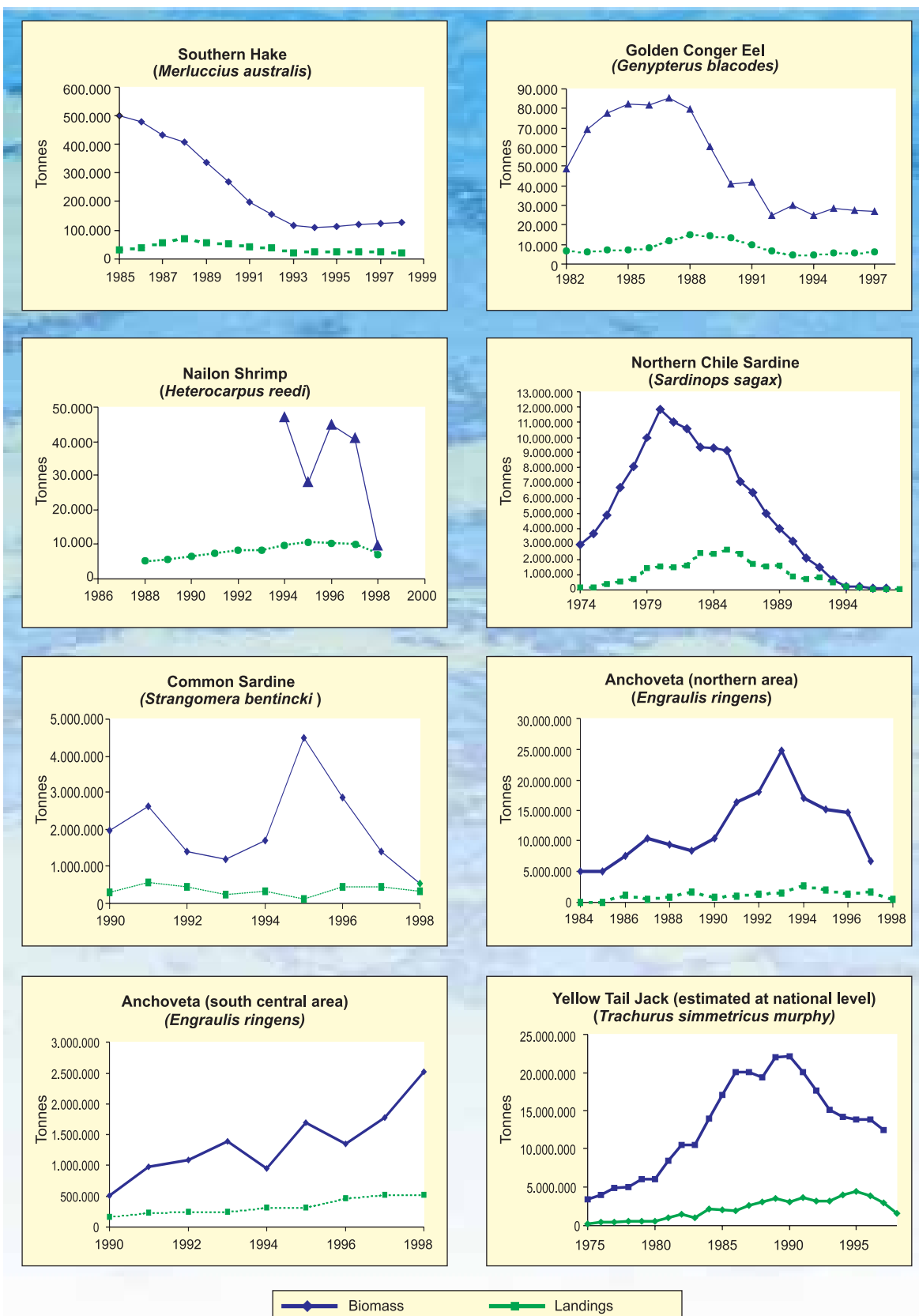
\* Expressed in terms of the original stock percentage reduction (groundfishes) or in exploitation rates (pelagic species)

(1) Relative to the level existing before the commercial exploitation of the species.

(2) As a proportion of the estimated stocks to the last reference year (see graphs below).

Source: Compiled from Moreno, 1999.

# **Biomass and landings of the main species exploited in Chilean waters**



Source: Moreno, 1999.

Over-fishing and the 1997-1998 El Niño phenomenon have caused a dramatic decline in Chilean fish catch.

country's catch. The quantity of yellow tail jack began to decline in 1997 as a result of over-fishing in 1994, 1995 and 1996, when landings exceeded the average of previous years, while the anchovy catch was affected in 1998 by the *El Niño* conditions (Chile, Ministerio de Economía, Subsecretaría de Pesca 1999a).

## Aquaculture

Many fishing activities – industrial, artisanal and recreational – co-exist in the Caribbean sub-region. Total catches by the principal fisheries increased from approximately 189 000 tonnes in 1975 to a maximum of 268 000 tonnes in 1985, before declining to around 146 000 tonnes in 1995. In 1996 and 1997 the volume remained at a similar level, with minor oscillations. According to an FAO assessment, around 35 per cent of the Caribbean stocks are over-exploited (FAO 1997c). This sub-region also has the highest percentage of waste, mainly as a result of shrimp trawling.



Fish farming is less important in Latin America and the Caribbean than it is in some other tropical regions, although it is growing, as are its environmental impacts (Lemay 1998; PNUMA 1999b). In Ecuador, Colombia and the Dominican Republic, shrimp farming has developed significantly, and in 1995 the region as a whole produced 21.6 per cent of the global harvest of this species.

Aquaculture in Chile is growing at more than 30 per cent per annum compared with a global increase of only 9.5 per cent. These activities are focused on salmon farming, induced by favourable export markets, and they generate some US\$450 million per year in export revenue. Salmon exports in 1997 reached 145 000 tonnes (Chile, Ministerio de Economía, Subsecretaría de Pesca 1998). During 1998, various forms of salmon exports represented 43.7 per cent of total fish exports; the returns resulting from salmonid exports grew 6.9 per cent; and the volume shipped grew 13.5 per cent (Chile, Ministerio de Economía, Subsecretaría de Pesca 1999b).

The conversion of mangroves affects several important ecological functions. Mangroves are the habitat of diverse organisms, including birds, crabs and oysters; they provide spawning and nursery areas for fish, shrimp, prawns and lobsters; and they protect the coastline against wave erosion (PNUMA 1999c). Other important impacts include the enrichment of habitats with nitrogen and phosphorus; interaction with the food chain; oxygen consumption; interaction between native and planted species; the introduction of exotic species; and the release of biotic compounds (including pesticides and antibiotics), chemicals, hormones and growth enhancers (PNUMA 1999c).

## Tourism

Tourism represents about 12 per cent of the gross domestic product of Latin America and the Caribbean, and is concentrated mainly along the coasts. Some 100 million tourists visit the Caribbean each year, contributing 43 per cent of the combined gross domestic product of the Caribbean and one-third of its export revenues (WTTC 1993). It is expected that for the year 2005, and just in the Caribbean, scuba-diving tourism alone could generate some US\$1.2 billion in income (OMT 1994). Aside from generating employment (10 million people were employed in tourism-related jobs in 1993), investments in tourism have led to important changes in land use and life-styles along the coasts, with many rural coastal areas experiencing a gradual shift from reliance on local agriculture and fishing to the provision of tourism services and related activities (WTTC 1993).

## Trade

The region's ports are the second most important destination for containerized goods exported from the United States, and the Panama Canal is a focal point for maritime trade. The overall tonnage going through the ports in the region increased from 3.2 per cent to 3.9 per cent of the world total between 1980 and 1990, and a significant increase is expected as a result of trade liberalization and the privatization of regional ports (UNCTAD 1995). Port expansion and maritime trade usually go hand in hand with expansion of trade routes along the coastline, as is already happening in Argentina, Brazil, Ecuador and Uruguay.

All these activities cause a rapid and often drastic transformation of the marine coastal zones (see map below for the case of Central America).

## Sediment and pollution loads

In general, the main contributor to coastal marine habitat degradation – including mangroves, estuaries and coral reefs – is the conversion of land for agricultural use, housing or tourism. Also important

are the impacts caused by surface transportation activities and by hydrocarbon production and processing.

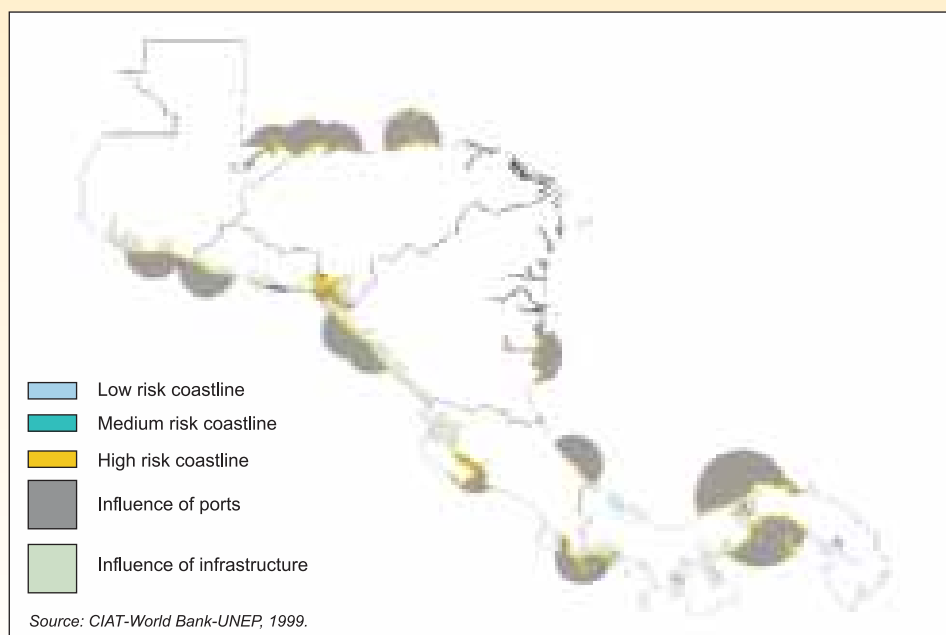
Erosion, caused by deforestation and poor management of agricultural land (see 'Land and food' section above) is one of the principal agents of coastal shallow water degradation. In the Greater Caribbean, for example, the sediment load deposited in coastal waters is estimated to be more than ten million tonnes per year (PNUMA 1999b). At the same time, the excessive use of fertilizers in agriculture has furthered algal population growth and eutrophication in coastal lagoons. There is little information on contamination of coastal waters from pesticides, but mean concentrations of heptachlorine of 10.12 nanograms per litre and 6.85 nanograms of dieldrin (PNUMA 1999b) have been detected in surface waters at the port of Bluefields, Nicaragua. In such countries as Brazil, Ecuador, Guyana and Honduras these factors are worsened by people migrating to coastal flood plains, not only increasing the pollution of the coast but also causing over-fishing and conflicts related to access to traditional fishing grounds (IDB 1995).

## A Coastal Risk Index for Central America

Within the framework of the CIAT–World Bank–UNEP project for rural sustainability indices, a Coastal Risk Index has been prepared based on a similar index developed by the Global Resource Institute, with a geo-referenced example for Central America.

This Coastal Risk Index is based on a port's 'radius of influence'. Port influence is considered to be high risk for a radius of influence of 60 kilometres for medium-sized ports and 100 kilometres for large ports. The influence of the infrastructure and population centres serves as an approximate measure of coastal development, rating it in accordance with how close it is to the maritime area: if two hours or less, it is considered to be highly accessible, with a risk of intermediate impact. All other coastal areas are considered to be low risk.

The map shows that the influence of infrastructure is greater in the Central American Pacific coast, while port pressure is similar on both coasts. As a result of this, 40 per cent of the regional coastlines are at high risk, 10 per cent are at intermediate risk, and the remaining 50 per cent are at low risk.



Coastal water quality has been declining region-wide because of an increase in untreated municipal waste discharges. For example, in the Greater Caribbean it is estimated that between 80 and 90 per cent of waste waters are discharged directly into coastal waters without having been adequately treated first (PNUMA 1999b).

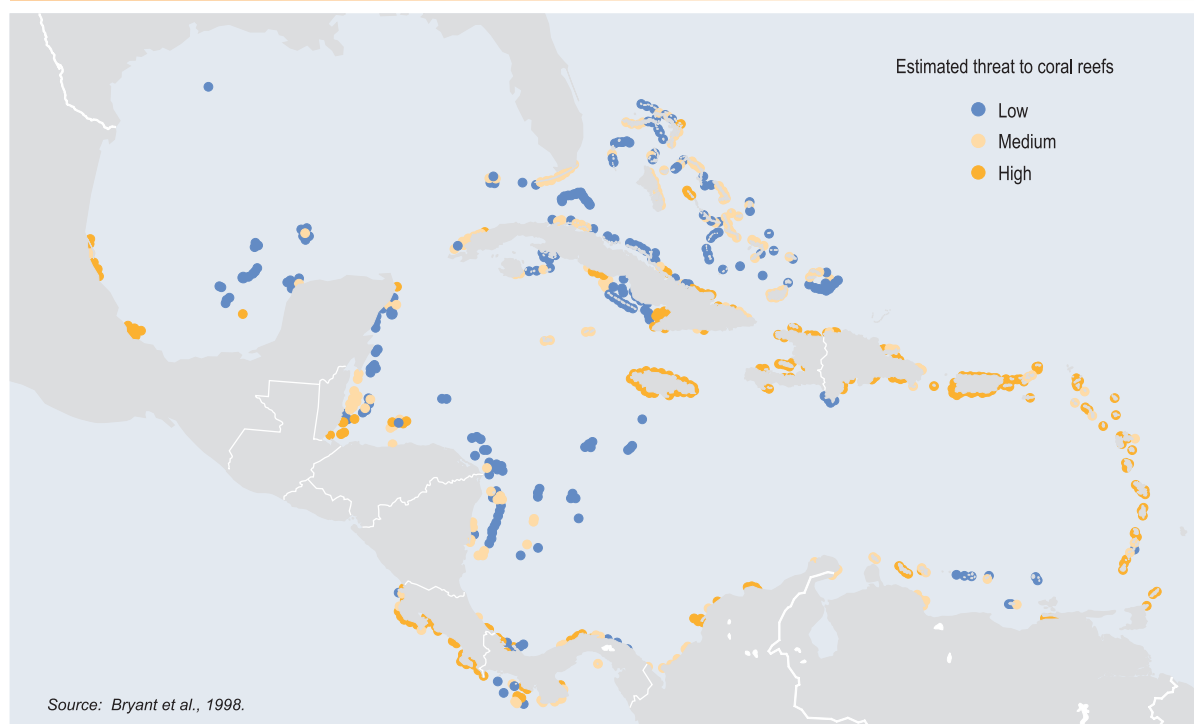
Particularly badly affected are the region's mangrove ecosystems, which have been rapidly disappearing over the last 20 years. In Mexico, for example, up to 65 per cent of the mangroves have already been lost (Suman 1994). Moreover, important environmental functions are also being compromised, including coastline stability, fish breeding grounds, recreational uses and flood control.

Reef ecosystems provide another clear indicator of the severe damage being caused to the environment. The reefs in the Caribbean and adjacent waters represent about 12 per cent of the global total: today, 29 per cent of the reef areas of the sub-region (see map) are considered to be at significant risk from runoff and sedimentation caused by deforestation, from nutrients coming from hotel and vessel sewage, from construction projects along the coast, and

from mining activities (Bryant *et al.* 1998) as well as from increases in sea surface temperatures (see box on page 57).

The infrastructure required for the tourism industry and for coastal settlements is a major source of coastal water contamination (UNEP 1999b). In addition to locally produced waste, it is estimated that more than 700 000 tonnes of waste are generated by the 35 million tourists who visit the Greater Caribbean each year (PNUMA 1999b). The growing popularity of the Greater Caribbean as a yacht and cruise ship destination has resulted in yet more waste being disposed of directly into the environment. Port facilities in general have inadequate collection systems to deal with the solid waste produced by visiting vessels. In extensively developed coastal areas there is high risk of sewage pollution due to the high water table and to the soil's high absorption capacity. In places like Barbados, Jamaica and Haiti, protective reef systems have been degraded by eutrophication caused by faecal material in the water, contributing to soil erosion and to beach destruction. Existing measurements for Havana Bay have found concentrations of 70 micromoles per litre of nitrogen from ammonia and between 0.7 and 2.5

#### The threat to coral reefs



Many of the region's coral reefs are under threat: the Caribbean sub-region is the most affected, with 29 per cent of its reefs at high risk.

micromoles per litre of phosphorus, causing the eutrophication of certain areas (PNUMA 1999b).

Another significant source of water pollution and coastal sedimentation is the extraction, processing, storage and transportation of natural gas and oil, as well as the cross-boundary transfer of hazardous and toxic wastes, including radioactive materials and chemicals. Although there is little up-to-date information about this, several studies carried out in the Greater Caribbean show hydrocarbon concentrations in surface waters ranging from 1.0 to 5.98 micrograms per litre in Bluefields (Nicaragua) and 1.0 to 1.85 micrograms per litre in Puerto Limón (Costa Rica) to 0.36 to 1.27 milligrams per litre in Havana Bay (Cuba) (PNUMA 1999b). Concerning sediments, hydrocarbon concentrations found in Bluefields (Nicaragua), Cartagena (Colombia), Yucatan and Veracruz (Mexico) and Havana (Cuba) range between 6 and 1 240 micrograms per gram, with averages varying between 26.6 and 994 micrograms per litre, the lowest values being found in Bluefields and the highest in Havana, according to data published in 1996 and 1997 (PNUMA 1999b).

Hazardous substance spills in maritime accidents involving oil tankers, freighters and other vessels are only one risk factor in this field. Most such incidents are caused by accidents or human errors, although a few have been of a criminal nature, such as discharging ballast waters near the coast. Between 1975 and 1997 thirteen oil spills were recorded, ranging from 50 tonnes to 6 000 tonnes, with an annual mean of 2 000 tonnes. In 1999 (to October) eight cases were reported, showing a marked reduction in magnitude, ranging between 10 and 4 000 litres, with a total of some 16 tonnes (Bezerra 1999). However, a 1 300 tonne oil spill occurred in January 2000 in the Guanabara Bay, next to Rio de Janeiro, affecting hundreds of square kilometres of sea waters and mangroves (including a 14 000-hectare protected area), and all the beaches in the bay area. The state-owned oil company was fined US\$28 million (the highest fine to date for ecological damage) in compliance with the new Environmental Crime Law (see Chapter Three). Estimates are that one-third of the oil spilled from 1983 to 1999 went into the ocean since the spills were caused by accidents at port terminals or in refineries built along the coast.

## Integrated management

Successful marine coastal resource management implies thoroughly understanding how ecosystems work, including habitat distribution and species composition. Species' interactions and their responses to human interventions are extremely relevant to coastal resource management. The conservation of these resources demands an integrated and comprehensive framework for policy-making, planning and management.

The current situation and importance of coastal marine resources demand urgent action, as well as international co-operation and agreements. For these agreements to be successful, institutional capacity-building is needed among the regional governments, in addition to efforts to promote the design, monitoring and assessment of marine coastal activities.

Careful, co-ordinated, simultaneous planning and management of all sectoral activities will bring much greater overall benefits than the separate implementation of individual sectoral development plans. The integrated coastal management approach is necessary, bringing together into one single administrative framework all the human, physical and biological aspects of coastal areas.

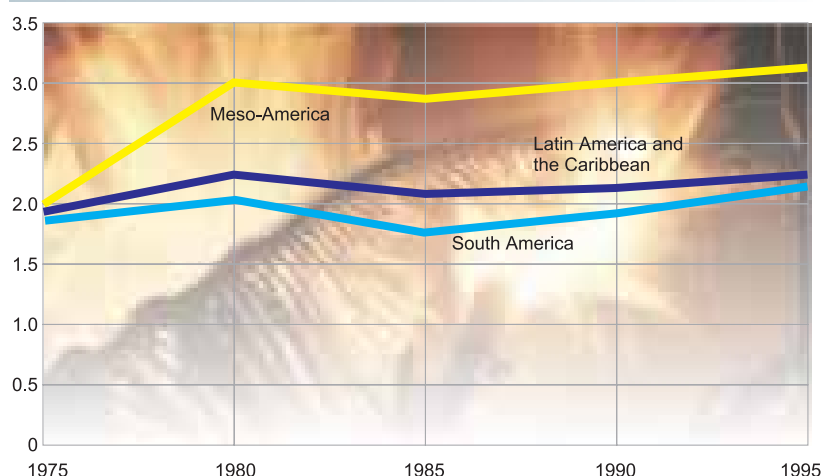
## Upper air and ozone

Internationally there is now a much greater understanding of the interconnections between atmospheric issues such as local air pollution, acid rain, global climate change and atmospheric ozone depletion. It is also now understood that an isolated response to one environmental issue may, in fact, exacerbate others.

In Latin America and the Caribbean, the main source of atmospheric emissions is deforestation, particularly in the Amazon Basin (UNEP 1999a). Some parts of the region also face air pollution problems as result of industrial development and urban growth. This, in fact, could worsen as a result of the deregulation and privatization of the power sector. For example, in countries like Argentina, Brazil and Colombia, this could lead to reduced use of biomass and hydroelectric power, and to increased use of fossil fuels (Rosa *et al.* 1996).



## Carbon dioxide emissions per capita 1975 - 1995 (tonnes/year)



Note: data for the Caribbean are unreliable

Source: compiled by UNEP GRID Geneva, from WRI, UNEP, UNDP, and WB 1998 and CDIAC 1998.

## Greenhouse effect gases

Reliable information with which to prepare inventories of greenhouse gas emissions is difficult to obtain in most countries of the region. Few specific emission factors have been identified for specific regions or systems; the forest status and land use changes are difficult to characterize; and data are either totally non-existent or derived from related statistics or even from anecdotal evidence. There is also a general absence of monitoring infrastructure, except in some large metropolitan areas.

Trends depicted by existing inventories, either complete (Argentina, Virgin Islands,

*Per capita emissions of carbon dioxide are well below the 12 tonnes estimated for the high-income economies, and also below the world average of 4.0 tonnes.*

## Air pollution due to energy use in Chile

Man-made air pollution is caused mainly by the use of fossil fuels to generate electrical power, by changes in land use, deforestation and agriculture, and by diverse industrial activities. At the global scale, carbon dioxide is one of the main pollutants – estimated to be responsible for around 60 per cent of the global warming attributable to the 'greenhouse effect' caused by human activities. Some estimates indicate that 85 per cent of anthropogenic emissions of this gas come from industrial processes while the rest is due to changes in land use.

Even though it is estimated that in South America as a whole the main source of carbon dioxide emissions is deforestation, there are no data available to support this statement in the case of Chile. However, a recent study carried out in that country sheds some light on the emission of pollutants from combustion of fossil materials. As shown in the accompanying graphs, based on 1994 data, combustion of crude oil is responsible for 64 per cent of carbon dioxide emissions originating from energy use. In relation to the role of the energy consumer sector, it is estimated that transportation generates 36 per cent of carbon dioxide emissions, followed by the manufacturing and construction industries and the energy industry (26 per cent and 24 per cent of emissions respectively).

Total carbon dioxide emissions due to the burning of fossil fuels in Chile are similar to those of countries such as Estonia, Lithuania and Norway, which oscillate –according to 1990 estimates– between 35 and 39 million tonnes per year. However, per capita emissions are considerably lower: 2.45 tonnes per year for Chile compared to 8.26 tonnes per year for Norway, for example. As an average, yearly per capita emissions for 1995 were higher in North America (19.93 tonnes) and Europe and Central Asia (7.93 tonnes), than for Latin America and the Caribbean (2.55 tonnes.)

## Carbon dioxide emissions from energy use by type of fuel (in thousands of tonnes)

| Fuel                                   | Emissions*      |
|----------------------------------------|-----------------|
| Liquid fossil fuels:                   | 23 673.1        |
| Crude oil:                             | 22 630.1        |
| Others:                                | 1 043.0         |
| Solid fossil fuels:                    | 7 788.4         |
| Gaseous fossil fuels:<br>(natural gas) | 3 930.7         |
| <b>Total</b>                           | <b>35 392.2</b> |

\* In thousands of tonnes.

## Air pollutant emissions from energy use by emission sectors (in thousands of tonnes)

| Sector                                    | Carbon dioxide (CO <sub>2</sub> ) | Carbon monoxide (CO) | Methane (CH <sub>4</sub> ) | Nitrogen oxides (NO <sub>x</sub> ) | Nitrous oxides (N <sub>2</sub> O) | Non-methane volatile organic compounds (NMVOC) | Sulphur dioxide (SO <sub>2</sub> ) |
|-------------------------------------------|-----------------------------------|----------------------|----------------------------|------------------------------------|-----------------------------------|------------------------------------------------|------------------------------------|
| Energy industry                           | 8 439.8                           | 3.0                  | 0.2                        | 25.7                               | 0.1                               | 0.6                                            | 58.8                               |
| Manufacturing and construction industries | 9 255.2                           | 32.8                 | 1.6                        | 38.8                               | 0.2                               | 2.7                                            | 48.5                               |
| Transportation                            | 12 695.3                          | 378.3                | 2.1                        | 77.7                               | 1.1                               | 74.2                                           | 6.1                                |
| Commercial, institutional and residential | 4 049.6                           | 464.5                | 28.9                       | 14.9                               | 0.4                               | 55.7                                           | 27.8                               |
| Agriculture, forestry and fisheries       | 787.1                             | 6.0                  | 0.7                        | 4.6                                | 0.0                               | 1.1                                            | 5.0                                |
| Fugitive sources                          | 0.7                               | 40.7                 | 0.4                        |                                    | 13.2                              | 6.8                                            |                                    |
| <b>Total</b>                              | <b>35 227.0</b>                   | <b>885.2</b>         | <b>74.1</b>                | <b>161.9</b>                       | <b>1.7</b>                        | <b>147.5</b>                                   | <b>153.0</b>                       |

Source: UNFCCC Secretariat 2000; PRIEN-CONAMA 1999; UNEP 1999a.

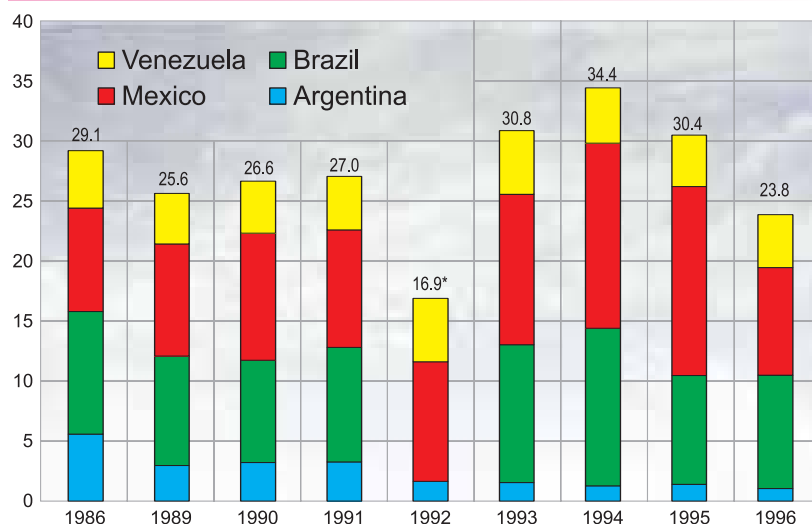
Puerto Rico, Uruguay) or preliminary (Chile, Costa Rica, Mexico, Trinidad, Venezuela), suggest that more than 50 per cent of the emissions result from industrial production and power generation. In the Caribbean, emissions are caused mainly by oil refineries, but also significant are those resulting from mining activities. Transcontinental dispersion of suspended particles between Africa and the Caribbean has also been recorded. However, in Brazil and Chile the gross emission of greenhouse gases due to power generation is considerably lower than that caused by deforestation, changes in land use and agriculture (Bonduki *et al.* 1995).

The region is responsible for 4.3 per cent of the total global emissions of carbon dioxide by industrial processes, and for 48.3 per cent of emissions caused by land use changes. Anthropogenic methane emissions represent 9.3 per cent of the world total. The mean per capita carbon dioxide emission in 1995 was 2.55 tonnes – way below the 11.9 tonnes calculated for high-income economies (19.93 tonnes for North America, 7.93 for Europe and Central Asia, 7.35 for West Asia) and also below the world average of 4.0 tonnes (CDIAC 1998).

The main cause of anthropogenic emissions is deforestation, and the Amazon region is an important source of methane and nitrogen oxides. The conversion of primary tropical forests to agriculture and to secondary growth has produced great changes around the globe. In the Amazon Basin, encompassing almost 7 million square kilometres, biomass combustion and the introduction of new types of green cover will have significant ecological implications for the region, the continent and the whole planet (LBA 1996).

Because of the renewable energy sources in the region, and the potential of many forest conservation and reforestation programmes to provide valuable carbons sinks, many countries might be able to decrease their carbon emissions. Using ethanol as a gasoline substitute, for example, can reduce carbon dioxide emissions. However, although a significant proportion of the power in the region is hydroelectric (see 'Energy' section), the deregulation and privatization of power generation could increase emissions since market forces will most likely not favour biomass and water power.

**CFC production in Latin America and the Caribbean, for the four main producing countries, 1986-1996**  
(thousands of tonnes multiplied by the ozone depleting potential)



Source: UNEP Ozone Secretariat, 1999.

\* There are no 1992 data for Brazil.

For the Caribbean specifically it is worth noting that despite its small contribution to regional carbon emissions, and even smaller contribution to global emissions, this sub-region will probably experience the consequences of climate change before many other regions. A rise in sea level, for example, will profoundly affect the small island states.

## Ozone-depleting substances

Global consumption of chlorofluorocarbons (CFCs) – the most widespread ozone-depleting substances (ODSs) – dropped from 1.1 million tonnes in 1986 to 160 000 tonnes in 1996 thanks to their almost complete elimination in industrialized nations (UNEP 1999a). If the reductions foreseen in the Montreal Protocol continue, the concentration of these substances in the atmosphere will have reached its highest point in 1997 and 1999, and will decrease during the next century (as is already occurring in mid latitudes).

Reducing production of these substances is now an important task for developing nations, where production more than doubled in the period 1986 to 1996 and where consumption increased by 10 per cent. At the same time, the virtual elimination of CFCs in industrialized countries is now being compromised by a rise in the illegal trade in these substances, estimated to be running at 20 000 to 30 000 tonnes per year (UNEP 1999a).

CFCs production in the region is around 14.9 per cent of global production.

Among the developing countries that produce CFCs are Brazil, China, India, Republic of Korea, Mexico and Venezuela. In Latin America and the Caribbean, production represented 14.9 per cent of world production in 1996.

## Urban areas

About half the world's population lives in urban areas, and their numbers are growing at almost 160 000 per day (UNEP 1999a). Cities have an impact on areas much larger than those they physically occupy because of their need for electricity, food and other resources, and also because of the regional and

global effects of their waste and emissions into the soil, air and water.

Most of the one billion new urban dwellers projected for 1999–2010 will most likely be absorbed by cities in developing countries, which already face a shortage of housing and infrastructure and already struggle with overcrowded transportation, insufficient potable water, deteriorating sanitation systems and environmental pollution. More than 600 million urban dwellers in Africa, Asia and Latin America live in slums or as squatters, and their population growth rate in some cases exceeds 20 per cent per year – twice as high as in the cities themselves. Despite this, migration from rural areas to the cities continues, fuelled by complex economic and environmental patterns and by the attractive urban consumption model and life style.

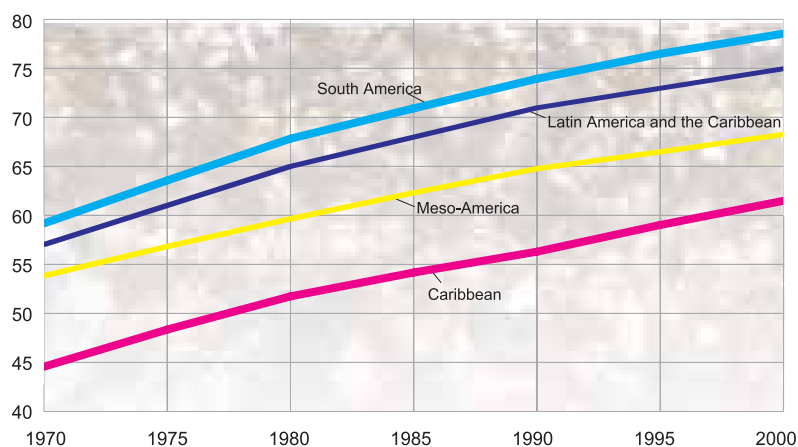
Latin America and the Caribbean already have a largely urban population. In 1950, 43 per cent of the total population lived in urban areas, and this increased to 73 per cent in 1995, but with strong regional variations. Between 1975 and 1995, the regional urban population practically doubled, from 192 million to 344 million, and it is estimated that in 2000 the figure will be 380 million (CELADE 1999). The majority of urban dwellers live in large cities, such as Mexico City (15.4 million), São Paulo (15.6 million) and Rio de Janeiro (9.5 million). In the early 1990s, Buenos Aires, with 11.2 million inhabitants, and Santiago, with 4.6 million, housed around 35 per cent of the total population of Argentina and Chile (CEPAL 1999a).

## Effects of infrastructure

Although urban development in itself does not necessarily have negative economic or environmental impacts, unplanned urban growth has led to the proliferation of slums in the hearts and outskirts of cities, many of them lacking basic services. Unplanned urban development can exert great pressure on the environment, often worsening generalized environmental problems such as land and coastline degradation, poor air quality, inadequate water supply and sanitation, pollution, and

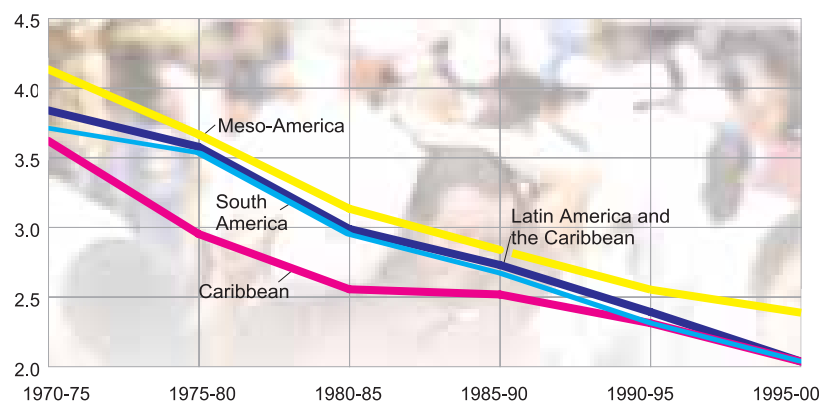
Meso-America and South America have highly urban populations. Urbanization levels are expected to reach 85 per cent by the year 2025.

**Urban population, 1970-2000**  
(as a percentage of the total population)



Source: Centro Latinoamericano y Caribeño de Demografía (CELADE): <http://www.eclac.cl/Celade-Esp/index.html>, downloaded January 18, 2000.

**Urban population growth, 1970-2000**  
(annual rate)



1/ Based on an exponential growth model

Source: Centro Latinoamericano y Caribeño de Demografía (CELADE): <http://www.eclac.cl/Celade-Esp/index.html>, downloaded January 18, 2000

Urban population growth rates are falling sharply, mainly because of the already very high levels of urbanization in the region.

solid and hazardous waste management. Inefficient urban land use results in the unnecessary loss of valuable land that could have been used for other high-priority environmental and social uses, ranging from water basin protection and biodiversity preservation to safeguarding preferred recreational sites. Ground suitable for cultivation has been built on for many years, and the inexorable growth of urban communities has forced the use of environmentally inappropriate and risky lands (steep slopes and flood plains) for human settlement.

The absence of planning, poor regulation and weak enforcement of controls combine to create a dangerous juxtaposition of residential and industrial activities. Firstly, residents in the poorer city areas are at risk from the inadequate infrastructure itself. Slum areas are overcrowded, often built on steep hillsides, and consist of shacks that do not meet even the most basic building safety standards. Many of them are located near hazardous industrial activities and solid waste disposal sites, exposing the residents to potentially harmful substances. Secondly, as dem-

onstrated by the devastating impact of hurricane Mitch in Central America at the end of 1998 and the floods in Venezuela at the end of 1999, the lack of planning and control enforcement result in extremely high reconstruction costs and a terrible cost in human lives and livelihoods (see 'Disasters' section).

## Urban air pollution

The growth of economic activity and population density cause pollution to increase in many cities. Santiago, for example, is one of the most contaminated urban areas in the world. The most significant sources of air pollution there are urban transportation and the proliferation of small and medium-sized industrial enterprises (IMO 1995). Urban residents are suffering severe respiratory problems, and the numbers of pneumonia cases and premature deaths from respiratory diseases are increasing yearly. Medical treatment for these cases is extremely costly, and there is a significant loss in productivity due to absenteeism (O'Ryan 1994). Air pollution in Mexico City, São Paulo and Bogota is also severe.

### Air quality in the Valley of Mexico Metropolitan Area

In December 1994, the Secretariat of Health of the Mexican Federal Government published official standards to evaluate air quality in terms of its content of ozone, sulphur dioxide, nitrogen oxides, carbon monoxide, lead, total suspended particles (TSP) and suspended particles with a diameter less than 10 microns (PM-10), which represent the breathable fraction of TSPs. These standards established the maximum allowable levels of pollutant concentration, similar to those in the United States and Canada.

The Metropolitan Air Quality Index (IMECA) converts pollutant concentrations into a figure that indicates the level of pollution in a manner accessible to the population. An IMECA of 100 points is the quality standard for a specific pollutant. Air quality is not satisfactory if the index is between 100 and 200, poor if it is between 200 and 300 and very poor if it is over 300.

In the Valley of Mexico, pollutant emissions originate to the north of Mexico City, where the industrial zones are concentrated. However, the highest levels of exposure are located in the south-western part of the city, due to the prevailing north-east-south-west winds. The impact of this pollution on human health has been identified in symptoms such as dyspnoea (breathing difficulties), headaches, conjunctivitis, irritation of the respiratory membranes and coughing. Depending on the symptom and the levels reached in the corresponding pollution indices, the proportion of the population affected can vary between 7 per cent and 19 per cent.

It has been recognized that contamination by ozone is critical since its level exceeds the standard for most of the year, and particularly in the south-western region. The number of days with ozone concentra-

tion levels above 200 points diminished during the 1990–1996 period, but there remained a relatively stable number of days with levels of between 100 and 200 points.

The trend for carbon monoxide (99 per cent of it emitted by transportation) shows levels below the standard. By contrast, in the case of nitrogen monoxide the diminishing trend of previous years was reversed in 1995 and 1996, with the increase concentrated between November and February due to the presence of cold air in the Valley of Mexico.

The sulphur dioxide concentration trend has improved as a result of control measures aimed at industry (which generates almost 60 per cent of this pollutant), aided by the distribution of less polluting fuels. There have been hardly any days showing levels higher than the standard since 1993.

Between 1995 and 1996, the levels of total suspended particles diminished in the north-eastern and south-eastern regions, but increased in the central, south-western and north-western regions. The concentration of particles with a diameter smaller than 10 microns exceeded the standard on more than half the days of 1996, although no days were recorded with levels higher than 200 points.

Lead has shown a downward trend, associated with the reduction of the lead content in gasoline and it is said that the problem has been solved.

Source: INEGI 1998, 1999.

Among the causes of atmospheric degradation, the following can be singled out (UNEP 1999b; INEGI 1998):

- Quantity and quality of fuel consumed, as well as inadequate vehicle emission control, worsened recently in many countries of the region by a rise in used-car imports. For example, in Jamaica, the motor vehicle pool has doubled in the last five years (PJC 1998).
- Industrial activity.
- Inefficient power use.
- High-density urban areas and human settlements.
- Pesticide fumigation in rural agricultural communities.
- Particles resulting from soil erosion and agro-industrial biomass degradation.
- Existing meteorological conditions.

Measures that can be taken to overcome or at least reduce the air pollution problem include the elimination of lead in gasoline, the creation of motor vehicle emission standards, the implementation of inspection and maintenance programmes, and the control of industrial emissions.



The Brazilian programme of adding alcohol to gasoline has not been sufficient although there has been a 30 per cent reduction in carbon dioxide emissions and a general reduction in overall air pollution. The use of private vehicles is now limited in São Paulo, as it is in Mexico City and Santiago. In Rio de Janeiro and São Paulo, 27 million people are exposed to high levels of contamination from particles in the air, which are believed to cause some 4 000 premature deaths per year (CETESB 1992).

Concerning lead pollution, the main sources of exposure are the emissions of cars using leaded gasoline. These effects are felt principally in urban areas. People living in high vehicular traffic areas usually have higher levels of lead in their blood than those who are less exposed. For about the last ten years the lead content in gasoline has been decreasing in most countries, and unleaded gasoline is now being produced. The countries with the highest proportion of this type of fuel are Brazil (100 per cent), Costa Rica (100 per cent), Guatemala (80 per cent) and Mexico (46 per cent) (Christopher *et al.* 1996).

Other sources of lead and other pollutants are paint manufacturing, food processing, metal foundries, petrochemical industries and battery factories. There are enormous limitations to the proper treatment and disposal of these wastes. Often they just pile up in factories, or on empty lots and municipal dumps, or are discharged directly into rivers with little or no treatment. Inadequate lead waste management has caused the pollution of many sites, resulting in the acute poisoning of children in such countries as Mexico, Jamaica, and Trinidad and Tobago (UNEP 1999b).

## Urban poverty

Up to the mid 1970s, poverty was most prevalent in rural areas. In the 1990s, however, regional statistics showed that some 65 per cent of poor households were located in urban areas (World Bank 1996). From 1990 to 1997, the actual proportion of poor households in the urban areas of Latin America (18 countries) decreased from 35 per cent to 30 per cent (CEPAL 1998b). For example, estimates indicate that in Buenos Aires, 17 per cent of the population live with their basic needs unsatisfied (overcrowding, dilapidated housing, scarce access to



potable water and sanitary infrastructure), compared with 22 per cent in the 1980s (La Serna *et al.* 1997). Despite this, between 1996 and 1997, urban areas in some countries still contained close to, or more than, 40 per cent of poor households. Such is the case in Bolivia (47 per cent), Colombia (39 per cent), Ecuador (50 per cent) and Paraguay (40 per cent) in South America, while examples in Meso-America include El Salvador (39 per cent), Honduras (67 per cent), Mexico (38 per cent) and Nicaragua (66 per cent) (CEPAL 1999b). There is no recent information for other countries with high indices of urban poverty, such as Guatemala and Haiti.

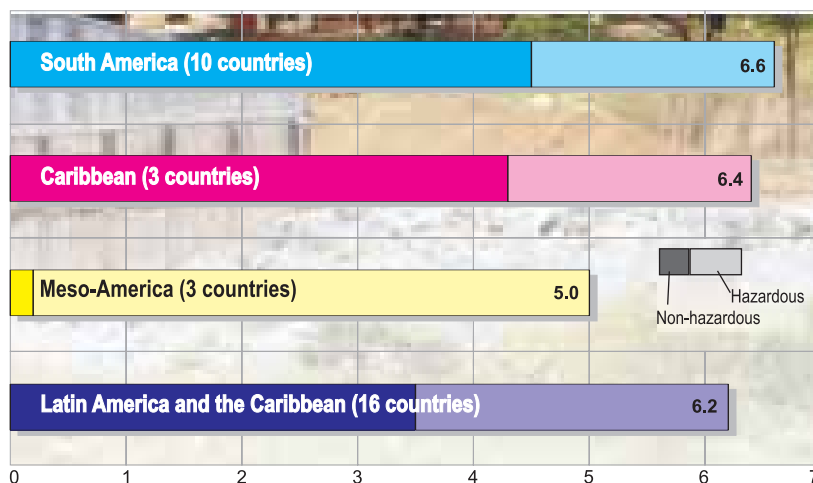
The strongest impact of unplanned urban growth is on the poor, who are forced to settle in marginal areas, more vulnerable to natural hazards. These fringe settlements often lack adequate water and sanitation services, and are much more exposed to natural disasters and to serious diseases such as cholera and dengue. Unplanned growth produces other effects on the environment since the waste water disposal systems are inadequate, the demand for water exceeds supply, and aquifers are being contaminated.

## Effluent and solid waste management

Effluent and solid waste treatment is particularly troublesome in Latin America and the Caribbean. Only 30 years ago, the per capita solid waste production was between 0.2 and 0.5 kilograms per day, while it presently ranges between 0.5 and 1.2 kilograms per day, the regional average being 0.92 kilograms. Estimates for 1995 were that the urban population region-wide (some 344 million) was producing around 330 000 tonnes a day of solid waste (CELADE 1999; Acurio *et al.* 1997).

The problem lies not only in the quantity but also in the quality and composition of these wastes, which have gone from being dense and almost completely organic to bulky and ever more non-biodegradable, containing a larger proportion of toxic substances. This trend seems to be directly proportional to city size and to personal income, and to a shift in life styles. More and more plastic, aluminium, paper and cardboard packaging are being used and discarded by homes and by businesses. Just as an example, in Santiago, higher income neighbourhoods produce one kilogram of waste per person per day, while in

**Annual per capita production of industrial waste, 1993 (tonnes)**



Source: Acurio *et al.*, 1997.

poorer neighbourhoods the production is 0.5 kilograms (Escudero 1996). In Trinidad and Tobago, on the other hand, organic waste production decreased from 44 per cent in 1987 to 27 per cent in 1994, while plastic-based wastes jumped from 4 per cent to 20 per cent in the same period. In 1994, the volume of waste disposed of in the main landfills was 44 per cent greater than in 1979, while in that same period the population grew only 30 per cent (UNEP 1999a).

In addition to residential wastes, so-called 'special' and hazardous wastes must be taken into account, because although small in quantity they have possibly the greatest impact on the environment (Acurio *et al.* 1997). Solid waste includes, among others, solid residues from health centres (estimated at some 600 tonnes per day in the region), expired pharmaceutical and chemical products, expired food products, old batteries, sludge, debris, and bulky residues. Although there are no detailed regional studies on this, surveys carried out by the Pan American Health Organization (PAHO) indicated that in Brazil, for example, less than 8 per cent of the local governments studied adequately disposed of their hospital wastes. In Mexico barely 46 per cent of these wastes are treated before disposal, while in Venezuela the proportion ranges from 30 per cent to 40 per cent. (Acurio *et al.* 1997.)

Hazardous wastes are those solids or semi-solids characterized as toxic, reactive, corrosive, radioac-

The region is not equipped to manage hazardous industrial waste.



tive, flammable, or infectious, and which therefore pose a health or environmental threat if improperly managed, legally or illegally, in urban areas. According to PAHO studies (Acurio *et al.* 1997), these wastes are disposed of in factory yards, empty lots, open-air dumps or controlled landfills, without regard for the damage done to the environment and human health. Despite the existence of a legal framework to control such dumping in some countries – for example Argentina, Brazil, Chile, Mexico and Venezuela – the physical infrastructure and human resources necessary for nation-wide enforcement are usually absent. The problem is aggravated by the importation of hazardous wastes from industrialized nations.

In order to collect and bury these wastes in a safe and sanitary manner, a fleet of 30 000 trucks and 350 000 cubic metres of earth a day would be needed. Between 90 per cent and 100 per cent of all garbage is collected in large Latin American cities like Buenos Aires, Santiago, Rosario, Havana, Mexico City, São Paulo, Rio de Janeiro, Bogota, Medellin, Cali, Montevideo, Brasilia and Caracas. However, in metropolitan zones, such as Mexico, São Paulo and others, this garbage collection does not include the marginal urban areas (Acurio *et al.* 1997). The average collection coverage in large cities is 89 per cent, while in smaller cities the figure ranges from 50 per cent to 70 per cent (Acurio *et al.* 1997).

Although in general terms solid waste collection services have improved, less attention has been paid to waste disposal itself. The waste treatment facilities in the region are split as follows: 35 per cent are sanitary landfills, and 25 per cent are semi-controlled landfills (PAHO 1995). The most commonly used disposal systems throughout the region are open-air dumps and non-sanitary landfills that do not even comply with minimum standards. Some progress has been made in a few cities – a factor that, due to city size, distorts statistics and causes unfounded optimism: the situation in other cities gives cause for concern. In Brazil, a national survey revealed that 88 per cent of the cities have open-air dumps, 9 per cent have controlled landfills, and another 3 per cent have sanitary landfills and other appropriate waste treatment methods (Acurio *et al.* 1997). Eighty-three per cent of the waste treatment facilities in Chile are sanitary, as are 30 per cent in Mexico. In Bolivia,

Ecuador, Peru and most of the Central American countries, there are no sanitary landfills outside the capital cities, although Bolivia and Colombia are developing programmes for medium-sized cities (PAHO 1995). A Central American study covering 158 urban sites with more than 10,000 inhabitants showed that industrial and residential wastes were not being treated (Incer 1994). A problem usually overlooked is the management of biotic waste resulting from agricultural practices (including slaughterhouses), which covers agro-chemicals, excrement and carcasses. Another problem is the collection and disposal of bulky items such as vehicles, electrical appliances and furniture, which usually end up dumped in waterways and wetlands.

Other important concerns regarding waste disposal include the following:

- Most of the existing dumps and landfill sites were chosen without preliminary hydro-geological studies.
- Drains, rivers, creeks, wetlands, alleys and other inappropriate sites are being used to dispose of wastes.
- Many informal dump sites have no permits and have resulted from the unmet need for adequate sites.
- The lack of toxic waste disposal facilities forces people to dispose of these wastes in dumps and landfills.
- Lack of suitable waste disposal facilities particularly affects the residents of lower income areas and slums who cannot pay for garbage collection services.

**Solid waste production, waste water treatment and garbage collection**

|                | Solid waste per capita (Kg.year) | Wastewater treated (%) | Households with garbage collection (%) |
|----------------|----------------------------------|------------------------|----------------------------------------|
| Brasilia       | 182                              | 54                     | 95                                     |
| Havana         | 584                              | 100                    | 100                                    |
| La Paz         | 182                              | 0                      | 92                                     |
| San Salvador   | 328                              | 2                      | 46                                     |
| Santiago       | 182                              | 5                      | 57                                     |
| By comparison: |                                  |                        |                                        |
| Toronto:       | 511                              | 100                    | 100                                    |

Source: UNEP, 1999a.

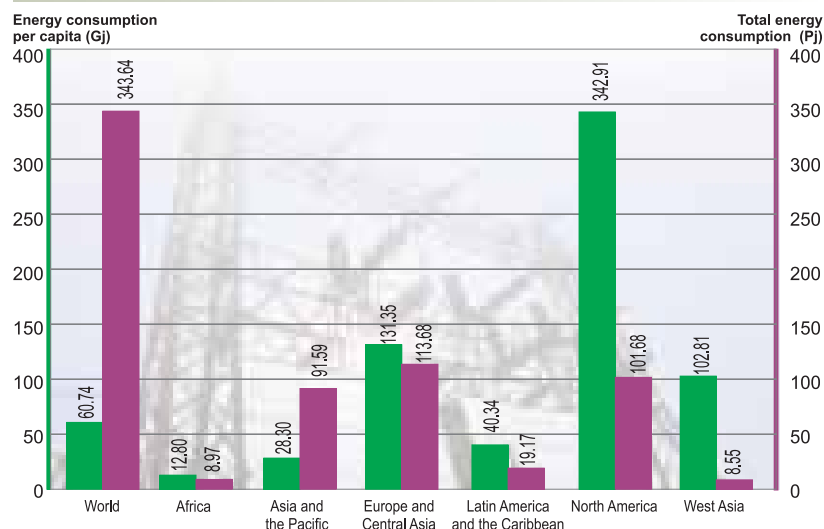
Similar problems are seen when it comes to effluent collection and treatment. In Latin America and the Caribbean as a whole, less than two per cent of waste water receives any kind of treatment (World Bank 1997a). In Brazil, the sewerage system reaches only 49 per cent of the urban population, and lack of clean water and sanitation causes some 8 500 premature deaths in the country's urban areas (Barros *et al.* 1995). In 1991, only ten per cent of the Caribbean population were served by a centralized sewerage system (Vlugman 1992). In that same year, 13 per cent of the treatment plants studied in the Eastern Caribbean were not operating, 58 per cent were operating either poorly or moderately, and 75 per cent of the plants did not comply with existing treatment quality criteria. If corrective actions are not taken in the near future, these problems could pose very serious risks to human health, especially in low-income urban areas, and to the environment, through pollution of rivers, marine environments, and surface and ground water.

The topography of most Latin American cities makes it difficult to use conventional methods to make water drinkable, to treat sewage and to collect effluents and solid waste. Contaminated runoff from impermeable surfaces in developed areas exerts additional pressure on the environment, on top of the already high load of contaminants in industrial effluents discharged into urban waste waters. The pressure of development will continue to increase as the urban areas grow, and as people continue to settle in sensitive areas – especially on steep slopes and over underground aquifers.

## Energy

Energy consumption in Latin America and the Caribbean is less than ten per cent of the world total, while for Canada and the United States it is almost one-third of the total. As with other developing areas, when international oil prices climbed in the early 1970s the region sought other, non-hydrocarbon sources. Between 1980 and 1996, the region's electrical power production more than doubled, jumping from 361 billion to 810.3 billion kilowatt/hours. The dependence on hydrocarbons to generate this electricity dropped to 16.6 per cent of the total, while hydropower increased to 64.1 per cent. Exemplified by Gurí (Venezuela), Tucuruf (Brazil) and Itaipú

**Total and per capita energy consumption, 1995**



Source: data compiled by UNEP GRID Geneva from UNSTAT, 1997.

(Brazil–Paraguay), enormous hydroelectric projects modified the regional power-generation scenario. In Paraguay and Brazil, hydroelectric generation satisfies, respectively, 99.7 per cent and 91.7 per cent of national requirements. In Central America, the proportion is more than 50 per cent. However, dependence on hydrocarbons has been growing in some countries, including El Salvador, Haiti, Nicaragua, Jamaica and Cuba. Power generation in the Caribbean is based primarily on fossil fuel – mostly oil, but also natural gas, as in Trinidad and Tobago (PNUMA 1999c),

Despite the growing importance of hydroelectric power generation in the region, the conflict between access to water and water use also continues to grow because of the vulnerability of water to climatic variation. Uruguay, for example, relies heavily on water sources to produce electricity, and the severe droughts of recent years have forced the country to assign water sources to this use, with direct effects on agriculture. Additionally, in some countries such as Argentina, Brazil and Colombia, and due to deregulation of the sector, there is a tendency to switch from renewable energy sources to fossil fuel for power production and transportation (Rosa *et al.* 1996). Private investors seem to favour fossil-fuel thermal plants over hydroelectric installations because the capital cost is less and the return on investment is faster – even though the cost of the energy is higher (Tolmasquim 1996). In many coun-

Energy consumption in Latin America and the Caribbean is less than 10 per cent of the world total, while North America (Canada and the United States) have almost one-third of the total.

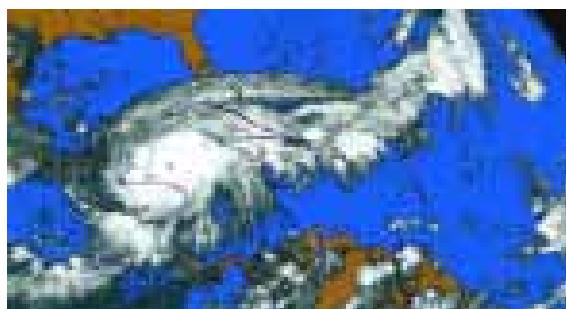
tries that depend on non-renewable sources for power generation, a fundamental barrier to the switch to renewable resources is the huge investment already made in fossil fuels, in their processing, and in the equipment set up to utilize them. Such is the situation in the insular Caribbean countries.

In addition to hydroelectric power generation, other technologies using renewable sources to produce electricity are:

- biomass conversion;
- wind energy;
- solar energy systems, both active (thermal and photo-voltaic) and passive (low-energy architecture);
- oceanic thermal energy conversion, and
- geothermal energy.

However, some of these technologies could have negative impacts on the environment. Biomass conversion, for example, poses a potential risk to biodiversity because it replaces natural forests with monoculture forests. There is also competition to use agricultural land and the need to preserve and improve soil quality. Many solar and wind power systems are land-intensive.

Coal, oil and natural gas continue to be the least expensive fuels. Wind power costs almost the same as oil, but depends on specific geographical conditions and requires a certain critical mass of facilities to ensure that maintenance is efficient. Active solar power systems are economically viable only in remote areas where it would be more expensive to lay power cables.



*In late 1998, Hurricane Mitch caused severe damage and loss of human lives in several Central American and Caribbean countries.*

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## Disasters

Throughout the region, earthquakes, volcanic eruptions, fires, floods, hurricanes, tropical storms and landslides cause significant losses of human lives and livelihoods. It is estimated that throughout the world and over the last three decades almost three million people have died as a result of such events, and millions more have suffered (UN 1997). This is getting worse in two senses: first, the so-called ‘natural’ disasters are occurring more and more frequently, and second, their effects are becoming ever more severe. Some estimates suggest that the economic loss resulting from such disasters was eight times greater between 1986 and 1995 than it was in the 1960s, reaching a total of US\$120 billion in the 1997–1998 biennium (Munich Re 1997, 1998). In general, the poor are the most severely affected, and have the least potential for recovery.

The most common types of disasters in Latin America and the Caribbean are caused by tectonic activity (earthquakes, tsunamis, volcanic eruptions) and climatic phenomena (hurricanes, floods, avalanches, fires), but a number of important anthropogenic factors aggravate the environmental and social impact of such disasters. These factors fall into two main categories – land use patterns (deforestation, urban developments in vulnerable areas, and increased impermeability of the land surface) and humanity’s influence on the atmosphere and climate (degradation of the ozone layer, greenhouse gas emissions and global warming). Institutional weaknesses in monitoring, regulation, and response further amplify the impact of these factors.

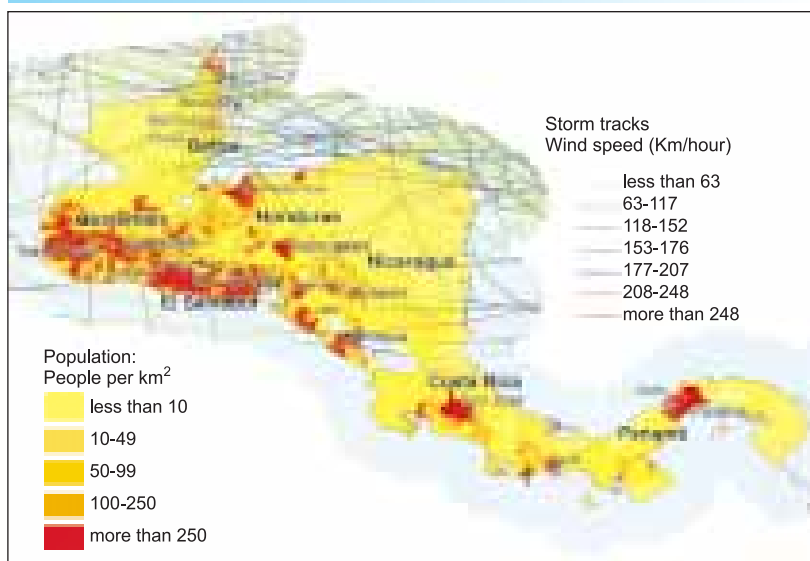
Tectonic activity affects the whole western coast of Latin America, including all of Meso-America and the Caribbean, due to the pressure between the Pacific and North American plates, the Cocos and Caribbean plates, and the Nazca and South American plates (Cunningham and Saigo 1999). The environmental effect of such seismic and tectonic activity is a relatively high risk of earthquakes and volcanic eruptions, which in some areas adds to the already high risk of hurricanes and floods. In the Caribbean sub-region, where disasters are so frequent and widespread, they are one of the principal causes of environmental degradation.

The typical environmental degradation pattern is not a continuous process: it is the gradual accumulation of small damages and transformations that increasingly compromise the ability of natural systems to respond. They do not produce an immediate deterioration of the system operation until an already vulnerable area is hit by a major disaster. Then, the host system cannot recover, and the previous system is quickly replaced by a new regime or ecosystem, less resilient, less diverse, and less able to provide basic environmental services such as water purification, sediment containment or protection against weather inclemency.

Most countries in the Greater Caribbean and Central America are located within the hurricane belt and are prone to be hit by frequent and very severe weather systems. The distribution of these weather hazards, as in the case of earthquakes, volcanic eruptions and avalanches, arises from common geological, geophysical, and climatological conditions. Given this, and the enormous economic, social and ecological costs that result from these events, much more attention has been given in this decade to disaster preparedness, evaluation and mitigation.

Hurricanes Georges and Mitch, the most recent in a long sequence of disasters, claimed thousands of lives and caused billion-dollar losses in infrastructure. In Honduras, the country most severely affected by hurricane Mitch, more than 7 000 people lost their lives and more than 12 000 were injured, while the number directly affected (displaced or forced to take refuge in shelters) reached 618 000. Economic and environmental damage has been calculated to be US\$3.8 billion (CEPAL 1999e). In Nicaragua, there were over 3 000 deaths and 65 000 people directly affected, while the economic and environmental damage was estimated at US\$988 million (CEPAL 1999f). Deaths and serious economic and environmental damage were also suffered by El Salvador, Guatemala, Dominican Republic and Costa Rica (CEPAL 1999g, 1999h, 1999i, 1999j). In Venezuela the intense rainfall in December 1999 resulted in an unprecedented national emergency, principally affecting the state of Vargas and the north-western part of the city of Caracas. Preliminary estimates are that some 120,000 persons were affected, 15 000 lost their lives or are missing, and 35 000 hectares of crops were lost (PNUMA 1999a).

### Tropical storms (Central America)



Source: Colorado State University and NOAA Tropical Prediction Center: <http://weather.unisys.com/hurricane>

Among the most important problems arising from natural disasters are:

- the irrecoverable physical destruction of resources caused by fires, avalanches and floods;
- habitat destruction during emergency response efforts immediately after a large-scale disaster;
- resource poisoning by leaking pollutants after a disaster (oil spills, broken sewage pipes, chemical spills, etc.);
- the huge amounts of waste that result from clean-up and reconstruction operations after a disaster.

To a large degree, the damage caused by natural events is directly related to decisions made, activities undertaken and technologies utilized during the development process. Among the main concerns we can identify:

- shortcomings in disaster prevention, including zoning of vulnerable areas during the development planning process;
- weak mitigation mechanisms;
- deficient regulation, knowledge and use of appropriate construction methods, and inadequate

More than 100 tropical storms have hit Central America in the last century, and more than one third of them were hurricanes (sustained winds at more than 119 km/hour). Dangers associated with tropical storms include heavy seas, strong winds and floods. Belize is the country most affected by heavy seas, strong winds and floods, while Guatemala, Honduras and Nicaragua are affected by floods and landslides.

administrative arrangements and human resources to guarantee enforcement;

- absence of adequate insurance policies for low-income households;
- inadequate support systems for affected communities.

## Climate change

Current global warming models indicate that the higher temperatures now being experienced worldwide can affect many atmospheric parameters, including precipitation and wind speed, with a consequent increase in both the frequency and severity of extreme climatic conditions such as storms, heavy rainfall, cyclones, floods and droughts (Munich Re 1997). Some of these natural phenomena – particularly floods – are exacerbated or triggered by man-made environmental degradation, and by disturbance of previously stable ecosystems. Rural and urban populations are becoming more and more vulnerable to natural disasters because of demographic growth and inadequate city planning. In many developing areas, demographic pressure and poverty force farmers to plant in marginal and vulnerable terrain, in flood-prone areas or on steep slopes. Deforestation can, in the short term, lead to a dramatic increase in run-off and soil erosion, as well as to mud slides and floods.

According to the Intergovernmental Panel on Climate Change (IPCC), the thermal expansion of sea water could result in a fivefold increase in the rate of sea level rise, leading to a sea level rise of one metre in the next 100 years. In addition, the possible melting of polar ice could add a further increase of five or six metres. Furthermore, temperature increases could foster the spread of infectious diseases carried by vector insects, pushing up the incidence of malaria, dengue, cholera and other diseases (Cunningham and Saigo 1999).

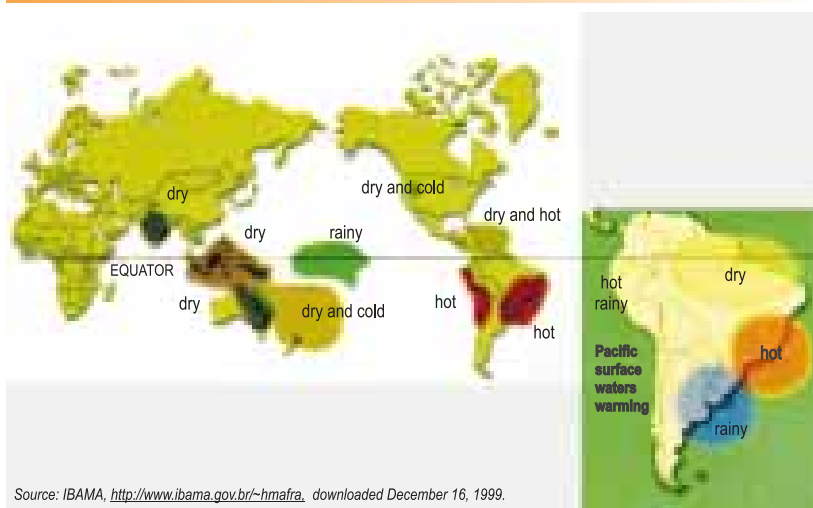
Climate change poses a threat to Latin America and the Caribbean because of the ecological and socio-economic vulnerability of most of the region – not least its vulnerability to a rise in sea level. Although climate change is a world-wide concern, there are issues to be dealt with from the regional perspective, including:

- the magnitude and rate of climate change in different parts of the region;
- its relative vulnerability and the possible impacts of climate change on its ecological and socio-economic systems;
- the identification and implementation of viable response options, and
- the effective role of countries of the region in promoting regional and international actions.

Most of the region's cities, towns and settlements – including the most important ports of Latin America and the Caribbean – have developed along the coast and are therefore particularly susceptible to any rise in sea level. The following are some of the possible environmental impacts of sea level rise:

- Coastal settlement flooding and contamination, with increased precipitation and storm frequency.
- Loss of the many fertile fish breeding-grounds that exist along the coasts.
- Destruction of coral reefs, due to a combination of slower growth caused by temperature increase, excessive bleaching caused by sea level

### Global weather impacts associated with the *El Niño* phenomenon



Source: IBAMA, <http://www.ibama.gov.br/~hmafra>, downloaded December 16, 1999.



rise, and physical damage caused by stronger wave action during storms. This could expose many coastal areas to the direct action of waves, something never experienced before.

Climate change could affect agriculture and water resources, as well as the ecosystems and fisheries in tidal areas. Other potential health impacts of global temperature increase include heat-related morbidity and mortality and the propagation of tropical disease vectors. Regional public health programmes must be ready to fight such diseases as malaria, schistosomiasis, dengue, yellow fever and cholera.

## The *El Niño* phenomenon

One of the most important symptoms of the global climate change process in recent years has been the unusual frequency and duration of the so-called *El Niño* events. *El Niño* is the term used to describe a phenomenon that begins with the warming of the sea surface near the Equator in the Eastern Pacific Ocean, and whose effects cover practically the whole globe. This is not a natural disaster – in fact some of its effects can be beneficial – but it is a very significant climatic variation. *El Niño* events normally occur every three to five years, last between six and

## Coral bleaching

The year 1998 was a difficult one for coral reefs around the world due to abnormally high sea surface temperatures which caused widespread coral bleaching. Coral-forming animals, or polyps, contain minute algae that live symbiotically inside their tissues. The brown or yellow colouring of coral colonies is due to the presence of these algae.

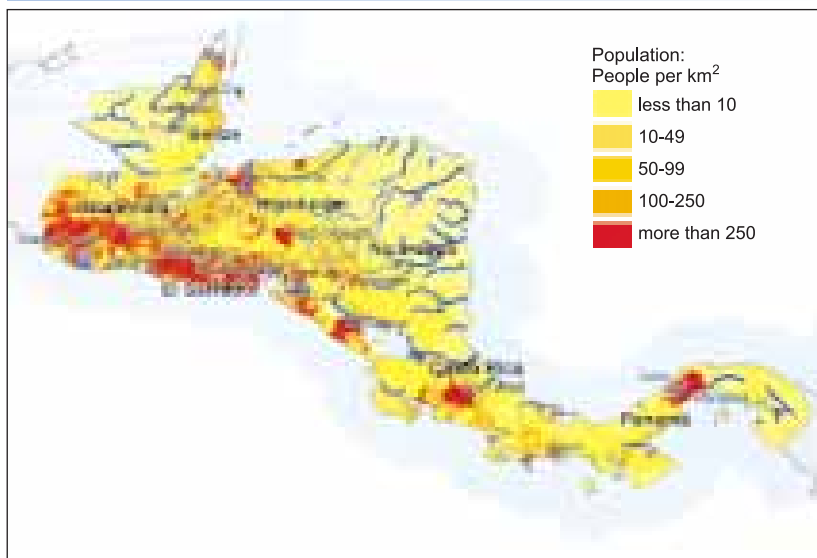
High water temperatures (and sometimes other environmental conditions such as pollution) make these algae leave the coral, which turns white or 'bleached' as a result. The bleached coral is still alive, but it is not healthy since it is not receiving the energy it normally obtains from the close symbiotic relation with the algae. Bleached corals do not grow much and usually do not reproduce. If sea-water temperatures return to normal after a short period of time, the algae will

recolonize the coral and the colony will probably recover. Nevertheless, some coral colonies die as a result of these bleaching events.

A severe and extensively documented coral bleaching event took place in the Caribbean between June and November 1998. During this period, sea surface temperatures were higher than average. The map shows the anomalies in sea surface temperatures, or 'hot spots', taken from satellite data recorded on 29 September 1998. Coloured areas indicate the regions where sea surface temperatures were higher than normal. It has been speculated that coral bleaching is a response to global climate change. Data are still insufficient to evaluate whether this is really the case; however, recent very extensive bleaching events at the global scale are causing concern among coral reef specialists.



## Floodplains (Central America)



Source: USGS EROS Data Center GTOPO30, HYDRO1K - <http://edcwww.cr.usgs.gov/landdaac/dataproducts.htm>

Impacts are stronger on the Pacific floodplains than on the Atlantic

eighteen months, and show a peak around Christmas – which is why Peruvian fishermen named the phenomenon *El Niño* (The Child). The occurrence of this event often alternates with a cooling of the sea surface temperature known as *La Niña*. During an *El Niño* episode, atmospheric pressure fluctuations occur, similar to the fluctuations of the sea surface temperature in the equatorial eastern Pacific. The complete cycle is called the *El Niño* Southern Oscillation (ENSO).

This phenomenon has some far-reaching effects. An increase in the volume of warm surface waters along the western coast of South America hinders the normal upwelling of cooler waters from the deep ocean. In the western Pacific, cloud systems – usually loaded with rain – move east, towards the central and eastern Pacific, producing significant rainfall in these areas but causing droughts in the western Pacific countries.

The 1997–1998 *El Niño* was one of the strongest ever recorded, developing much faster and showing greater temperature increases than any other. It was even stronger than the 1982–1983 *El Niño*, with temperature increases ranging from 2 degrees Celsius to 5 degrees Celsius above normal. This huge volume of warm water contained so much energy that its impacts dominated global climate patterns until the middle of 1998.

In Latin America and the Caribbean, the 1997–1998 *El Niño* caused catastrophic floods in southern Brazil and near the Pacific coast of Ecuador, Peru and Chile, as well as in Paraguay, Uruguay and north-east Argentina. In some of these countries, precipitation was 12 to 17 times greater than normal. By contrast, droughts occurred in Colombia, Guyana, north-eastern Brazil and the highlands of Peru and Bolivia, and dramatic falls in catch rates were experienced by fishermen along the Pacific coast. Sea level rose by 20 centimetres in the Colombian Pacific. After the 1983 *El Niño* event, the Peruvian gross domestic product plummeted 12 per cent, agricultural production dropped 8.5 per cent, and fishing production was down by 40 per cent. Peru needed a whole decade to recover. The 1997–1998 *El Niño* event caused economic losses that exceeded the total non-military, non-reimbursable international development aid for that same period (see ‘Forest fires’ section).

## Conclusions

Recent trends in Latin America and the Caribbean point to high economic growth rates, new opportunities for public participation, and improvements in certain aspects of the quality of life. Nevertheless, the region is still characterized by its large and ever-growing imbalances, both in wealth distribution and in access to opportunities. Although some health indicators have shown an improvement, the growing poverty gap is causing the reappearance of contagious diseases.

The environmental costs of regional economic growth are already excessively high, and seem to continue growing. The main issues are:

- accelerated over-exploitation of the earth and its resources and subsequent desertification;
- deforestation, habitat degradation and loss of biodiversity;
- increasing water contamination and conflicts over water access and use;
- urban environmental and human health problems such as waste disposal and treatment and air pollution.

If the key challenge facing Latin America and the Caribbean is to build political consensus to maintain economic growth and stability, the fast-growing social and environmental problems must also be dealt with urgently and effectively. The current improvement in access to environmental information is a significant step forward.

The top priority is to find solutions to the problems of the urban environment which currently houses almost three-quarters of the region's population.

There is a great need to improve housing, sanitation, transportation and employment in large urban areas.

The second most important priority is to find ways to promote the sustainable use of tropical forests and biodiversity. There are numerous examples of what should not be done, but forest conversion and reforestation have finally become a political priority for many countries.

### Recent history of forest fires in several countries of the region

#### Brazil

After the Roraima accident of March–June 1998, when close to 400 000 hectares of forest burned, the Brazilian federal government enacted a decree creating a Task Force for the implementation of the Fire and Forest Fire Control and Prevention Program in the Deforestation Arc (PROARCO). The supplementary decree of February 1999 defines PROARCO's management structure for co-ordinating emergency actions during large forest fires. Initially, PROARCO included members of the Federal District's Fire-fighting Military Corps, Civil Defence staff, military forces from the Army and Air Force, the Brazilian Institute of the Environment and Renewable Natural Resources (IBAMA) and the Secretariats of the Environment of the federal states. PROARCO is co-ordinated by the Ministry of Regional Integration of the Presidency of the Republic of Brazil. The PROARCO operational budget for the 1999–2001 period is close to US\$20 million, three-quarters of which is financed by a World Bank loan and the rest through federal government budgets.

Physically located at IBAMA headquarters in Brasilia, PROARCO has the operational capacity to mobilize financial, material and logistical resources to fight forest fires in the Brazilian Amazon region. The programme includes a forest fire early warning system (in operation) that provides information on weather conditions, drought severity, wind speed and direction, and location of hot-spots. This information is displayed in maps, which include the location of protected areas, indigenous reserves and available access points. PROARCO includes all the municipalities located inside the critical fire-prone area in the Amazon region: a strip to the south of the Amazon River in contact with the savannah region (closed), known as the Arco region.

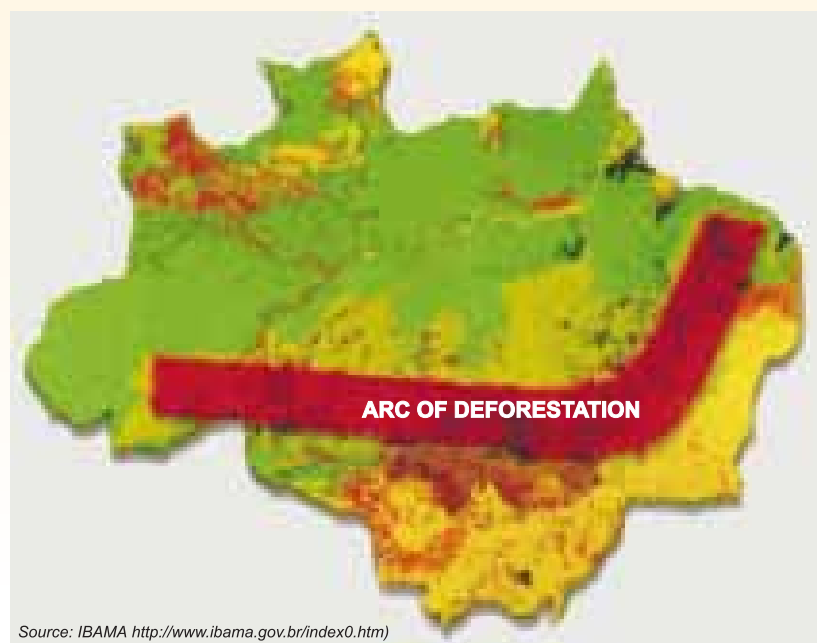
PROARCO makes full use of satellite technology: GOES and Landsat images provided by the National Oceanographic and Atmospheric Agency (NOAA) are analysed daily, and data are available on the Internet on IBAMA's web page (<http://www.ibama.gov.br/>).

In 1998 the Task Force acted twice to fight forest fires in the municipality of São Jose do Sing and the Araguaia National Park. In 1999 the government of the state of Mato Grosso requested support in an emergency situation caused by forest fires in the municipality of Sinop, mobilizing more than 1 500 people to fight the fire.

#### Bolivia

In just seven days – from 6 October to 12 October 1999 – 351 forest fires in Bolivia devastated more than three million hectares. The districts of Guarayos in the province of Santa Cruz and Santo Ignacio de Moxos in the province of Beni were declared environmental emergency zones when more than 7 000 people were directly or indirectly affected and more than 600 houses were totally destroyed, according to Bolivian Civil Defence estimates. This declaration by the government facilitated the availability of international funds destined for damage relief.

*continued on next page...*



Source: IBAMA <http://www.ibama.gov.br/index0.htm>

## Chile

In Chile, more than 56 per cent of the 3 120 forest fires recorded between 1991 and 1995 occurred in 24 of the country's 291 communes. The main communes affected were Curanilahue, Viña del Mar, Valparaíso and Concepción, with an average of between 250 and 380 fires per year. The 1998–1999 season showed a significant increase in frequency, to over 7 000 forest fires in the country, following a period of relative stability at between 5 000 and 6 000 fires per year. The reasons for this increase are still unknown. Despite these high indices for 1998–1999, if the last ten years are compared a decrease of almost 14 per cent in forest fires can be seen in the 24 most critical communes, while the levels increased in other communes, such as Lumaco (147 per cent), Puren (94 per cent), Victoria (63 per cent), Mulchen (61 per cent) and Cañete (47 per cent).

On average, the last ten years have witnessed 5 241 forest fires affecting a total area of 51 026 hectares, of which 21 per cent were native forest, 32 per cent brush-land, 28 per cent natural prairie, 14 per cent forest plantation and 5 per cent agricultural land. The National Forestry Corporation (CONAF) estimates that around 15 million cubic metres of woody material burn each year, releasing more than 55 000 tonnes of contaminating particles into the atmosphere.

The Chilean Government adopted a 'National Forest Fire Prevention Campaign 1995-2000', implemented by CONAF, which approached the problem in a series of progressive steps, with emphasis on the social groups most likely to initiate forest fires. In the period between 1970 and 1998, 33 people working for private companies and the government died while fighting forest fires, mainly as a result of aviation accidents, medical problems and direct contact with the fires. All fires were determined to have been caused by people: 70 per cent were either set intentionally or caused by traffic.

## Mexico

In Mexico, according to the Secretariat of the Environment, Natural Resources and Fisheries (SMEARNAP), forest fires cause 2.1 per cent of the country's deforestation. In 44 per cent of the fires, a relationship has been found to agriculture and cattle-raising activities (slash and burn), 23 per cent are set intentionally, and 23 per cent are caused by cigarettes and campfires. In the 1997–1998 period, 848 911 hectares burned in 14 391 fires, while 7 979 fires had occurred in the period to 2 September 1999, affecting a total of 231 061 hectares. The areas burned were: grasslands 38 per cent, forests 18 per cent, other types of vegetation 44 per cent. Reasons for the decrease are related to variability in rainfall, which was much more intense in 1999 than in 1997–1998. Mexico, Chihuahua and Michoacan states suffered the greatest number of fires, while Chihuahua, Durango and Oaxaca had the largest areas affected. March, April and May are the months when most forest fires occur in Mexico.

SMEARNAP is focusing its efforts on personnel training, increasing the number of fire brigade members under contract, strengthening the institutional integration process, improving fire-fighting equipment, and promoting public information campaigns on the dangers and economic losses caused by forest fires.

## Panama

In Panama, the National Environmental Authority (ANAM) reports that 41 298 hectares were affected nation-wide in the period from December 1997 to June 1998, with most events occurring in the provinces of Panama (219 cases), Darien (34 cases) and Colon (16 cases). Almost 59 per cent of the fires affected primary and secondary forests, 40 per cent were in grasslands and brush, and slightly over 1 per cent occurred in plantations. ANAM estimated that the production of contaminating particles averaged at least 200 tonnes of carbon per hectare, with a total of 8.3 million tonnes (ANAM 1999.)

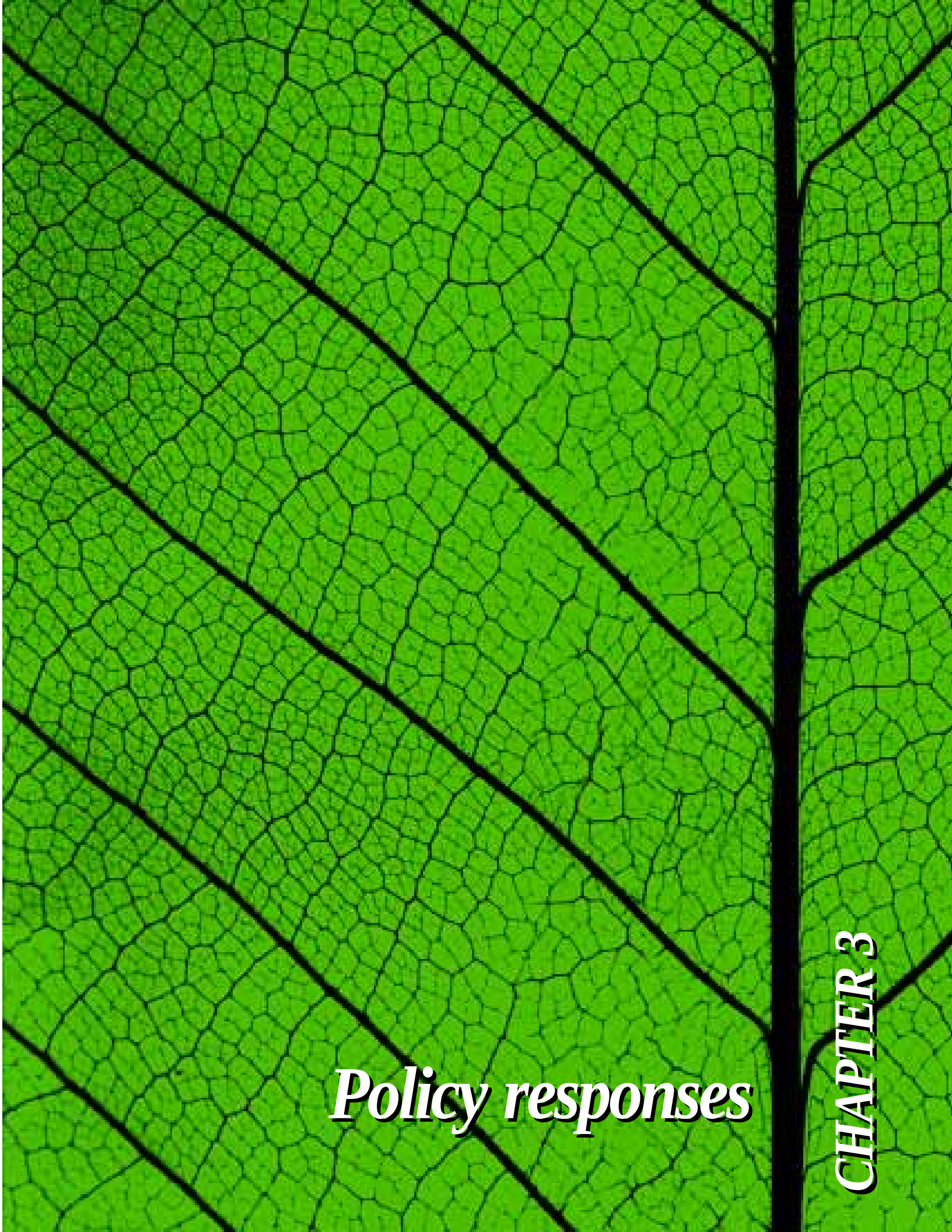
In 1994 the Government of Panama created the Fire Prevention, Control and Management Plan. Its main objectives are to implement a monitoring and co-ordination system among the institutions involved in the matter, to favour forestry investments and the development of mechanisms to protect such investments (such as forestry insurance) and to expand protected areas. Forestry Law No. 1 of 3 February 1998 established a forestry policy and created a Forestry Fund (FONDEFOR), financed from the national budget, to improve fire protection and control, among other aims. Resources are being invested in training and monitoring and in improved fire-fighting systems (ANAM 1999.)

## Dominican Republic

In the Dominican Republic, the effects of the drought caused by the 1997 *El Niño* event left a balance of 225 fires that affected 207 000 hectares of natural forests and grasslands, with economic losses estimated at 69 million pesos (about US\$ 4.8 million at the time). This figure seems very high compared with the 1992–1997 period, when 341 forest fires burned 247 000 hectares. The most damaging fire occurred in 1997 in the southern watershed of the Central Mountain Range, inside the Jose del Carmen Ramirez National Park. Pushed by strong winds, the fire expanded out of control towards the northern watershed of the mountain range and into the Armando Bermúdez National Park, affecting around 150 000 hectares. In some areas the vegetation was totally scorched, causing very severe damage.

The General Directorate of Forestry of the Dominican Republic is developing a 'Forestry Strategy to Achieve Conciliation Between Development and Conservation' which includes strategic actions for the purpose of expanding forest plantations for forest management and wood production, expanding protected areas, generating jobs and income through forest management for populations in poverty, protecting drainage basins, reducing bureaucracy in forest management, improving professional training and outreach for guiding rural workers, and institutional restructuring to create a National Forest Service. Some projects under development are: Reforestation and Conservation of the Camu River Basin, Agroforestry Extension Project, Educational Project for Technical Experts in Forestry and Reforestation, and Conservation of the Jamao River Basin.

Sources: ANAM 1999; Duarte 1999a, 1999b; Salcedo 1997; SMEARNAP 1999; MDSP 2000.



# *Policy responses*

## CHAPTER 3





# Policy responses

## Key facts

- ◆ As a general rule, public environmental agencies, given their limited mandates, have had little impact on industrial and productive activities.
- ◆ Global multilateral environmental agreements and non-binding instruments have increased knowledge of environmental issues and have contributed to an environmental awareness that would have seemed unimaginable a quarter of a century ago
- ◆ It is difficult to enforce rules and regulations because many institutions are unable to monitor compliance and because systematic enforcement may have negative economic effects.
- ◆ In Brazil, fees are charged for the use of natural resources, and the income is distributed to the federal government and the states in which the exploitation occurred.
- ◆ In Costa Rica, a series of forestry laws has established the principle that people involved in reforestation or forest conservation should be compensated for the environmental and social services provided by forests.
- ◆ The 1996 Declaration of Santa Cruz commits signatory parties to support and promote broad participation of civil society in the design, implementation and evaluation of environmental policies and programmes in all countries of the Americas.
- ◆ In Argentina, a set of legal initiatives empowers the National Secretariat of Natural Resources and Human Environment to publish a list of violators of environmental regulations, thereby generating negative publicity for the offending industries.
- ◆ Programmes designed to fight poverty are seldom related to environmental policies.

## Introduction

In the last 25 years, and particularly over the last decade, there has been growing domestic and international pressure to combat environmental degradation. The result has been that environmental matters are increasingly being dealt with in the general context of the development process and its policies.

Milestones at the international level include the United Nations Conference on Human Environment, held in Stockholm in 1972, which set off a long and growing succession of multilateral agreements in the field. This process was accelerated by preparations for the United Nations Conference on Environment and Development (known as the Rio Summit), held in Rio de Janeiro 20 years later, which led to the establishment of fora to examine environmental and natural resources issues and to a new approach to North–South differences. At the same time, a gradual and ever-increasing economic globalization has generated new economic practices with serious environmental implications.

At the regional level, the process has resulted in the ratification and adoption of diverse international legal instruments. Within this framework, governments have sought to strengthen environmental policies

through institutional transformation and legal, technical and economic initiatives at the national level as well as through sub-regional and in some cases regional co-operation agreements. The political openness resulting from the return of democracy to the region has been an important factor within this context, increasing pressure for the development of environmental planning policies and systems.

It is not easy to evaluate the success or failure of environmental policy and management initiatives as a whole. Four questions must be answered (UNEP 1999a):

- Have the policies to solve environmental problems been adequately framed?
- Have the intentions stated in the policies been implemented?
- Has implementation had positive effects on the problems it aims to solve?
- Are these results sufficient?

The last two questions are particularly hard to answer: frequently, policy monitoring is not systematic, data are poor or non-existent, and often there

are no adequate indicators or periodic reports or data regarding the environmental situation before and after implementation. Neither are there appropriate mechanisms, methods or criteria to establish which policy contributes to what change in the state of the environment. Generally, it is impossible to identify a specific action or policy that has had a particular impact, since interaction between human activities and environmental results is complex and not yet well known. In addition, it is easy for political events and governance problems to annul the potential benefits of policy instruments. These problems make it difficult to compare the current situation and what could have happened in the absence of certain policies.

In general, a complete and more precise analysis will require better mechanisms to monitor and evaluate

the effects of environmental policies on environmental quality.

Having recognized the methodological and conceptual limitations stated above, this chapter analyses the main response policies of Latin American and Caribbean countries at the international, regional (or sub-regional) and national levels.

The first section analyses multilateral environmental agreements (MEAs) and non-binding instruments adopted in the region. The section deals separately with global multilateral agreements, regional (or sub-regional) MEAs and non-binding instruments (such as action plans at national or sub-regional levels). A second section analyses the legal initiatives and institutional transformations that have been introduced in the different countries in order to implement a new

### Environmental policy evaluation: some recent experiences

Among recent environmental policy evaluation experiences, worth mentioning at the national level is the Rio + 5 Forum, while at the regional level the consultation for the first *Panama Environmental Report* must be noted.

#### Rio + 5

The Rio + 5 Forum was organized for the fifth session of the United Nations Commission on Sustainable Development, held in New York on 7-15 April 1997 to review the status of the agreements resulting from the Earth Summit and the degree to which they had been implemented by the member states. Within this framework, the Earth Council supported holding 70 national consultations and 11 regional consultations aimed at gathering national information relevant to the Forum. The countries were asked to report on the progress made in implementing the Rio agreements, to identify critical issues and priorities, and to describe successful cases, lessons learned, values and principles, gaps in policies and limitations to implementing sustainability, together with recommendations for local and global governance.

In all cases, the consultations involved diverse national, governmental and non-governmental actors in jointly evaluating sustainability (sometimes for the first time) at the national level. The regional consultations allowed neighbouring countries to discuss multi-laterally a range of common interests related to sustainable development, to exchange experiences and to explore regional co-operation possibilities.

In the case of Latin America and the Caribbean, three sub-regional consultations took place: in Central America and the Caribbean, in the Andean countries, and in the Southern Cone. The consultations revealed that all parties were deeply concerned about the ongoing tension between economic and commercial policies – concentrated on foreign debt issues and globalization – and the social and environmental aspects of sustainability. The parties identified a need to create a regional sustainable development strategy capable of articulating such factors as international trade, external debt, and financial

and technical co-operation, utilizing economic incentives and instruments to foster sustainability. Stronger ties were requested between governments and non-governmental organizations, and between project promoters and beneficiaries. Another necessary action identified through the consultations was the need to create broader and more effective communication networks to disseminate the information needed to implement the Rio Summit agreements. The indigenous populations participating in the consultations demanded to be more strongly represented in the decision-making processes, and demanded recognition of their territories

#### Panama Environmental Report

While elaborating the first *Panama Environmental Report* in July 1999, the National Environmental Authority of that country (ANAM) invited a group of people from the academic sector and experts in the management of international environmental agreements and conventions to assess the national impact of eleven global environmental policy agreements ratified by Panama. The group analysed the commitments entered into by the authorities, as well as the actions undertaken and the results obtained.

The group of experts concluded that through these agreements and conventions national compliance and follow-up commissions have been created and some institutional capacities have been strengthened – facilitating, to a certain degree, the implementation of these commitments through the execution of projects and plans of action.

However, these same experts also pointed out that the intention, when ratifying the agreements, was not in line with the commitments entered into nationally. The lack of economic instruments, specifically the lack of funds or their non-allocation in the national budget, together with the lack of political will to comply with the agreements accepted, are clear obstacles to the implementation of international agreements in Panama.

Sources: Earth Council 1997; ANAM 1999a.

vision of environmental policy in the context of the development policy. Subsequent sections summarize the countries' experiences in using economic instruments for environmental management, the main industrial and technological innovations in the field, the existing funding activities, the phenomenon of growing public participation in environmental policy, and environmental education and information initiatives related to the above.

## Multilateral environmental agreements and non-binding instruments

### Global environmental agreements

The first international environmental agreements emerged at the beginning of the 20th century, for the purpose of seeking a better management of some commercial animal species threatened by over-exploitation (UNEP 1999a). However, it wasn't until the 1960s that the concern over environmental pollution and natural resource depletion generated the type of binding multilateral environmental agreements (MEAs) that we know today.

The evolution of environmental agreements and legislation has taken two (inter-related and overlapping) generations of achievements in the field. The first generation of agreements and legislation was sectoral and monothematic, directed at the appropriate use of natural resources such as wildlife, and the air and marine environments. The second generation of environmental agreements is more trans-sectoral, systemic and holistic. Second generation instruments do not replace first generation efforts, but rather complement them. Among the first instruments of the second generation are the Declaration of the United Nations Conference on Human Environment and the Plan of Action for Human Environment, both adopted in Stockholm in 1972.

At the global scale, out of ten MEAs selected according to their importance (UNEP 1999a), seven entered into force in the last 15 years. In what could be considered a relative international consensus over

their importance, eight of the ten agreements selected entered into effect four years or less after their adoption. These are the international conventions on biological diversity (one year), climate change and desertification (two years), world heritage, hazardous waste and ozone (three years) and wetlands and migratory species (four years). Only two conventions in this group have taken considerably longer: endangered species and the law of the sea (14 and 12 years respectively).

However, their swiftness in entering into force does not always coincide with the speed in the growth of the number of parties ratifying these MEAs. Of a total of 193 countries, ratification percentages (in decreasing order) are as follows: climate change (91 per cent), biological diversity (90 per cent), ozone (87 per cent), world heritage (81 per cent), endangered species and desertification (75 per cent), law of the sea (67 per cent), hazardous waste (63 per cent), wetlands (59 per cent) and migratory species (29 per cent).

Within this context there is a high level of regional participation in global MEAs. Regional participation is lower than 80 per cent in only three of the MEAs selected: the conventions on the law of the sea (79 per cent), wetlands (67 per cent) and migratory species (18 per cent). In fact, only in the latter agreement is regional participation lower than the global percentage. This is in contrast to the situation at the beginning of the 1990s, when a UNEP study found that only 26 per cent of the countries in the region participated in some or all of the 53 global multilateral instruments under consideration (PNUMA-ORPALC 1993). One reason for this improvement is the greater harmony that now exists between national and international priorities in the environmental field.

Global MEAs and non-binding instruments have increased public knowledge of environmental issues and have contributed to a level of environmental awareness in the private and public sectors that would have been unimaginable a quarter of a century ago when environmental problems were identified with specific pollutants and these matters were considered to be the exclusive problem of wealthy countries. In addition, during the 1990s, these agreements and non-binding instruments – particularly

those generated in the Stockholm (1972) and Rio de Janeiro (1992) conferences – have had significant influence in the development of national legislation to protect the environment and promote sustainable development.

Of course, some MEAs are highly relevant to certain specific problems of the region or one of its sub-regions, such as protecting the ozone layer in the southern countries and the effects of climate change on the small Caribbean island states. An anomaly in this respect is the low level of ratification of pollu-

tion-related conventions in the Caribbean states. Even though a mechanism (supported by the Cartagena Convention) exists for emergency response in case of oil spills in the region – which shows government interest – and despite public statements against the movement of hazardous materials, this is not reflected in the ratification of global MEAs such as the International Convention on Liability for Damages Caused by Oil Pollution.

The degree of involvement of the countries in the different MEAs may be linked to national percep-

### Parties to major environmental conventions (as of 20 January 2000)

|                                 | CDB<br>(176) | CITES<br>(146) | CMS<br>(66) | Basel<br>(134) | Ozone<br>(172) | UNFCCC<br>(181) | CCD<br>(162) | Ramsar<br>(119) | Heritage<br>(158) | UNCLOS<br>(132) |
|---------------------------------|--------------|----------------|-------------|----------------|----------------|-----------------|--------------|-----------------|-------------------|-----------------|
| LATIN AMERICA AND THE CARIBBEAN | 33           | 32             | 6           | 27             | 32             | 33              | 29           | 22              | 29                | 26              |
| Caribbean (13)                  | 13           | 12             | 0           | 9              | 12             | 13              | 11           | 3               | 9                 | 12              |
| Meso-America (8)                | 8            | 8              | 1           | 8              | 8              | 8               | 8            | 8               | 8                 | 6               |
| South America (12)              | 12           | 12             | 5           | 10             | 12             | 12              | 10           | 11              | 12                | 8               |

0-25% 25-50% 50-75% 75-100%

|       |                                                                                                                                                                                                                                      |          |                                                                                                                                                                                                       |
|-------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| CBD   | Convention on Biological Diversity, Nairobi, 22 May 1992<br><a href="http://www.biodiv.org/">www.biodiv.org/</a>                                                                                                                     | FCCC     | United Nations Framework Convention on Climate Change, New York, 9 May 1992<br><a href="http://www.unfccc.de/">www.unfccc.de/</a>                                                                     |
| CITES | Convention on the International Trade of Endangered Species, Washington, 3 March 1973<br><a href="http://www.wcmc.org.uk/cites/">www.wcmc.org.uk/cites/</a>                                                                          | CCD      | United Nations Convention on Desertification in Countries with Severe Draught and/or Desertification, Particularly in Africa, Paris, 17 June 1994<br><a href="http://www.unccd.de/">www.unccd.de/</a> |
| CMS   | Convention on the Conservation of Migratory Species of Wildlife, Bonn, June 23, 1979<br><a href="http://www.wcmc.org.uk/cms/">www.wcmc.org.uk/cms/</a>                                                                               | Ramsar   | Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (Ramsar Convention), Ramsar, 2 February 1971<br><a href="http://www.ramsar.org/">www.ramsar.org/</a>              |
| Basel | Basel Convention on the Cross-boundary Movement and Disposal of Hazardous Wastes, Basel, 22 March 1989<br><a href="http://www.unep.ch/basel/index.html">www.unep.ch/basel/index.html</a>                                             | Heritage | Convention on the Protection of World Cultural and Natural Heritage, 23 November 1972<br><a href="http://www.unesco.org/whc/">www.unesco.org/whc/</a>                                                 |
| Ozone | Vienna Convention for the Protection of the Ozone Layer, Vienna, 22 March 1985, and the Montreal Protocol on Ozone-Depleting Substances, Montreal, 16 September 1987<br><a href="http://www.unep.org/ozone/">www.unep.org/ozone/</a> | UNCLOS   | United Nations Convention on the Law of the Sea, Montego Bay, 10 December 10 1982<br><a href="http://www.un.org/depts/los/losconv1.htm/">www.un.org/depts/los/losconv1.htm/</a>                       |

#### Notes:

1. The numbers in parentheses under the abbreviated names of Conventions are the total number of parties to that Convention.
2. The numbers in parentheses after the names of the regions or sub-regions are the number of sovereign states in that region or sub-region.
3. Only sovereign countries are taken into account. The territories of other countries and groups of countries are not included in this table.
4. The absolute number of countries party to each Convention in each region or sub-region appears in the cells.
5. The parties to the Conventions are states that have ratified, adhered to or accepted the Convention. A signatory is not considered a party to the Convention until that Convention has also been ratified.



tions regarding the benefit of the respective agreements, in contrast to the problems that might arise from participating in them. Another important factor is the manner in which each convention secretariat promotes working with the different countries. Finally, informing the public through education and awareness campaigns is also important.

Few specific regional or national institutional structures have been created to implement global MEAs (PNUMA-ORPALC 1996). In most countries, new functions associated with implementation are added to existing national structures. The creation of National Committees on Biological Diversity in Meso-American countries (among others) is an exception, as are the National Committees Against Desertification, which exist in practically all countries of the region. The only global MEA with a regional co-ordinating unit is the Convention Against Desertification, headquartered at the UNEP Regional Office for Latin America and the Caribbean, which since 1997 has had an executive committee and a programme of action with regional scope.

In some cases, good communication has existed between those responsible for implementation in the different countries – for example, the Regional Networks of ODS (ozone depleting substances) Officials that exist for South America, Central America and the Caribbean to monitor the Montreal Protocol. Another important example is the Caribbean Global Climate Change Adaptation Plan, in which more than ten Caribbean Community (CARICOM) countries participate in pilot and demonstration activities at the national level, as well as in regional training and technology transfer activities (UNEP 1999b).

Implementation of global MEAs at the national level has taken place through a variety of different instruments, especially through the recent development of various specific programmes and funds.

Other economic instruments may contribute indirectly to this purpose, even if they have not been specifically created for MEA implementation (see ‘Economic instruments’ section below).

One problem hindering implementation of global MEAs is the lack of adequate international financing to guarantee compliance and to complement national funding efforts. When such funding has been available, progress has been made. For example, the Ramsar Convention and its Small Grant Fund for the conservation and rational use of wetlands financed 25 projects in 13 countries between 1992 and 1995, for a total of US\$800 000 (Ramsar 1998). In general, however, these mechanisms have not been very effective. The Capacity 21 programme has not had sufficient resources to respond to the demands generated by MEA implementation.

Many MEAs include regulations to monitor compliance and prepare compliance reports. This could generate adequate information on the progress of MEAs, but these regulations are not always fully enforced. An exception can be found in the Montreal Protocol, under which strict compliance with the procedures for data reporting is monitored through an Implementation Committee (UNEP Ozone Secretariat 1997).

The adoption of national legislation to comply with MEA requirements normally takes several years,

Special financial funds related to the implementation of the Convention on Biodiversity

| Fund       |                                          | Relevant legislation                  |
|------------|------------------------------------------|---------------------------------------|
| Brazil     | Brazilian Biodiversity Fund              | National Environmental Fund Law, 1998 |
| Costa Rica | Wildlife Fund                            | Wildlife Conservation Law, 1992       |
| Ecuador    | National Forestry and Reforestation Fund | Regulation of 1993                    |
| Panama     | National Wildlife Fund                   | Wildlife Law, 1995                    |
| Paraguay   | Special Wildlife Conservation Fund       | Wildlife Law, 1992                    |
| Paraguay   | Special Wildlife Areas Fund              | Protected Wildlife Areas Law, 1994    |

depending on the country, the MEA in question and the issues over which regulation is established. A good example is the Convention on Biological Diversity (CBD), which has been implemented differently according to the country. Brazil, for example, established a National Program on Biological Diversity in 1994. The Brazilian Institute for the Environment and Renewable Natural Resources (IBAMA) has approved, and is responsible for managing, 165 conservation units in different ecosystems, including 39 national parks, 24 biological reserves, 21 ecological stations, 11 extraction reserves, 46 national forests and 24 environmental protection areas (MOE Brazil 1998).

In Peru, the Law for the Conservation and Sustainable Use of Biological Diversity, which covers most of the commitments under the CBD, entered into force in 1997. Costa Rica approved a Biodiversity Law at the beginning of 1998 (ALDA 1997). Some countries enforce the CBD, or its objectives, by including regulations in general or sectoral laws. Among them are Costa Rica, Cuba, Honduras, Mexico, Nicaragua and Panama. It is likely that the nine Caribbean countries that are currently preparing national biodiversity strategies –Antigua and Barbuda, Belize, Dominica, Guyana, Jamaica, St. Kitts and Nevis, St. Lucia, Suriname and Trinidad and Tobago– will support the CBD with legislation, clear institutional mechanisms and adequate resources.

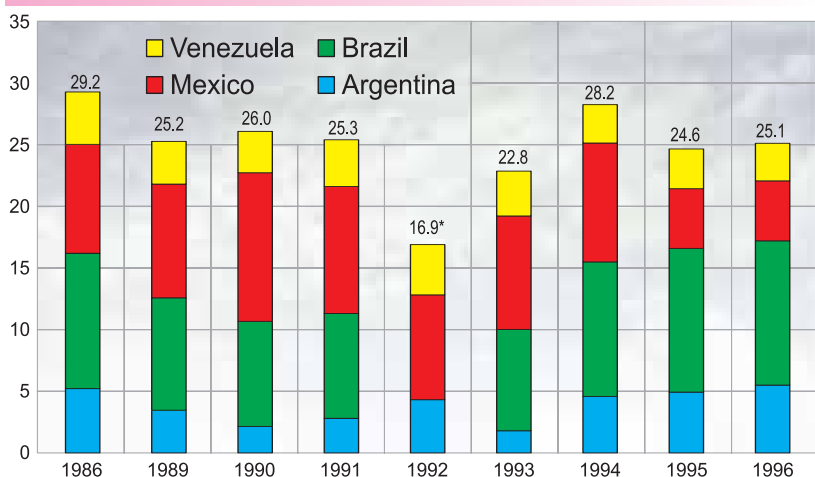
It is still not possible to undertake a general evaluation of the impact of global MEAs on the region's environment, mainly because the degree of development, and consequently of impact, varies according to the instrument and country involved. In addition, in many cases environmental programmes gain greater momentum from different bilateral or multilateral financial arrangements –which vary from country to country– than they do from obligations derived from the agreements themselves.

In the Caribbean, for example, only Aruba and Cuba have updated their legislation related to issues covered in the Framework Convention on Climate Change. However, more than ten convention-party countries in that sub-region have established inter-agency co-ordination mechanisms to implement the Caribbean Global Climate Change Adaptation Plan.

In the Latin America and Caribbean region as a whole, the Montreal Protocol has promoted an 18 per cent reduction in the production of chlorofluorocarbons (CFCs), although with significant variations among countries. According to recent statistics for the four largest producers in the region, between 1986 and 1996, annual production in Argentina was reduced from 5 574 tonnes to 1 050 tonnes (more than 81 per cent); Brazil decreased from 10 218 to 9 434 tonnes (slightly less than 8 per cent); Venezuela reduced its production by a percentage similar to that of Argentina, while Mexico – the other large producer – slightly increased production (UNEP Ozone Secretariat 1998). CFC consumption in the region has diminished somewhat (about 10 per cent), according to the same source. Of the four largest consumers – again, Argentina, Brazil, Mexico and Venezuela, with almost 74 per cent of total consumption – only Mexico has experienced a dramatic reduction (of 45 per cent) and Venezuela a smaller reduction (29 per cent).

The Mexican strategy used to achieve this reduction includes agreements with the industry, regulation of the import and export of controlled substances, the development of technical training programmes and the implementation of cleaner technologies. The projects have included commercial and domestic refrigeration, solvents, foams, and both domestic and automotive air conditioning systems. Many of these projects have received support from international agencies such as the World Bank, the US Environ-

**CFC consumption in Latin America and the Caribbean, for the four main consumer countries, 1986-1996<sup>1</sup>**



1) Millions of tonnes of ozone depleting potential/year.

Source: UNEP Ozone Secretariat, 1999.

\* There are no 1992 data for Brazil.

mental Protection Agency, UNDP, UNEP and UNIDO (United Nations Industrial Development Organization) (PNUMA-ORPALC/ALDA 1998).

CITES is also of critical importance for Latin America, home to an extraordinary number of species. Brazil, perhaps the richest nation of the world in species, has had difficulties with CITES implementation and entry into force (Weiss and Jacobson, 1998), although IBAMA now has more than 400 officials helping control wild animal trafficking, deforestation and other environmental crimes in the Amazon region. The vastness of the Amazon and the reduction of public sector budgets have also impeded implementation of the International Agreement on Tropical Wood Species. However, the Pilot

Program for the Conservation of the Brazilian Rainforest has been established jointly by the government, civil society, non-governmental organizations and the international community, and is now beginning its second phase (World Bank, 1997b).

## Regional agreements

Existing limitations to the evaluation of the impact and effectiveness of global environmental agreements also affect regional agreements. However, the effects of these regional agreements are often more tangible within the scope of regional planning.

In general, environmental agreements that exist specifically in a regional framework are rather of a sub-

### Mejor regional MEA's

| Treaty                                                                                                                                                                 | Place and date of adoption |      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|------|
| Convention for the Protection of Flora, Fauna and Natural Scenic Beauty in the Countries of the Americas                                                               | Washington DC              | 1940 |
| Treaty for the Prohibition of Nuclear Weapons in Latin America and the Caribbean (Treaty of Tlatelolco)                                                                | Mexico City                | 1967 |
| Río de la Plata River Basin Treaty                                                                                                                                     | Brasilia                   | 1969 |
| United Nations Convention for the Defense of Archeological, Historic and Artistic Heritage in the Countries of the Americas (San Salvador Convention)                  | San Salvador               | 1976 |
| Amazon Cooperation Treaty                                                                                                                                              | Brasilia                   | 1978 |
| Convention for the Conservation and Management of Vicuña                                                                                                               | Lima                       | 1979 |
| Convention for the Protection of the Marine Environment and Coastal Areas of the Southeastern Pacific                                                                  | Lima                       | 1981 |
| Regional Cooperation Agreement to Fight Pollution by Hydrocarbons and Other Harmful Substances in Emergencies in the Southeastern Pacific                              | Lima                       | 1981 |
| Supplementary Protocol to the Agreement to Fight Pollution by Hydrocarbons and Other Harmful Substances in Emergencies in the Southeastern Pacific                     | Quito                      | 1983 |
| Protocol for the Protection Against Land-Based Contamination in the Southeastern Pacific                                                                               | Quito                      | 1983 |
| Convention for the Protection and Development of the Marine Environment in the Greater Caribbean                                                                       | Cartagena de Indias        | 1983 |
| Protocol on the Cooperation to Fight Oil Spills in the Greater Caribbean                                                                                               | Cartagena de Indias        | 1983 |
| Central American Convention for Environmental Protection                                                                                                               | San Jose                   | 1989 |
| Protocol on Specially Protected Wildlife and Wildlife Areas under the Convention for the Protection and Development of the Marine Environment in the Greater Caribbean | Kingston                   | 1990 |
| Convention for the Conservation of Biological Diversity and the Protection of Priority Wildlife Areas in Central America                                               | Managua                    | 1992 |
| Regional Agreement on the Cross-Boundary Movement of Hazardous Waste                                                                                                   | Panama                     | 1992 |
| Regional Convention for the Management and Conservation of Natural Forest Ecosystems and the Development of Forestry Plantations                                       | Guatemala City             | 1993 |
| Central American Alliance for Sustainable Development                                                                                                                  | Managua                    | 1994 |

Source: UNEP, 1997

regional nature and are limited to a group of countries (Central America), to certain regional seas (south-eastern Pacific and the Greater Caribbean) or to a group of ecosystems (the Amazon or River Plate basins). One relates to the protection of a specific species, vicuña. There are also some important inter-American agreements such as the Washington Convention of 1940 (for the protection of flora, fauna and natural scenic beauty) and the San Salvador Convention of 1976 (for the defence of archaeological, historic and artistic heritage).

These MEAs are not only relevant to specific problems, not included in global MEAs, but also help to make those international agreements more effective, through greater participation of the countries involved and a more realistic vision of their ability to implement and comply with those agreements.

There is a high degree of participation in regional MEAs, but it is not the same for all countries or instruments. For example, in the case of the Convention for the Protection and Development of the Marine Environment in the Greater Caribbean Region, adopted in Cartagena in 1983, nine of the thirteen Caribbean countries have ratified both the Convention and its protocol on oil spills, but only two have ratified the protocol on specially protected areas and wildlife (UNEP 1999b). Within this context, the Caribbean governments have already identified the need for a stronger regional approach to negotiating and implementing environmental agreements (aimed towards the recognition of the Caribbean Sea as a 'special area'), including the identification of relevant agreements or issues, the inclusion of their commitments in national legislation, the creation of a regional mechanism for technical support on this matter, and the training of negotiators for international fora.

In general, the regulations contained in the regional MEAs have been implemented through existing legislation and have not been developed as new national legislation. Few regional MEAs have generated substantial modification of national institutional structures. In the best of cases, they have led to the establishment of administrative units within existing structures specializing in matters covered by the MEAs. The National Council for Vicuña Conservation, established in Peru, is an exception.

Some sub-regional MEAs, such as the Treaty for Amazon Co-operation (TCA) and the Convention of the South-eastern Pacific, have secretariats that alternate between signatory countries. Others have permanent secretariats.

Economic instruments have not generally been used to implement these MEAs, but some national funds, not necessarily created for MEA implementation, have been used, such as the Amazon Environmental Fund in Colombia and the Amazon Regional Eco-Development Fund in Ecuador (PNUD-PNUMA 1996). Debt-for-nature swaps have also been used.

Most of these MEAs do not have their own funding. The Rio de la Plata Basin Treaty is an exception, with its Financial Fund for the Rio de la Plata Basin Development, created to finance pre-feasibility and feasibility studies, engineering designs and projects in the member countries. This fund also expects to attract additional contributions from international organizations.

The Treaty for Amazon Co-operation (TCA) and the Central American Convention for Environmental Protection are among the regional MEAs that receive international funding for some projects. The TCA Special Commission receives GEF financing for its Strategic Regional Project for the Conservation and Sustainable Management of Natural Resources in the Amazon. The Amazon Zoning Support Program receives funding from the Inter-American Development Bank and FAO; and the Regional Project for Planning and Management of Protected Areas in the Amazon Region receives financial support from the European Union and some additional resources from FAO (Tratado de Cooperación Amazónica 1997).

It is difficult to evaluate the effectiveness of these sub-regional MEAs given the problems in establishing a direct relationship between MEAs and environmental changes. The TCA, for example, has led to some important political results after the meetings of the Foreign Affairs Ministers of the signatory countries regarding the sovereignty of Amazon states over this territory. However, the quantity and quality of the projects launched through this treaty do not reflect the environmental importance of the Amazon region.

The Convention on Vicuña, one of the most modest regional MEAs in terms of its objectives, is a good example of successful implementation. After 25 years in operation, there has been satisfactory re-population of the species in the participating countries. In Bolivia, for example, a 1996 census showed the number of vicuña had doubled since 1986 (National Vicuña Census 1996).

Despite the difficulties in evaluating MEAs, their existence has clearly helped to establish certain important issues more firmly on the environmental agenda and to strengthen the awareness of the public and private sectors, both with respect to overall environmental problems and with respect to specific problems covered in the MEAs.

One example of the above can be found in the marine pollution prevention and control actions triggered in the Greater Caribbean by the Cartagena Convention. The Cartagena Convention has three protocols, dealing with oil spills, specially protected areas and wildlife, and terrestrial sources of marine pollution. Several articles in the convention refer to the need to establish measures to prevent, reduce and control pollution caused by discharges from land sources and vessels, as well as discharges and activities on the sea bed.

In this context, high priority has been assigned to waste management in the Caribbean, and most countries have ratified the relevant international conventions. National and regional institutions have been involved in preparing plans and developing diverse initiatives, including the Solid Waste Management Project of the Organization of Eastern Caribbean States, which seeks significant medium-term improvements in waste management.

Finally, a Regional Response Mechanism has been established with telecommunication networks connecting all Natural Disaster Co-ordinators, the Donor Co-ordinating Group for Disasters in the Eastern Caribbean, the Caribbean Disaster Assistance Unit and the Caribbean Disaster Emergency Response Agency. These organizations can carry out rapid damage assessments, identify needs and mobilize resources to provide initial assistance to affected communities.

## Non-binding instruments and action plans

Non-binding instruments are often the precursors of binding policy instruments and sometimes have had a greater effect on environmental policies than the latter. They have also helped to change the attitudes and perceptions of all sectors of society. Although binding instruments receive more attention from politicians and the public, non-binding instruments have played a vital role in the management of global and regional environmental problems, and will continue to do so in the future (UNEP 1999a).

Non-binding instruments produce a more flexible framework than legally binding commitments, goals and time schedules. In some cases, the main goal is to propose important issues and priorities, to foster discussion and attention and to stimulate new ways of seeing and understanding the relationship between humans and nature. In other cases, non-binding instruments facilitate international procedures and arrangements that contribute to the development of a legally binding regime.

Many non-binding instruments have arisen following the United Nations Conference on Environment and Development, held in Rio de Janeiro in 1992. Two of them were adopted during the conference: the Rio Declaration and *Agenda 21*.

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 the states, the 'precautionary principle' and the 'polluter pays' principle. Many of the environmental agreements made after the Rio Summit include principles originating in the Rio Declaration, which is now becoming part of international legislation: these principles include the right to an adequate environment, the right to information, the right to participate in environmental management and the polluter pays principle.

*Agenda 21* is essentially a plan of action that encompasses 40 sectors and issues. It focuses particu-



larly on national legislation, measures, plans, programmes and standards and the use of legal and economic instruments for environmental planning and management, with great emphasis on pluralist participation in policy formulation and implementation. It probably constitutes the most prominent, significant and effective non-binding instrument in the environmental field and has become the environmental management guide for the world. Its most important impacts, using the core concept of sustainable development, have been to extend the environmental debate beyond environmental institutions and non-governmental organizations and to establish a starting point for the linking of environmental and socio-economic issues.

Within this context, several high-level regional meetings have been held in the last few years in Latin America and the Caribbean, mainly to review matters related to the development process (including environmental issues) from the perspective of sustainable development.

At the presidential level, the most relevant meeting has been the Summit of the Americas for Sustainable Development, held in Santa Cruz de la Sierra, Bolivia, in December 1996, as a follow-up to the First Summit of the Americas held in Miami in 1994. In the Declaration of Santa Cruz de la Sierra, the signatories stated: 'Development strategies must include sustainability as an essential requirement for

### Forum of Ministers of the Environment of Latin American and Caribbean

Since 1982, the United Nations Environment Programme (UNEP) has regularly organized meetings, in different cities of the region, during which the environmental policy-makers of the countries in the region – high level experts, Secretaries, Ministers and government delegates – have discussed their views, exchanged opinions, reached agreements and promoted the protection of nature and the environment.

During the 9th Meeting of Ministers of the Environment, held in Havana, Cuba, in 1995, agreement began to develop around the idea of creating an element that could shape and give continuity and consistency to the meetings. After numerous negotiations, and consideration of the opinions and experiences of the diverse institutional agents and stakeholders, the Forum of Latin American and Caribbean Ministers of the Environment was created. The main functions of the Forum were determined during the 11th Meeting of Ministers of the Environment of Latin America and the Caribbean, held in Lima, Peru, in 1998. Key functions were:

- ◆ To guide and evaluate the regional environmental co-ordination of actions within the context of sustainable development.
- ◆ To assess, discuss and agree to regional positions regarding the international environmental agenda.
- ◆ To consider issues of international funding so as to implement the *Agenda 21* commitments in the region.
- ◆ To approve four-year plans of action, based on proposals presented by the inter-sessional committee.
- ◆ To assess compliance with the agreements and objectives resulting from previous ministerial meetings.

The Forum of Ministers is today the highest-level entity for the discussion and approval of regional positions related to the international environmental agenda. During the 11th Meeting (1998), the governments in the region agreed to the following priority themes for the Forum:

- ◆ *Institutional framework, policies and instruments for environmental management*, including matters of education and environmental training; citizen participation; inclusion of the environ-

mental dimension in government policies; the inter-relation between trade and the environment; funding mechanisms; innovative economic and legal instruments, and the exchange of environmental management decentralization experiences.

- ◆ *Integrated basin management*, which includes the environmental planning of coastal zones and oceans, as well as integrated river basin management.
- ◆ *Biological diversity and protected areas*, which encompasses the institutional strengthening of services for national parks and other protected areas in the region, in addition to the bio-regional management and planning of protected areas in critical eco-regions selected in the region.
- ◆ *Climate change*.

Together with these thematic lines, the Ministerial Forum also encompasses the areas that UNEP focuses on, as defined during the 19th period of sessions of its Administrative Council (February 1999), namely:

- ◆ *Environmental information, assessment and research*, encompassing environmental assessments; environmental data management capacity-building; environmental emergency response; elements of biological diversity and protected areas, and desertification.
- ◆ *Improved co-ordination between environmental agreements and the elaboration of policy instruments*, including environmental management; environmental laws; multi-lateral environmental agreements and policies; climate change, and convention follow-up and implementation.
- ◆ *Fresh water issues*, including integrated water resource management and implementation of a global plan of action in the region.
- ◆ *Industry and technology transfer*, covering industry and technology transfer; ozone; environmental education and training; coastal-marine environmental management; environmental awareness, and trade and environment.

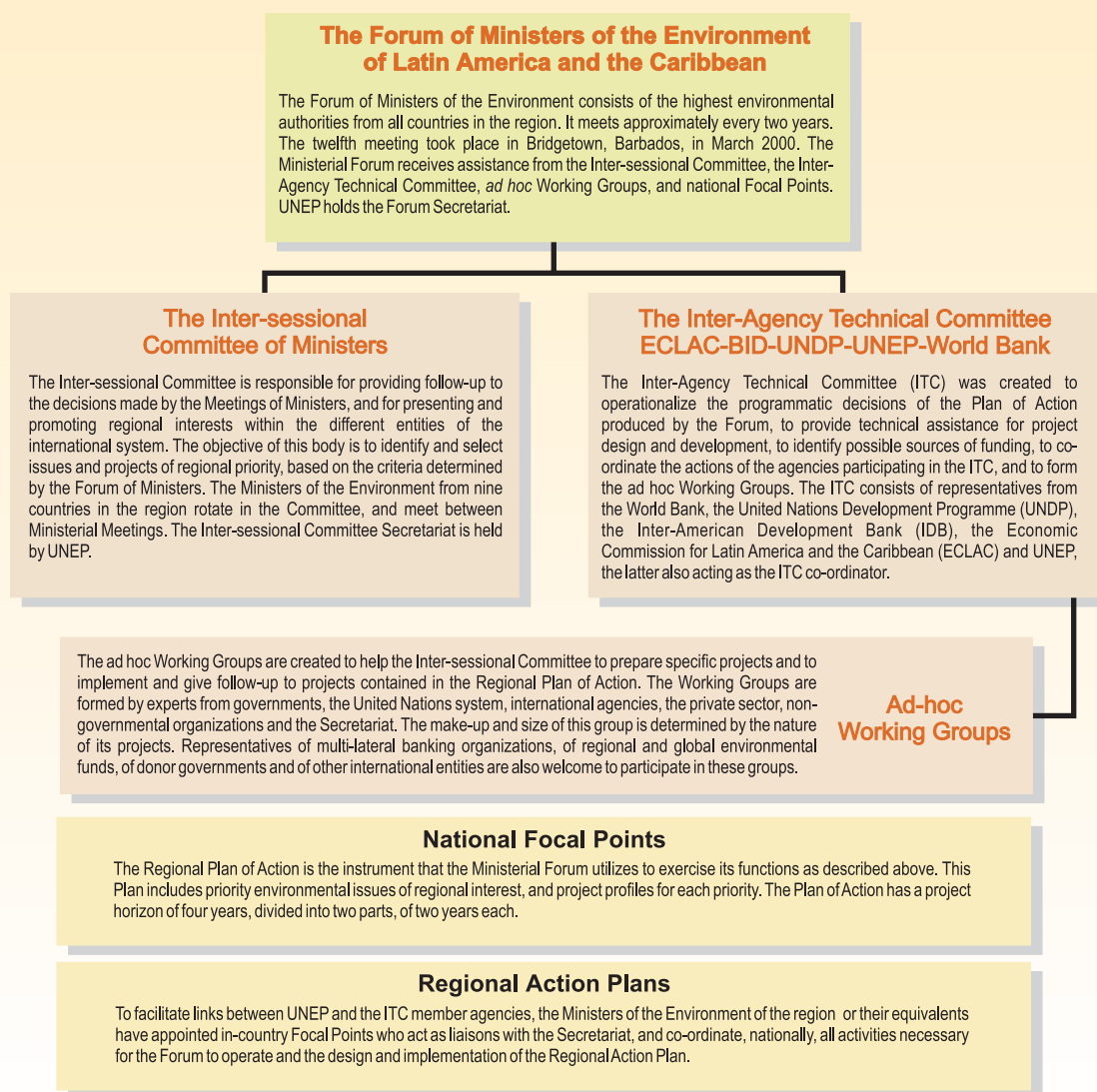
the balanced, inter-dependent and integral achievement of economic, social and environmental goals'. The Plan of Action they adopted is ambitious and includes 65 initiatives on health, education, agriculture, forests, biodiversity, water resources, coastal zones, cities, energy and mining (Summit of the Americas 1997).

The Santa Cruz Summit led to the formation of the Inter-Agency Support Working Group for Follow-Up to the Bolivia Summit. Its main objective is to improve co-ordination between the technical assistance organizations, international financial institutions and the Organization of American States member countries to implement initiatives contained in

the Plan of Action. It includes the participation of more than ten international agencies, with the OAS holding the presidency and technical secretariat.

The Second Summit of the Americas, held in Santiago, Chile, in April 1998, reinforced the Santa Cruz mandates and specifically the continuing role of the OAS, and of the Inter-Agency Support Working Group for Follow-Up to the Bolivia Summit and the Inter-American Strategy for Public Participation (see 'Public participation' section below). Implementation is in its initial stages.

At the ministerial level, one of the most important regional meetings is the Latin American and Carib-



Source: UNEP Regional Office for Latin America and the Caribbean, <http://www.rolac.unep.mx/>

bean Forum of Ministers of the Environment, which represents the highest political–environmental level forum in the region and which plays a fundamental role in the development of environmental policies and common positions for the region on broad international environmental issues.

Progress has been more significant at the sub-regional level. In Central America, for example, although environmental advances in the individual countries have not been equal, better harmonization and co-ordination of national activities has occurred. Environmental issues became an important theme in 1989, after signature of the Central American Convention for Protection of the Environment and the subsequent creation of the Central American Commission for Environment and Development (CCAD). Signature of the Central American Alliance for Sustainable Development (ALIDES) in 1994 was even more significant as it generated a conceptual and operational framework for sub-regional and national goals and strategies. ALIDES has had an important impact in the field of biodiversity through the Central American Biological Corridor project, integrating conservation into the planning of land use (CCAD 1998). This is particularly significant given the general context of inadequate co-operation on biodiversity matters

between research institutions and other academic entities in the region.

The formulation of the Program of Action for Small Island Developing States (SIDS) in 1994 was of great importance to the Caribbean as it introduced an explicit perspective of sustainability and has generated significant responses from the government sector as well as from the private sector and civil society. This programme of action has implied the adoption and implementation of environmental action plans and the creation of environmental authorities and ministries. In the energy field, a regional energy information network and a renewable energy centre in St. Vincent and the Grenadines were established as part of a Regional Energy Action Plan. A Caribbean Action Plan has also been established in support of the International Initiative for Coral Reefs. Other important sub-regional institutions arising in this context are the Caribbean Fisheries Management Program, the Caribbean Coral Reef Monitoring Program, the Caribbean Environmental Health Institute and the Caribbean Disaster Emergency Response Agency.

The South American Common Market (MERCOSUR) is another important example of a sub-regional non-binding agreement with environ-

### Central American Alliance for Sustainable Development (ALIDES)

#### Objectives:

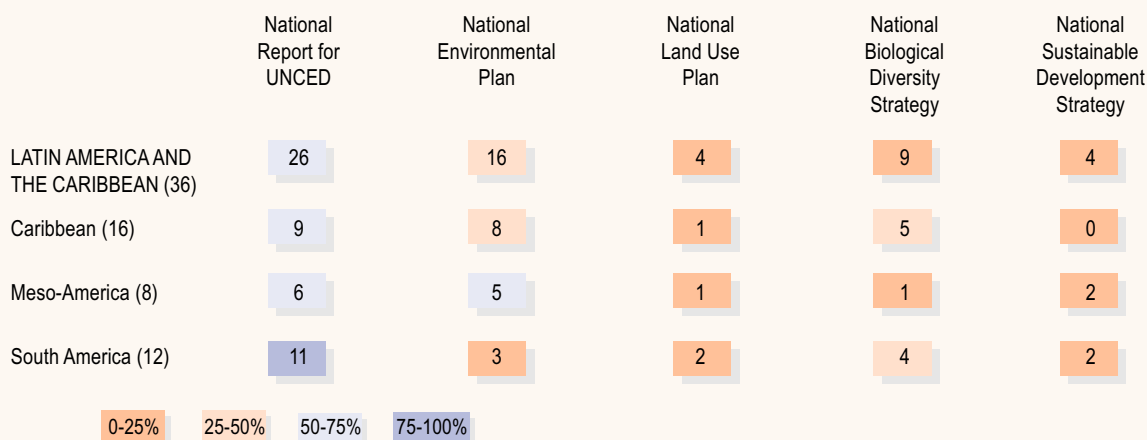
- ◆ To create in the isthmus a region of peace, freedom, democracy and development, by changing attitudes and promoting a model for sustainable development in the political, economic, social, cultural and environmental arenas, within the framework of *Agenda 21*.
- ◆ To foster the integrated sustainable management of territories so as to guarantee biodiversity conservation.
- ◆ To inform the international community about the progress made by the Alliance and the potential benefits of its development model.
- ◆ To promote society's capacity and participation to improve the quality of life.

#### Instruments:

- ◆ *National Sustainable Development Councils*, with representatives from the public sector and civil society, responsible for maintaining the coherence and consistency of national policies, programmes and projects within the framework of the sustainable development strategy.
- ◆ *The Central American Sustainable Development Council*, with the participation of the Presidents of Central America and the Prime Minister of Belize.
- ◆ *The Council of Ministers of Foreign Affairs and the Secretary of the Foreign Office of Belize*, responsible for co-ordinating presidential decisions, with the support of the Secretary General of the Central American Integration System.
- ◆ *The Central American Fund for Environment and Development*, to facilitate fulfilment of the environmental objectives of ALIDES.

Source: ALIDES, 1999.

## National environmental strategies and action plans



Sources: Compiled by PNUMA-ORPALC, based on UNDP/CSD, 2000; UNEP, 1997, 1999b.

mental impact. Even though it is a trade agreement, in which environmental considerations do not play a leading role, it has contributed to the discussion of significant changes in environmental policies. MERCOSUR legislation related to environmental protection includes regulations for acceptable pesticide residue levels in food products, the levels of certain pollutants in food packaging, eco-labelling, and regional transportation of hazardous materials (IDB 1996). The greatest progress is in the field of the environmental impact of new physical infrastructures, where a new environmental protocol is being negotiated (Gligo 1997).

Regarding non-binding agreements at the national level, it is of great importance to prepare environmental profiles and environmental or sustainable development plans of action. These diagnoses and plans frequently provide the necessary information, the policy formulation fora and the basic orientation to foster integrated environmental management. Many countries in the region have forestry action plans, conservation and biodiversity strategies, monitoring procedures and environmental reports. In several countries, environmental issues are included in national planning activities. Mexico, for example, promoted a chapter on environment and sectoral environmental plans, water resources and forestry, among others, in the National Development Plan for the period 1995–2000. Costa Rica did something similar for the periods 1994–1998 and 1998–2002. In Ecuador, significant public discussion took place in 1999 on a proposal for a Sustainable Development Strategy.

## Legal and institutional frameworks

Latin American and Caribbean countries have adapted their legal and institutional frameworks to the new paradigm of sustainable development. In total, 18 of 33 countries have constitutions that explicitly refer to the right to a healthy environment and the duty to protect the environment. In some of these countries, the new constitutions enacted in the last 25 years contain environmental provisions, frequently inspired by the principles shaped by the world fora in Stockholm (1972) and Rio de Janeiro (1992). In others, various amendments to existing constitutions have incorporated environmental rights and duties. Of special note is the case of the Colombian constitution, known in the region as the ‘ecological constitution’ by virtue of its close to fifty articles related to the environment. The Caribbean, however, is still lagging behind in this regard, as only 2 of the 13 countries there have taken environmental themes to constitutional level.

A significant number of countries have established a general environmental legal framework that articulates sectoral regulations related to water resources, wild flora and fauna, genetic resources, energy and mineral resources, the atmosphere, forestry, marine and coastal resources, and production and service activities such as industry and tourism, as well as contaminants such as chemicals and pesticides.

While drafting constitutions and laws, important preventive as well as punitive rules and regulations have appeared, along with institutions charged with enforcing this legislation. These legal instruments usually contain direct 'mandate and control' regulations for environmental management, but enforcement often depends on the existing capacity for control and sanction. This type of regulation differs from indirect regulations – which induce or provide incentives for certain environmentally appropriate conducts that are not obligatory. The section below on 'Economic instruments' deals with these in more detail.

Among the preventive direct rules and regulations there are provisions on land planning, natural resource conservation, technical standards for environmental impact (i.e. relative to energy efficiency), environmental impact assessment, environmental standards and audits and systems for granting environmental permits.

The most widely disseminated instrument for territorial regulation, and one of the most important, is the establishment of protected areas for biodiversity conservation (CEPAL1999d; see also Chapter 2, 'Biodiversity'). Plans to regulate municipal and coastal development have also been established, for example in Costa Rica.

Other important preventive direct regulations are the mandatory environmental impact assessments and the environmental licences established in several of the countries in the region (such as Brazil, Colombia, Costa Rica, Chile, Peru and Argentina). These provisions require prior approval of the environmental authority for certain investments (particularly for infrastructure projects and productive activities). Many of the assessments performed to date, however, have been for specific previously approved projects in some economic area not related to the environment and not based on general environmental policies and programmes. These evaluations have focused mainly on the reduction of negative environmental impacts and in very few cases have significantly changed a proposal, much less led to a rejection. Regardless, implementation of these assessments – often required by external financial organizations – may generate inter-disciplinary and inter-institutional experiences with significant components of local participation and exchange between external and national experts, thus improving capacities and opening up the way for new environmental management practices. The environmental impact assessment for the La Sirena hydropower project in Nicaragua is a good example (Tercero 1995).

Punitive rules and regulations include those that impose administrative, civil and criminal sanctions.

### The Environmental Crime Act of Brazil

The regulatory framework for the Environmental Crime Act of Brazil (12 February 1998) was established by federal decree in September 1999, with a broad spectrum of fines for environmental infractions ranging from 500 Reals (R\$500 or US\$250 at the September 1999 rate of exchange) to 50 million Reals (R\$50 000 000 or US\$25 000 000) depending on the severity of the environmental damage caused. Some offences may even incur a five-year prison term. This decree replaced legal provisions in at least six different environmental laws which had created many operational hurdles for the Brazilian environmental authorities. Many times in the past a judicial verdict has been declared invalid because of the legal interpretation of environmental damage or the application of an inappropriate provision, favouring further environmental destruction. The decree has facilitated and simplified the everyday work of officers of environmental agencies, leading to much greater effectiveness of environmental control.

To provide the environmental authorities with a powerful damage-prevention tool, maximum limits were set – allowing the violator the right to have a smaller fine imposed (as little as 10 per cent of the full

amount) if the environmental damage caused should be fully repaired. The decree sets forth the limitation of rights that apply both to physical persons and to enterprises, such as suspension of licences, permits and authorizations, loss of fiscal benefits or incentives, and denial of access to official lines of credit or to public administration contracts, for a period of up to three years.

Another important element contained in this law is that 10 per cent of the fines applied by the federal environmental agency (IBAMA today) are set aside in the National Environmental Fund (FNMA) and utilized to finance nature conservation programmes proposed by public institutions, NGOs or universities. Property confiscated from offenders by the environmental authorities may be put up for auction: such items include illegal timber, illegal fishing and hunting gear, and vehicles used in unlawful operations. The proceeds are used by research, criminal investigation, military, public and philanthropic institutions or by entities from communities with scarce resources.

*Source: Lopes 1999; Araújo 1999.*



The 1992 Environmental Penal Law of Venezuela and the Brazilian Environmental Crime Act approved in February 1998 constitute exceptional texts in environmental penal law. The Brazilian text is considered to be the most modern.

Environmental legal instruments have often been criticized for lack of enforcement and compliance, but it is difficult to guarantee compliance with such rules and regulations, firstly because many institutions are unable to monitor compliance and secondly because their systematic enforcement could have negative economic effects. For example, pollution from residential, industrial and agricultural waste waters in Nicaragua is regulated by many standards, but none can be adequately enforced (Dourojeanni 1991).

An important step in confronting this lack of implementation is to evaluate the economic, social and environmental impact of the new regulations before their approval. That is what the Legislative Assembly of Costa Rica did, for example, before enacting the Law for the Conservation of Wildlife in 1992.

Another fruitful mechanism consists of environmental awareness and technical training efforts at judicial level. Between 1996 and 1997, for example, the Central American Commission on Environment and

Development and a Costa Rican non-governmental organization (with Inter-American Development Bank support) carried out an environmental training project for judges. Three regional workshops and four workshops per country were held, and environmental legislation manuals were produced for each country for the guidance of officers in charge of enforcing the legislation. The project was carried out in co-operation with judicial schools and national facilitators linked to the universities in order to build local capacities (CEDARENA 1998). In Costa Rica, this awareness-raising process continued in 1999 through the co-ordinated efforts of the Ministry of the Environment and Energy (MINA E) and the judiciary: the environmental technicians from MINAE are teaching judges in different parts of the country to assign a value to the impact of actions forbidden by law, and the judges are teaching the Ministry technicians how to present their cases in the procedurally correct form.

In the field of institutional development, during the 1980s and 1990s many countries in Latin America and the Caribbean have created new environmental institutions such as ministries, commissions and councils, and others have changed or reorganized existing institutions. Of particular importance is the growing role of the judiciary in environmental conflict resolution and in recovery or reparation for environmental damages.

### An example of punishment for causing environmental damage

In October 1999, after a 27-month-long process, the Court of Cartago in Costa Rica convicted a coffee grower from the area of San Lorenzo de San Rafael de Tarrazú to five years in prison for polluting a local spring – a crime covered by Article 259 of the Criminal Code as, 'the corruption of food or medicinal products'. The judges revoked the benefit of parole that this same farmer had received following an earlier conviction, in April 1995, for destroying the vegetation around the same spring, which is protected by law.

A group of residents who used the spring has sued the farmer for polluting the water with a nematicide commonly used on coffee bushes. As can be read in the court decision, the statements made by officials from the Ministry of the Environment and Energy, the Ministry of Health, and the National Water Authority confirmed that 'Counter' or 'Biofox' is an extremely toxic substance, and very hazardous to human health. The neighbours claimed that the coffee grower had spilled agrochemicals into the spring that supplies their water. They also accused him of cutting down many trees in order to plant coffee bushes. The most serious consequences of the pollution offence were ob-

served weeks later when many residents began to experience vomiting, nausea, diarrhoea and severe heartburn. Ten people were hospitalized, including children and a pregnant woman, whose child was born with gastric problems. In all, 30 families were affected.

The Environmental Prosecutor had asked the Court to sentence the defendant to a total of thirteen years and eight months imprisonment. Additionally, the lawyers of the affected families, and the State, demanded 109 million Costa Rican colones in compensation (some US\$376 000 at the exchange rate in effect at the time). The prosecutor asked the court to demand payment of 100 million colones for moral injury and 1 million colones for physical injury, while the prosecution, representing the State, demanded an additional eight million colones for the damage caused to the protected area. Outside the courtroom, the defendant told the press that farmers throughout the country are using these substances on their crops.

Source: *La Nación Digital* 1999.

## Access to environmental justice in Latin America and the Caribbean

From 26–28 January 2000 the United Nations Environment Programme (UNEP) and the Federal Environmental Protection Proctorship (PROFEPA) organized a Judicial Symposium on Sustainable Development and Environmental Law, focusing on access to environmental justice throughout Latin America and the Caribbean. Judges from nine countries in the region participated, at a personal level. Other similar regional symposia have been held in Africa (Kenya, 1996), in South Asia (Sri Lanka, 1997) and in South-east Asia (Philippines, 1999).

In a public statement, the participants in the regional symposium in Mexico expressed their concern for:

- ◆ 'The principle of gratuity that must prevail in these processes as a condition for effective access to environmental justice. The lack of economic resources among litigants and the lack of technical support for the courts themselves is, in reality, a serious obstacle in the probatory field, as occurs especially with expert evidence.
- ◆ The fact that reparation for environmental damage continues to be treated in accordance with laws conceived to compensate for personal injury, and is based on conflict resolution methods

Mexico, Honduras and Nicaragua are examples of countries that work at the ministerial level (IDB 1996). Countries such as Chile, Ecuador, Guatemala and later Peru have chosen to create Co-ordinating Commissions (Gligo 1997).

Several environmental protection authorities have been created in the Caribbean, such as the Environmental Management Agency of Trinidad and Tobago, the Natural Resource Conservation Authority of Jamaica and, at the regional level, the Natural Resource Management Unit of the Organization of Eastern Caribbean States (UNEP 1999b). It is also worth mentioning the emergence of national agencies for disaster prevention and mitigation, with early warning systems, for example in the Caribbean, where a Caribbean Global Climate Change Adaptation Plan is being fostered. In that sub-region almost all countries have strengthened their environmental management institutions and capacities to integrate environmental considerations into physical planning. Land use plans or strategies have been developed in several countries and territories, including Anguila and the British Virgin Islands. Jamaica is an outstanding case: since 1978, national programming has included plans to reverse migration from the rural areas to Kingston and to implement measures to control disorderly urban growth.

that do not adjust to the type of legal protection that must be given to these widespread and collective interests.

- ◆ The consequent need in these processes to reconsider applying the traditional principles of procedural law, namely congruency and *res judicata*, and to expand the scope of legitimation and strengthen the power of the jurisdictional entity during the process, including application of the precautionary approach.
- ◆ The perfecting of actions by administrative bodies to prevent and punish conduct that violates the environmental order, without prejudice to the role to be played by the law in the criminal arena.
- ◆ The importance of educating and creating awareness in society as a way to ensure effective participation in environmental damage control.'

In response to these matters, the symposium participants expressed the need for 'the permanent training of judges, so they may meet the expectations inherent in the matter, as well as the eventual creation of specialized tribunals where this is possible and necessary'.

Source: PNUMA-ORPALC 2000c.

In the judicial field, some countries have established specialized environmental courts and comptrollers offices: Costa Rica is one. An important regional event at this level was the Judicial Symposium on Environmental Law and Sustainable Development, held in Mexico in January 2000.

Despite extensive institutional development experience in the environmental field, in many countries progress in the implementation of environmental laws, policies and regulations has been adversely affected by institutional conflicts resulting from weak co-ordination with other public, social and economic agencies, and by overlapping responsibilities between sectoral and environmental institutions. Budget restrictions, lack of technical capacity, shortage of skilled human resources to promote environmental management, and an absence of political will, are all factors that contribute to the difficulties (Figuerola 1994).

It is likely that within a few years national environmental laws and institutions will be strengthened as a result of international pressure and an increase in environmental degradation. However, several challenges will have to be overcome, such as the conflicts between fostering production and conserving the environment, the importance of preventive

mechanisms taking precedence over corrective mechanisms, and the administrative problems generated by the existence of different federal and state environmental jurisdictions. Mexico faces the new challenges of the North American Free Trade Agreement, and Colombia needs to begin implementing its environmental policy through its Regional Autonomous Corporations. Argentina has to confront the complexities of its own federal system, notably with respect to provincial jurisdictions and property rights over natural resources. By contrast, Chile (where a general declaration on environmental policy was recently adopted (Chile CONAMA 1998), Ecuador, Paraguay, Uruguay and the Central American countries have to face an excessively centralized institutional situation. In the case of the Caribbean, most countries will have to revise their current constitutions and regulatory bodies in order to integrate the environmental approach, bring those institutions into line with multilateral environmental agreements, and in general adapt them to the realities and demands of sustainable development.

## Economic instruments

The Rio Summit strongly emphasized economic incentives as a means not only to make production and consumption patterns more sustainable, but also to generate the resources necessary to finance sustainable development. Principle 16 of the Rio Declaration calls on national authorities to ‘promote internalization of the environmental costs and the use of economic instruments, taking into consideration the approach that the polluter must, in principle, assume the cost of pollution, with due consideration for public interest and without distorting trade and international investment’ (UN 1993).

In contrast to direct regulation instruments, which constitute a mandate under which non-compliance is subject to sanctions, economic instruments are conceptualized as a means of regulating matters indirectly: they grant incentives, or induce – but do not oblige – the actors to take certain courses of action by affecting their costs and benefits, thus promoting socially and environmentally desirable behaviour (PNUMA-CEPAL 1998). The concept also applies to various charges associated with the compliance or non-compliance with direct regulations. In this regard, economic instruments can not only act as incentives, but can also generate revenues.

From this perspective, the following can be considered indirect regulation instruments, or economic instruments for environmental management (PNUMA-CEPAL 1998; UNEP 1999a):

- Fiscal instruments: taxes on inputs, exports, imports, pollution, resources, land use.
- Financial instruments: loans, grants, subsidies, revolving funds, ‘green’ funds, low interest rates (see section ‘Financing environmental action’).
- Fees: for pollution, environmental impacts, access, toll roads.
- Bonds and deposit and reimbursement systems: forest management bonds, land restoration and effluent sanitation.
- Right of property and right of use: property, tenure, concessions.
- Market creation: tradeable emissions rights and permits, catch or exploitation fees, insurance.

Since the mid-1990s, most governments in the region have recognized the need to use economic instruments in environmental management. This is due partly to concerns about their implications for sustainable development, and partly to the need to mobilize additional financial resources. In the context of global multilateral environmental agreements such as the Framework Convention on Climate Change and the Kyoto Protocol, there is growing interest in the use of innovative economic instruments such as the trading of transferable greenhouse gas emission mitigation certificates (certified tradeable offsets). Costa Rica was the first country in the world to establish this market (Tattenbach and Pedroni 1999; Tattenbach and Mora 1998; Manso 2000): in 1996 it made the first sale of this type, to a public–private Norwegian consortium, for US\$2 million and 200 000 tonnes of carbon, in exchange for basin reforestation by the Costa Rican state-owned electricity company. Recently, the Costa Rican Joint Implementation Office has promoted the sale of these certificates in the Chicago and New York stock exchanges. Other countries in the region are promoting similar projects. Brazil, for example, has several carbon sequestration projects, among which there is

an important one from an American electricity company for US\$1 million in the Amazon state of Tocantins (Scharf 2000).

However, the use of economic incentives is still limited and has been aimed mainly at the control of contamination and access to certain natural resources. The most commonly used instruments are subsidies and fiscal exemptions (except in the Caribbean, where the use of incentives and subsidies is widespread) (UNEP 1999b). In Panama, as in other countries, incentives have been established that exempt the owners of forest plantations from paying income taxes. In this particular case, the Forestry Incentives Law makes investments in this sector 100 per cent tax deductible (PNUD-PNUMA 1996). Other successful fiscal tools are subsidies for reforestation, implemented for the first time in Brazil and Chile more than 20 years ago. In Argentina, the waste management law allows for an annual fee reduction for waste generators and operators of treatment plants if they recycle waste and improve their plants. Similar tax exemptions are offered to industries to promote the use of natural gas (IDB 1996).

The region is beginning to introduce green taxes in support of environmental policies, although they are still controversial. In Chile, for example, the debate on the possibility of establishing green taxes on gaso-

line has centred on problems related to the balance of the tax burden, the existing difficulties in allocating the amount collected exclusively to environmental management, the rise in fuel prices, and the limited scope of the environmental impact of this type of measure. In Costa Rica, by contrast, a fuel tax for the specific purpose of financing forest conservation and restoration activities has existed since 1996, perhaps in part because fuel prices in that country are among the lowest in the continent and allow a degree of fiscal leeway.

Implementation of market instruments is often difficult. In 1991, Chile adopted a transferable fishing permit system to regulate access to some fishing areas, but this initiative faced a variety of conflicts due to the opposition of fishing companies and the lack of adequate controls (O’Ryan and Ulloa 1996). However, its implementation has allowed the recovery of highly valued commercial resources that were being over-exploited under open access regimes and inadequate traditional ‘mandate and control’ measures (Borregaard *et al.* 1997).

The region is also starting to introduce guidelines for a system of tradeable emission permits, such as the Chilean Law on General Environmental Bases (1994) and the 1996 amendments to the General Law for Ecological Balance and Environmental Protec-

### Forestry incentives and payment for environmental services in Costa Rica

Several forestry laws enacted in Costa Rica – the most recent in 1996 – and the new Biodiversity Law of 1998, support the concept of granting rewards for the environmental services provided by natural forests and plantations. The draft Environmental Services Law, the discussion of which is quite advanced in the Legislative Assembly, regulates this new environmental management economic instrument. The Public Services Regulating Authority is about to authorize new water supply rates that include an amount for the forest owners, for their hydrological services. This set of public policies is helping to slow down the pace of deforestation, which has dropped to an average 14 000 hectares a year over the last four years, compared with 50 000 hectares a year in the 1980s and early 1990s.

Forestry Law No. 7575 proposes a payment to the owners of forest grounds, or land in the process of reforestation, as compensation for the services that their activities provides society at large. This law establishes a framework for carrying out co-operative projects and for strengthening the National Forestry Fund (FONAFIFO). The main sources of funds for FONAFIFO are projects by the Joint Implemen-

tation Office and fuel taxes, approved within the Framework Convention on Climate Change. The tax produced nearly US\$7 million in 1997 and is expected to yield a similar amount in forthcoming years.

A series of Certified Tradeable Offsets was taken to the stock market as a financial mechanism to facilitate the international trade of credit in exchange for carbon sequestration through co-operative projects. The revenue resulting from issuing these market shares will be used to pay small and medium-sized landowners for their voluntary conservation and reforestation efforts. Additionally, several studies have been undertaken to support adding the cost of water basin protection to the monthly water bills. The Forestry Law and the Wildlife Conservation Law also include fiscal and administrative incentives to compensate landowners for forest conservation and national wildlife area management. Among these incentives are tax exemptions, protection against squatters, and technical assistance.

*Source: Costa Rica 1998.*

tion in Mexico. However, the specific legislation required to enforce these instruments does not yet exist (Gonzalez 1997). In Chile, the private sector supports the use of these tools and some progress has been made towards the design of a technically coherent system and the definition of the necessary legal framework. In a preliminary phase, a transition system called the Compensation System for Particulates in the Santiago Metropolitan Area is applied to new sources.

Another type of market instrument that has gained ground in recent years is environmental certification and audit processes, such as ISO-14000 and 'eco-labelling' in the fields of agriculture, forestry and fisheries (see section 'Industry and new technologies' below).

Systems based on rates and fees are more broadly used, some already for many years, although many of these instruments were conceived to support general economic policies rather than environmental management (Borregaard 1997). In Brazil, for example, rates are established for the use of natural resources (oil, minerals and water) in a federal regulation dating back to 1991: companies pay a tax proportional to the economic value of the exploited resource and income is distributed among the federal government and the states in which exploitation has occurred (IDB 1996). More recently, several countries in the region have started charging users of ecotourism services (UNEP 1999b).

Mexico for the first time in 1991 established a tax on effluent discharges, so as to reduce pollution and encourage companies to adopt quality control measures. The rate per cubic metre of effluent varies according to the location. Similar initiatives are being implemented in Uruguay and Colombia (CEPAL-PNUMA 1997). Fees for solid waste collection are also common. In Chile, the Law on General Environmental Bases contemplates the possibility of setting fees to cover pollution prevention and decontamination costs.

Charging for potable water, including fees for sewerage and treatment where applicable, is a common practice, for example, in most of the Caribbean countries, although the environmental effectiveness of these fees has been minimal given limited user cov-

erage and a pricing policy that does not cover the capital costs. Peru and the Central American countries are looking to establish a value for these water resources, in order to reflect in their rates the decreasing availability of water and to promote more rational resource use (CEPAL-PNUMA 1997). The Costa Rican Environmental Services Law, which includes this aspect, is making good progress and it is expected that the Public Service Regulating Authority will soon approve the inclusion of charges for environmental services in water bills. Several countries are also charging for the exploitation of certain resources, especially in the mining sector and in construction material extraction (CEPAL-PNUMA 1997).

In the Caribbean, a glass bottle deposit and reimbursement system has been successful in Jamaica and Trinidad, and credit subsidies to promote the use of solar energy have proved successful in Barbados (UNEP 1999b). In Jamaica, for example, the deposit and reimbursement system has achieved recovery rates of 50 per cent and 80 per cent in beer and soda bottles respectively (UNEP 1999b). The growing use of plastic bottles limits the potential of this economic instrument, given the absence of incentives to recycle plastic. However, it is still possible to include other products in the scheme, such as batteries, tyres and lubricants.

There are few experiences in the region regarding the reallocation of property rights as an indirect regulation scheme for environmental management. The main example is the Chilean reform of water rights, which established perpetual, irreversible, transferable rights that individuals may acquire independently from land ownership (CEPAL 1999d). In this case, regulations were not established to prevent contravening the public interest, as has been done in some western states in North America where the right granted is subject to efficient and beneficial use of the water to prevent monopolies and speculation. Recently, Chilean antitrust organizations have been emphasizing public interest and control elements in proposals for legal reform (CEPAL 1999d).

Despite the many successes and the variety of actions taken in the countries of the region, difficulties persist in the use of economic instruments. Among them are weak public institutions, lack of



consolidated legal frameworks, limited technical and administrative capabilities and the existence of political and ideological conflicts over issues of equity, all of which affect the political will necessary for implementation (Borregaard 1997). In some cases, the absence of complementarity between economic instruments and direct regulations has had negative environmental impacts.

The use of indirect regulation instruments will probably increase in the next decade, particularly in the use of taxes, fees, tax deductions and subsidies, with the emergence of more preventive environmental policies. Of particular importance in this regard is the reduction of 'perverse' subsidies, such as the ones that exist in many countries for agrochemical-intensive agriculture and fossil-fuel-intensive industry, which represent – in effect – a subsidy to pollution. In any case, there is a tendency in some sectors to

expect too much from regulation programmes based on economic instruments. Direct regulation is still necessary to address the many different environmental problems, and the future will most likely require a mixture of direct regulations and economic instruments.

## Industry and new technologies

Economic globalization and the development of markets sensitive to environmental issues are exerting pressure to improve the environmental quality of products and promote cleaner industrial processes. However, although there has been a remarkable increase in the development of cleaner technologies in the industrialized world, the Latin American and Caribbean countries still do not possess the advanced

### Technological innovation in Brazil and Chile

#### Brazil: Fostering alcohol-combustion vehicles

In 1975, in the midst of the global oil crisis, the Brazilian Government initiated the Alcohol Fuel Production Programme, aimed at introducing ethyl alcohol as a fuel for vehicles. A first objective of the programme was to add anhydrous ethyl alcohol (AEA) to gasoline. A minimum proportion of 22 per cent was mandatory (but could reach 26 per cent). A second objective was to provide incentives to the national automotive industry to manufacture vehicles with engines capable of running on 100 per cent hydrated ethyl alcohol fuel (HEA).

The first HEA-powered automobile was sold in 1975, and by the mid 1980s 90 per cent of the vehicles sold used only HEA. However, the supply of alcohol-powered vehicles dropped at the beginning of the 1990s because there was no clear state policy to guarantee the supply of HEA. In the last few years, the manufacture of these vehicles has reached only 0.1 per cent of the total. However, total production was 5.4 million vehicles between 1975 and 1995.

Given the ever-growing problems of urban air pollution resulting from fossil fuels, the National Automotive Vehicle Air Pollution Control Programme (PROCONVE) was established in 1986. The programme seeks to reduce the emission of pollutants and to encourage, through incentives, technological development in automobile engineering and in methods and equipment for measuring pollutants. Three vehicle categories were determined, and each category has a specific time schedule within which to limit emissions. A result that PROCONVE has already seen is the complete elimination of leaded gasoline. On the other hand, having proved that using only HEA reduces emissions up to 20 per cent, the government is now fostering the purchase of HEA-powered vehicles. Law 9660 of June 1998 mandates the purchase of, or replacement of current official automobiles by, HEA-operated vehicles, and continues to offer tax exemptions for in-

dividuals who buy these vehicles. Still under discussion is the official objective that 20 per cent of the total motor pool sold should be of this type. The establishment of a policy to guarantee supply at competitive prices is also being discussed.

#### Chile: A Public–Private Committee for clean production

Within the framework of the Clean Production policy (CP) promoted by the Chilean Government in 1997, the Ministry of Finance considered it a priority to create a Public–Private Committee as the entity for co-ordination, dialogue and action, to result in policy implementation and improvement. Participating in this committee are public training and promotion institutions, regulatory and monitoring institutions, and representatives of trade associations and trade union organizations, all of which have the authority and capacity to commit to the decisions made and to execute tasks agreed by the committee.

The main objectives of this group are to commit the various sectors to participation, to strengthen the instruments of promotion and to develop the CP technological infrastructure. An additional goal is to shift from the current production systems to a Clean Production culture in the medium and long term. To date, voluntary agreements have been signed with cellulose manufacturers, thus making progress in industry's compliance with environmental regulations related to emissions from liquid industrial wastes (in this case those produced by cellulose manufacture). Forty-six metallurgy plants have agreed to encourage foundries to adopt clean production measures, especially in the area of air pollution and solid waste management. This will facilitate and promote the development of clean technologies that will lead to higher environmental standards and greater levels of competitiveness.

*Sources: Veloso 1999; Chile, Ministerio de Economía, Secretaría Ejecutiva de Producción Limpia 1999a, 1999b.*

technologies required for the efficient use of their resources, nor can they easily access them. Several obstacles hinder the transfer of clean technologies from industrialized countries, including lack of adaptation to local conditions, lack of adequate scientific and technological knowledge, fear among northern industries of a possible increase in competition, and lack of funds in the South. In addition, the existence of incongruent policies and the slow progress of economic growth and investment in the region constitute additional obstacles.

Nevertheless, in many cases environmental demands are beginning to be seen as challenges rather than limitations. Producers in Argentina, Brazil and Mexico are adapting their productive processes to ISO-14000 standards in some sectors as a means of demonstrating their compliance with the demands of international markets. In some countries, the more competitive sectors have taken the lead.

In Costa Rica, in 1998, a trans-national company obtained the first ISO-14000 certification in the world for its brand of export bananas, an achievement that is described as the result of a complex process of conflict and political negotiation with environmentalists and government entities (Fernandez 1998). In Chile, public and sectoral environmental agencies seek to transform the national production strategy through a series of economic incentives, multi-stakeholder negotiating fora, and voluntary agreements. The ten year old programme for adding alcohol to gasoline in Brazil is perhaps one of the most noteworthy examples in this area. Several Caribbean countries, including Jamaica, Trinidad and Tobago, and Guyana have clean technology initiatives through public and private sector alliances, including contributions in research by important universities. The sectors involved include agriculture, tourism and mining. In Jamaica, for example, a public-private consortium for aluminium extraction and processing has undertaken pioneer projects with two types of technology for treating bauxite residues.

These examples suggest that strict regulation of the use of resources is perhaps not the most efficient way to promote technological change. In general, it could be said that the introduction of cleaner technologies requires collaboration between the public and private sectors, where direct regulation meas-

ures could be combined with economic incentives and voluntary contributions.

Some of the fields in which technological research and development initiatives are occurring in different countries are agriculture (genetic engineering), fisheries, forestry, waste management and pharmaceuticals (taking advantage of biological diversity to manufacture medicinal products). In agriculture-intensive areas, new methods are gradually being introduced to exploit biotechnology and genetic engineering, new machinery, computer-assisted drip irrigation and radioactive isotopes. However, the potential environmental risks of some of these new technologies are being questioned.

In the energy field, several countries in the region are promoting energy efficiency and alternative energy sources (wind, solar, hydroelectric, biomass and biogas). Wind power is being exploited in Costa Rica, Curaçao, Jamaica and Barbados, among others (Tattenbach and Pedroni 1999; UNEP 1999b). Since 1993, Curaçao has been operating a three-megawatt wind power plant and Jamaica has proposed to install an 18–20 megawatt plant in 2000. Costa Rica, on the other hand, has just completed an agreement with a Dutch public-private consortium for the trade of certified tradeable offsets, through an already operating wind power plant with an installed capacity of 20 megawatts. Cuba has built the first ocean thermal energy conversion (OTEC) plant, which uses the caloric energy of warm surface waters to generate electricity: a second two-megawatt demonstration plant has been built in Jamaica. Biomass has been used as an energy source for the sugarcane industry in Cuba.

Recycling is another strategic area of technological development. Of particular importance is the case of empty toxic agro-chemicals containers, considered by the Pan-American Environmental Residue Management Network (REPAMAR) to be one of the main priorities in this field. In 1997, Brazil, for example, processed more than 83 million containers with a total mass of almost 16 500 tonnes (IBAMA 1999). In 1998, the National Association for Vegetation Defense (NAVD) co-ordinated a US\$1.1 million programme to create twelve container collection centres, and invested an additional US\$1.05 million to create 17 new centres in 1999. The con-

tainers are collected and transformed into electrical conduit for civil works. The Guariba pilot project in the state of São Paulo, for example, is capable of receiving 120 tonnes per month, equivalent to the total volume of empty containers in the state.

Technological development in itself, however, may not be sufficient to promote the adoption of cleaner technologies. Other measures can be adopted to promote a more widespread development. As stated in this section, the use of incentives must be considered in combination with regulatory mechanisms and standards, public debate and information dissemination, and the assistance of more technologically advanced countries.

## Financing environmental action

In the last 25 years, financial markets have expanded and integrated internationally. International capital flow has grown rapidly, particularly in the form of direct foreign investment in developing countries and countries in transition, which practically tripled between 1990 and 1996 (UNEP 1999a). The importance of the private sector in this globalization is made clear in the realization that in 1996, foreign currency in the hands of large investors reached about US\$350 trillion (UNEP 1999a) – more than ten times the world gross domestic product.

Private foreign investment – concentrated in a few developing countries – reached US\$250 billion in 1996, in sharp contrast to the flow of external assistance for development which has fallen to its lowest level in many decades and is now less than US\$50 billion. This reduction in official assistance for development has diminished the capacity of the public sector and the multilateral agencies to provide public services such as environmental health, despite the existing awareness in international fora such as the Earth Summit of the need to find new funding sources for environmental management (UNEP 1999a). In particular, the Rio Conference secretariat estimated that implementation of *Agenda 21* in low-income countries would cost an average of more than US\$600 billion per year between 1993 and 2000 (UN 1993), of which US\$125 billion should come from international grants or concessions. At the Summit, high-income countries reaffirmed the commitment agreed upon by the United Nations to allocate 0.7 per cent of their gross domestic product to official development assistance, and some committed to this by the year 2000. By 1997, however, only four developed countries had reached or exceeded this goal. They were: Sweden, the Netherlands, Norway and Denmark (in ascending order) (UNEP 1999a).

Within this framework, the cost of implementing *Agenda 21* must be financed through a combination of domestic investment and external assistance and investment. During 1997, the Latin America and Caribbean region received an average of US\$13 per

### Environmental expenditures in the Chilean and Costa Rican public sectors

In 1998, the Chilean public sector expenditure for environmental purposes was estimated at almost 148 billion pesos (approximately US\$315 million), where 63 per cent was for current or operating expenses and the other 37 per cent was for capital expenses and investments. These resources were destined to provide: technical and financial assistance, environmental services information and production (40.4 per cent); environmental planning (16.3 per cent); environmental regulations (12.8 per cent), and environmental control (12.8 per cent). The rest was used to fund environmental education and training activities, to repair environmental damage, for citizen participation and for environmental impact assessments. Considering only the fiscal expenses (in local currency) to be contributed to public sector organizations that year, the national environmental budget represents 2.6 per cent, which is very similar to the portion allocated to the Ministry of Agriculture, eight times less than the allocation to the Ministry of Education, and twelve times less than that to the Ministry of Labor, which receive the highest budgetary allocation.

For the period 1991-1995, the environmental expenditure for the Costa Rican public sector has been estimated at around 3.196 billion colones per annum (equivalent to some US\$26.2 million at the 1991 exchange rate). This was between 0.34 and 0.47 per cent of the gross domestic product at that time and between 2.4 and 3.4 per cent of the total public expenditure, while the per capita environmental expenses oscillated between 819 and 1 989 colones per year. Most of these funds were invested in waste treatment and forestry (41 per cent and 35 per cent of total expenditure respectively). As to the type of activity funded, the largest share was for environmental quality recovery actions (environmental damage treatment and mitigation), and environmental investment (protection, prevention, research and development, education, information and publicity), with 48 per cent and 47 per cent respectively.

Sources: Chile, CONAMA 1999; Barrantes 1997.

inhabitant in assistance and US\$62 in direct foreign investment (UNEP 1999a). In most countries, the environmental sector is subsidized mainly by government funds, with resources coming from national budgets, grants, subventions, certified tradeable offsets, tariffs, loans, trust funds, fines, indemnifications, auctions of confiscated products and other resources as determined by legislation (IDB 1996). Despite the reduction of global development assistance, in recent years there has been significant support from international assistance and bilateral technical co-operation programmes, aimed mainly at creating and strengthening environmental institutions.

The creation of special funds is a recent undertaking. An initiative from the Alliance for Sustainable Development seeks to establish a Central American Fund for Environment and Development, to fill the existing financial gap in national and regional conservation projects. Similar initiatives exist in Colombia, such as the National Environmental Fund and the Amazon Fund. The Environmental Fund of El Salvador supports small projects, while Costa Rica has several funds related to forestry, as well as some assigned to sustainable development activities within the framework of the Bilateral Agreement on Sustainable Development with the Netherlands. In 1989, Brazil created a National Environmental Fund to finance projects related to the sustainable use of natural resources, as well as the management and improvement of environmental quality. Government agencies and environmental NGOs may request funds for activities that meet environmental policy guidelines.

Other financial initiatives include some that take advantage of the restructuring of bilateral debts with the United States (Fund for the Americas), with examples in Argentina, Bolivia, Brazil, Chile, Colombia, Costa Rica, Ecuador, Dominican Republic and Uruguay (CEPAL-PNUMA 1997; IDB 1996; CEPAL 1999d). These are specifically aimed at non-governmental organizations.

Other initiatives are related to specific environmental matters, and include, among others:

- The National Environmental Fund (FONAMA) in Bolivia, established in 1990, which seeks to capture and manage funds for biodiversity.

- The Protected Wildlife Areas, Wildlife and Forestry Fund in Paraguay.
- The Environmental Protection Fund in Chile.
- The Federal Fund for Forest Replacement in Brazil, which has been financed since 1973 by payments made for forest resources exploitation.
- The Ecological Trust Fund in Panama, created in 1995 for a 30 year period, with a total of approximately US\$22 million from the Panamanian Government, the US Agency for International Development and The Nature Conservancy, with emphasis on natural resource management activities in the Canal basin.
- The Trust Fund for Rainforests, managed by the World Bank.

The National Environmental Program (PNA) in Brazil, with 70 per cent of its funding provided by the World Bank, was created to strengthen environmental organizations, implement the National Conservation Unit System, protect endangered ecosystems and help to reconcile economic interests and environmental protection. In December 1999, the Bank approved an additional US\$15 million for the second phase of PNA, out of a total US\$150 million to be disbursed over a ten-year period, for activities to strengthen environmental institutions at the local, state and federal levels. The first portion of the funding will be destined to strengthen environmental management at the municipal and state levels (Azeredo 1999).

A common problem with many of these financial mechanisms is the limited availability of resources, often related to institutional weakness (CEPAL 1999d).

## Public participation

Public participation has increased in recent years, together with a growing public awareness of the threats to the quality of life and the restoration of democracy in some countries. In many nations, the new perception of the role of civil society in achieving the goals of the Earth Summit (1992) has led to close collaboration between governments, non-gov-

ernmental organizations, community organizations and the private sector to establish standards and to prepare environmental policies and action plans. According to the Rio Declaration, 'only a committed and responsible citizenship, universally represented and actively representative, will be capable of contributing to public decisions an authentic representation of national priorities. That is, neither the power elites on the one hand, nor the best intentions of the State on the other, will be capable of creating an agenda of public priorities capable of gaining citizen commitment that will ensure the sustainability of its long term application.'

Later, the Santa Cruz Declaration of 1996 assumed significant commitments in this respect, highlighting the pluralist dimension of the challenge faced by the countries in the region for effective political action. This makes evident that beyond government structures there is a need to articulate the efforts of the non-governmental and private sectors and civil society in the framework of a profound cultural transformation of the peoples and nations.

Growing citizen participation in recent years has emerged through groups of individuals or social organizations dedicated to different activities, where social co-responsibility permeates their actions and translates them into management for change and development. In some Latin American and Caribbean countries, citizen participation in environmental issues occurs in formal participation spaces re-

lated to environmental impact assessment systems, environmental quality standards, actions for environmental damage, and prevention and decontamination plans. In other countries, participation spaces are opening, in sharing responsibilities in the management of protected areas, in environmental education processes, in consumer defence actions and in the political management of sustainable development.

In some countries, this co-operation has been formalized through measures to devolve governance to the community level, while in many countries public participation is becoming institutionalized as a result of legislative requirements (UNEP/UWICED/EU 1999). St. Lucia, for example, has included special mandates for public participation in the amendments to its National Trust Fund Law. The National Trust Fund of St. Lucia, together with the Caribbean Natural Resources Institute, is promoting participation in the management of protected areas throughout the country. In other Caribbean countries, NGOs have made significant contributions to the creation and management of protected areas, such as Kingshill Forest Reserve in St. Vincent and the Grenadines, and the Blue Mountain and John Crow Mountain National Parks in Jamaica and Trinidad and Tobago respectively, where concerned individuals and NGOs, with government support, have introduced a 'co-management' arrangement, entrusting to the local population the management of beaches where turtles nest.

### Formation of National Sustainable Development Councils

| Country                        |   | Country      |   | Country       |   |
|--------------------------------|---|--------------|---|---------------|---|
| Caribbean                      |   | Meso-America |   | South America |   |
| Barbados                       | ✓ | Belize       |   | Argentina     | ✓ |
| Bahamas                        |   | Costa Rica   | ✓ | Bolivia       | ✓ |
| Cuba                           | ✓ | El Salvador  | ✓ | Brazil        | ✓ |
| Dominica                       | ✓ | Guatemala    | ✓ | Colombia      |   |
| Granada                        | ✓ | Honduras     | ✓ | Chile         | ✓ |
| Haiti                          |   | Mexico       | ✓ | Ecuador       |   |
| Jamaica                        | ✓ | Nicaragua    | ✓ | Guyana        |   |
| Dominican Republic             | ✓ |              |   | Paraguay      | ✓ |
| St. Kitts and Nevis            |   |              |   | Peru          |   |
| St. Lucia                      | ✓ |              |   | Uruguay       |   |
| St. John, Antigua and Barbuda  |   |              |   | Suriname      |   |
| St. Vincent and the Grenadines |   |              |   | Venezuela     |   |
| Trinidad and Tobago            |   |              |   |               |   |

Source: Earth Council.



The Popular Participation Law of Bolivia grants significant rights and functions to all citizens, and to trade and community organizations. The most important function they have is the monitoring, by surveillance committees, of the use of public funds in municipalities. In Argentina, even though the formulation of environmental standards at the national level does not require formal consultation mechanisms, the recently created sectoral regulating entities (electricity, natural gas and water) have institutionalized mechanisms through which to consult about regulations related to permits or design processes, and public hearings are regularly held as part of the decision-making process.

It is important to point out the growing participation of large companies and groups of companies from Latin America and the Caribbean in the debate about sustainable development issues. Large corporations in the region have included in their actions global initiatives promoted towards the end of the 1980s by the International Chamber of Commerce and at the beginning of the 1990s by the World Business Council for Sustainable Development (CEPAL 1999d). The World Business Council for Sustainable Development in Latin America, the regional chapter of the global network, completed consolidation in 1997 and currently represents more than 300 companies, with eight national councils, one binational council and one sub-national council in the

Gulf of Mexico. The Council promotes study, education, training and technological innovation activities for the business sector in the field of sustainable development.

A field of institutional development of utmost importance for public and citizen participation is related to the recommendations arising from the Earth Summit for the formation of National Sustainable Development Councils throughout the region. Currently, 20 of these councils exist and the number is growing. Their main functions are to:

- Raise the awareness of the main actors and decision-makers at all levels through a dialogue on the importance of sustainable development, the responsibilities of government and all other sectors, and the need to work in an integrated and co-ordinated manner.
- Monitor national progress towards sustainable development.
- Identify gaps in policy, influence policy-makers and promote research, policy reforms, programmes and legislation for sustainable development.
- Advise the government on international co-operation matters related to the promotion of sustainable development.

## Global environmental citizenship for Latin America and the Caribbean

In 1997 the Regional Office of the United Nations Environment Programme received a subsidy from the Global Environment Fund (GEF) to elaborate a Global Environmental Citizenship project profile that included actions and activities to raise public awareness. The projected goal was to ensure citizen participation and more effective measures and decision-making processes related to the global environment. Four key thematic areas had to be included: Biological Diversity, Ozone Depletion, Climate Change and International Waters. For GEF, one of the key operating principles is citizen participation.

The project profile, approved during the GEF Council meeting in New Delhi in March 1998, focuses on carrying out national awareness campaigns to benefit the participating countries, such as reduction of pollution, the effective use of resources, and the conservation of biological resources.

The Environmental Citizenship project arises from the need to incorporate local and global environmental protection into the development process, built with the broad participation of the different social

actors. It will additionally prove the effectiveness, in terms of credibility and costs, of entering into strategic alliances with groups of civil society and networks of non-governmental organizations with political and social influence. These will be in charge of integrating GEF key areas into their agendas and will disseminate these through their communication mechanisms. The participating regional citizen networks will be: PARLATINO (Latin American Parliament), with 924 members; IULA (International Union of Local Authorities), with 205 local governments; IUCN-CEC (International Union for the Conservation of Nature and the Commission on Education and Communications), with 131 organizations (Ministries of Education, Universities, NGOs); Consumers International (consumer organizations), with 34 members (national civil society associations and institutions); CLAI (Latin American Council of Churches), with 3 million active members; and AMARC (World Community Radio Association), with 390 community radio stations.

Source: PNUMA - ORPALC 2000b.

- Promote and facilitate training and awareness-raising programmes on sustainable development.
- Co-ordinate and harmonize sustainable development activities at the national level.

Upon signing *Agenda 21*, Mexico made a commitment to prepare its own proposal in the form of a Program to Attend to the Sustainable Development Agenda, under the co-ordination of the Environment, Natural Resources and Fisheries Secretariat (SMEARNAP). This programme, which involves different government sectors for formulation and compliance purposes, has produced a planning and implementation exercise never seen before, based on an innovative scheme to integrate contributions and commitments from the different areas of public administration. In 1995, Mexico also promoted the formation of a National Consultative Council and four Regional Consultative Councils, as well as several consultative councils by thematic areas: for basins, for environmental regulation, Metropolitan Area Councils for Air Quality Management, the National Council for Protected Wildlife Areas, and the National Consultative Technical Councils on Forests and Soil Conservation.

The Sustainable Development Council of Bolivia was created in 1996 for consultative purposes, and includes representatives from the government, non-

governmental organizations, the private sector, the press, the academic sector, indigenous populations and trade unions. In Chile, the National Environmental Commission (CONAMA) promoted the formation of the National Sustainable Development Council, created by decree in 1998. This Council is a national forum for open and pluralist discussion on sustainable development and environmental issues, with room for proposals and consultation. Its main tasks can be summarized as follows: to report annually on the state of sustainable development in the country and to present to the President of the Republic a report containing a vision of sustainable development in the medium and long term, as well as suggestions and proposals on matters of sustainable development. The National Environmental Council of Brazil similarly advises the government on policy formulation at the national and regional levels.

Partly as a consequence of growing citizen participation, in recent regional summit meetings governments have recognized that the involvement of civil society in decision-making has a key role to play in improving democracy, promoting sustainable development, attaining economic integration and free trade, improving livelihoods, and preserving the natural environment for future generations. In response, they propose, among other actions, to promote environmental information and education among all citizens and sectors of society, and to sup-

### Inter-American strategy for public participation

The Plan of Action resulting from the second Summit of the Americas, held in Santiago, Chile, in 1998, calls for dialogue and collaboration between the public sector and civil society, and entrusts the Organization of American States (OAS) to encourage governments and society to provide support, as well as to develop adequate programmes, to help implement this initiative.

The OAS, complying with the mandate coming from the Summit of the Americas in Santa Cruz, Bolivia, and in consultation with officers and experts from the governments and civil society, formulated the 'Inter-American Strategy for the Promotion of Public Participation in Sustainable Development Decision-Making Processes' (ISP). The strategy additionally aims at identifying mechanisms to guarantee the transparent, responsible and effective participation of members of government and civil society, and at promoting participatory decision-making processes in matters pertaining to environment and sustainable development. The strategy is based on demonstrative studies

and on analysing relevant legal and institutional mechanisms and frameworks. Information and experiences will be shared and the basis for long-term financial support will be determined for the alliances between public and private sectors. The ISP received the support of the Global Environment Fund (GEF), the United Nations Environmental Programme (UNEP); the United States Agency for International Development (USAID), the United Nations Educational, Scientific and Cultural Organization (UNESCO) and the OAS.

Several meetings and consultations have taken place (in Guatemala, Washington, D.C., Costa Rica, Jamaica, Barbados, Uruguay, Honduras, Peru and Mexico) to review the lessons learned and identify the best practices related to public participation mechanisms. The Strategy web site is at <http://www.ispnet.org/>

Source: ISP 1998.

port citizen participation and awareness campaigns to resolve or mitigate the main problems affecting communities.

In the field of sustainable development, the Declaration of Santa Cruz de la Sierra in 1996 specifically supports the principle of public participation, and commits its signatories to support and promote the active participation of civil society in the design, implementation and evaluation of policies and programmes. The governments also agreed to promote more opportunities for the expression of ideas and for the exchange of information and traditional knowledge among groups, organizations, companies and individuals, including indigenous populations, and also to promote opportunities for their active participation in the formulation, adoption and implementation of decisions affecting their living conditions.

The Bolivian Summit Action Plan entrusted the Organization of American States with the formulation of a strategy to promote public participation in sustainable development decision-making. In addition, the regional office of the United Nations Environment Programme is preparing a project profile on 'Global Environmental Citizenship for Latin America and the Caribbean', which is currently in the final approval phase.

The State transformation process must bring with it greater allocation of responsibilities to civil society: their rights, resources and participation must be expanded not only in policy implementation but also in the decision-making process and in environmental management control. Within the framework of growing environmental awareness and increased democratic freedom, it is likely that citizens will demand broader and more institutionalized legal participation channels. Decentralized actions to handle environmental conflicts at local or provincial levels may offer an effective way to channel public participation.

Nevertheless, it is important to take into consideration the numerous problems and difficulties that limit public participation in the region. Among them are:

- shortcomings in the institutional capacity of governments, non-governmental and commun-

ity-based organizations (financial, human resources, infrastructure), as well as the lack of a participation culture in all sectors, and mistrust among the parties;

- legislation gaps that cause uncertainty about the roles and responsibilities of the various parties;
- absence of relevant policies or scarce integration of sustainable development issues in economic and policy planning;
- limited flow of information between governments, non-governmental organizations, community-based organizations and individuals, and
- lack of capacity in the countries to implement international agreements, due to the shortage of financial resources or the lack of political will.

## Environmental information

Information available on environmental issues has increased considerably since the Rio Conference. Several countries have created programmes to develop information, data management and education systems in support of environmental policies in the fields of land resource management, biodiversity and marine coastal zones. Many governments have also supported environmental information and education programmes for waste management and sustainable tourism. However, more collaboration is needed among the countries of the region, and with other regions, especially on the exchange of experiences and information, and the development of common approaches to resolving problems. Governments must allocate more resources to developing awareness campaigns related to *Agenda 21*, and to the commitments assumed in the continental summits and in different multilateral and regional environmental agreements to foster dialogue among policy-makers, technocrats and the public at large.

The incipient creation of institutions responsible for information shows the growing awareness of governments of the value of information for environmental management purposes. However, it is too early yet to evaluate their impact on decision-making. In Chile, for example, a National Environmental Information System was launched in 1994, on

the basis of a decentralized, low maintenance, open and flexible platform. There is a pilot web site with information organized in modules and by environmental themes (CHIPER 1999). In the Caribbean, government policy is to establish environmental management institutions that are also responsible for information management. Jamaica, Trinidad and Tobago and Guyana have established institutions that will also be in charge of developing National Environmental Information Systems.

In many Caribbean countries, non-governmental organizations are becoming more involved in data collection, public education and capacity building (UNEP 1999b). The Caribbean Conservation Association, in Barbados, runs an information management system and participates in information dissemination and public education. The Environmental Management and Conservation Organization in Guyana undertakes ecological research and, in St. Lucia, the National Trust Fund is evolving from scientific data collection to the incorporation of the data into a management system for its national parks. Among the many information exchange networks are the Fisheries Newsnet of CARICOM and the Caribbean Community. Other networks such as AMBIONET, CARISPLAN, CEIS, INFONET, CEPNEWS and UNEPNet are dedicated to the creation and maintenance of regional databases on socio-economic and environmental data and information.

However, information policies have focused mainly on natural resources, with little information on the dynamics of ecosystems. Another common problem is the lack of compatibility between data from different agencies and countries. Some efforts have been made in Brazil since 1984 to maintain a National Environmental Information System, despite the difficulties in co-ordinating federal and state environmental agencies. A National Information Center is underway, connecting national and international scientific organizations, and its implementation has already started (IDB 1996).

In several countries, different information systems focus on different aspects of the environment and are managed by sectoral institutions, such as the Protected Areas Information System of the National Office for Biodiversity Conservation in Bolivia. In Argentina, a set of legal initiatives empowers the

National Secretariat of Natural Resources and Human Environment to publish a list of violators of environmental regulations, thereby generating negative publicity for the offending industries. In Chile and Uruguay, eco-labelling has been introduced for products that do not contain ozone-depleting substances, and in Bolivia, the Council for Sustainable Development publishes periodic reports (Bolivia 1996 and 1997).

At the sub-regional level, in Central America the UNDP Sustainable Development Network Program began in Honduras in 1994 with the aim of improving mechanisms for processing and exchanging information in support of sustainable development, and of involving the government and all sectors of society at national and regional level (SDN 1998).

In some countries of the Caribbean, the private sector is a minor actor in environmental information collection and dissemination (UNEP 1999b). Nevertheless, worth noting is the case of the Andean Promotion Corporation (CAF), a sub-regional bank that has proactively compiled biodiversity-related information (in the Condor project) (CAF 2000). Geographic information systems and remote satellite sensing are used mainly in government agencies, although universities and the private sector also make some use of these technologies. However, there is a tendency toward a lack of co-ordination, duplication and absence of common standards in the quality of the information. The use of Internet technology is growing but exhibits great variation, at both regional and national levels. In general, although the potential exists to utilize these technologies, many countries lack the financial resources and technical capabilities to efficiently adopt them in the short term.

Among the main needs in developing successful information systems in the region, the following stand out:

- Development of primary reference data.
- Location and updating of existing data and information.
- Articulation between environmental and socio-economic data.

## The Environmental Training Network for Latin America and the Caribbean

The International Program for Environmental Education was created in 1975 following a recommendation of the Stockholm Summit (1972) and under the direction of two United Nations agencies – the United Nations Environment Programme (UNEP), which was also a spin-off of the Stockholm Summit, and the United Nations Educational, Scientific and Cultural Organization (UNESCO).

The World Conference on Environmental Education, held in Tbilisi (Georgia) in 1977, ended with the guideline to incorporate the so-called 'environmental dimension' throughout the education system (informal, formal and university) and with an inter-disciplinary perspective. According to the Tbilisi Conference, environmental education should pursue the following goals:

- ◆ To support a clear understanding of the existence and importance of economic, social, political and ecological inter-dependence, in both rural and urban areas.
- ◆ To offer all persons the opportunity to gain knowledge, the sense of values, the attitudes, the active interests and the aptitudes needed to protect and improve the environment.
- ◆ To give individuals, social groups and society at large new guidelines for conduct related to the environment.

This first guideline was reiterated during the UNESCO/UNEP World Conference on Environmental Training and Education (Moscow, 1987) and by *Agenda 21*, which resulted from the United Nations Conference on Environment and Development (Rio de Janeiro, 1992). In 1981, UNEP outlined this precept for the university environment, proclaiming its commitment to encourage and promote the following actions, among others (UNEP, Resolution 9/20/A, May 1981):

- Human resources development.
- Inter-institutional collaboration.
- Development of common information collection methodologies, to improve the comparability of data.

## Environmental education and training

Governments in the region have made slow progress in integrating environmental education into the formal education system. The momentum in this field has come mainly from non-governmental organizations and from several international and regional organizations (such as UNESCO and UNEP). Within the awareness campaigns promoted by these groups there are growing numbers of important educational activities aimed at saving natural resources and re-

- ◆ To include environmental aspects in the curricula of traditional university careers, particularly: law, economics, medicine, engineering, architecture and urban planning, education and agronomy, as well as biological, human and natural sciences.
- ◆ To provide training in those professions needed to protect, rehabilitate and plan the environment.
- ◆ To carry out experimental research programmes and national and regional seminars around the subject of 'Modern universities and the environment', and to prepare appropriate teaching materials and methodologies.
- ◆ To implement university faculty training programmes in the environmental field.

In the Latin American and Caribbean region, the governments requested that UNEP create a network of environmental training institutions for executive-level professionals. This led to the creation, in 1982, of the General Programme of the Latin American and Caribbean Environmental Training Network, supported by UNEP.

Currently, the Latin American and Caribbean Environmental Training Network aims to co-ordinate, promote and support activities in the area of environmental education and training in the region. To do so, the Network co-ordinates and provides assistance to institutions wishing to offer courses and develop environmental training programmes and activities at the community level, and to promote sustainable development policies and strategies.

Source: PNUMA-ORPALC 2000a.

ducing waste generation, as well as advertising campaigns to promote recycling and the consumption of non-polluting products.

Formal education institutions have made progress in technical and higher education, thanks to the establishment of specialized graduate programmes in Brazil, Chile, Colombia, Costa Rica and Mexico. Bolivia has a specific law that creates a Ministry of Education and Culture, as well as a National Secretariat and Departmental Councils, which have the responsibility of defining policies and strategies to plan and develop formal and informal environmental education in co-operation with other public and private institutions. This Ministry also contributes to the promotion of seminars and short courses at the national level (IDB 1996).

Some institutions dedicated to technical and scientific research have added environmental matters to their programmes in response to an incipient demand



from the private sector, while the establishment of private universities is fostering the study of emerging themes such as environmental issues.

There has been modest progress at the primary and secondary levels of formal education, where environmental courses and programmes are being offered on an experimental basis. In Peru, for example, some progress has been made by developing an educational strategy for sustainable development, changing the educational curricula, and expanding the scope of 'natural sciences' to include 'science and the environment'.

Despite the many environmental education initiatives being promoted in the region, their effectiveness is compromised by several difficulties, among them:

- absence of appropriate curricula;
- inadequate materials and methodologies;
- lack of funding, and
- weaknesses in the environmental training of teachers.

## Conclusions

The last decade has seen a marked increase in concern for environmental issues. Almost all countries have created environmental institutions and have developed new environmental laws and regulations. Nevertheless, and although it is too early to judge the effectiveness of the measures adopted, preliminary analyses indicate that environmental management continues to focus on sectoral perspectives, without a coherent and explicit integration with economic and social strategies. Other common problems are deficiencies in funding, technology, staff and training, as well as, in some cases, legal frameworks that are excessively abundant and complex.

The fundamental economic objective is the implementation and expansion of a liberal approach centred on export growth and external capital flow, regardless of the consequences to the environment and the preservation of natural resources and without any internalization whatsoever of environmental costs (Gligo 1997). Economic policies are still prepared

following criteria that imply non-sustainability and, in some cases, total indifference to environmental impacts (CEPAL-PNUMA 1997). Economic development programmes for fighting poverty still have no relation to environmental policies; and poor co-ordination among agencies and lack of attention to the general scenario have limited progress under *Agenda 21*.

Regarding the need to link environmental and social policies, the latter are known to have had an undeniable impact on environmental problems in the region. The needs of the poorest, who must struggle for survival, often without environmental conscience or education, exert pressure on the environment. On the other hand opulence, growing income concentration and lack of interest from other social sectors, aggravate consumption patterns that cause environmental problems. In most countries, however, environmental management is dissociated from social policies, creating the controversies generated by projects harmful to the environment but none the less considered to be valuable given the employment or exports they generate. Another example can be found in housing programmes or urbanization processes that feed disorderly urban growth and discourage better use of existing urban areas. Inequality persists as a result of regulatory practices and measures that benefit the industrial sector or high-income social groups who disregard environmental deterioration and its impact on the quality of life.

Despite the existence of significant institutional strengthening initiatives, public environmental agencies, with their limited and diverse mandates, have had little impact on industrial and productive activities in general, and have become involved in confrontations with other public agencies and non-governmental organizations. At the same time, environmental impact is not properly considered in the decisions made at other levels of public policy or by productive sectors (Brzovic 1993).

Environmental policy implementation is often difficult given the lack of appropriate control, monitoring and start-up mechanisms. In some cases the legal framework for environmental management is diluted in numerous legal texts and throughout diverse institutions, and environmental matters are often delegated to several public institutions at dif-

ferent political levels. The creation of new policies and institutions does not always include a revision of previous legislation. Environmental regulations are implemented through complex and sophisticated instruments, and often impose standards that are difficult to meet because of financial restrictions and lack of human and operational resources (IDB 1996).

It is clear that the challenge to sustainable development goes beyond environmental quality. It is also related to social factors that are highly critical for development. For example, accelerated demographic growth, inadequate food supply, polluting energy sources and threats to ecosystems all have critical impacts on socio-economic exclusion and inequality in urban and rural areas. In practice, social and environmental policies are seldom related. Populations face serious gaps in terms of basic social needs, particularly in less developed countries. In general, programmes designed to fight poverty, especially extreme poverty, are not related to environmental policies, and effective action has yet to be taken to make these policies mutually beneficial and reinforcing. Together with the imperative to overcome social and economic exclusion, one of the main challenges for the future is to tackle the absence of consistent and consolidated environmental policies.

As a starting point, it is necessary to recognize that there is a high level of ratification of global and regional multilateral environmental agreements. Although it is difficult to evaluate the extent of imple-

mentation of these agreements and their impact on the environment, they have been successful in increasing knowledge on environmental matters among decision-makers and the public at large. This, however, has seldom led to the establishment of priorities for environmental matters in political agendas or national budgets. Political action must focus on overcoming the many barriers that hinder the successful implementation of agreements. Among the main barriers are:

- The absence of a coherent political vision that can effectively and equitably link economic, social and environmental dimensions into the development process.
- The lack of funds.
- The need to transfer adequate technologies to facilitate implementation of agreements.
- The lack of national legislation to guarantee compliance with obligations.
- The absence of institutions to implement international agreements and national legislation.
- The weakness or non-existence of systems to monitor the progress of agreements.
- The lack of environmental information systems that allow citizens to monitor and control environmental management.

## Environmental legislation and institutions in Latin America and the Caribbean

### CARIBBEAN

*Note:* References to the right to a healthy environment, the right to information, the rights of minorities and the right to an environmental policy are included.

| Countries                      | CONSTITUTION AND LAWS                                                                                                                                                                                  | INSTITUTIONS                                                                                                                                                                                                                                                                      |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Barbados                       | ♦ Constitution (1966).                                                                                                                                                                                 | Ministry of Health and the Environment<br>( <a href="http://isis.uwimona.edu.jm/cesd/barbados/barbados.html">http://isis.uwimona.edu.jm/cesd/barbados/barbados.html</a> )                                                                                                         |
| Bahamas                        | ♦ Constitution (1973).                                                                                                                                                                                 | Commission on Environment, Science and Technology ( <a href="http://www.un.org/esa/earthsummit/baham-cp.htm">http://www.un.org/esa/earthsummit/baham-cp.htm</a> )                                                                                                                 |
| Cuba                           | ♦ Constitution (1992): Duty of the State and the citizens to protect the environment.<br>♦ Environmental Law (1997): right to an adequate environment, to information, and to an environmental policy. | Ministry of Science, Technology and Environment                                                                                                                                                                                                                                   |
| Dominica                       | ♦ Constitution (1978).                                                                                                                                                                                 | Ministry of Agriculture, Land and Fisheries<br>Sustainable Development Council<br>( <a href="http://isis.uwimona.edu.jm/cesd/dominica/sdc/sdc.html">http://isis.uwimona.edu.jm/cesd/dominica/sdc/sdc.html</a> )                                                                   |
| Grenada                        | ♦ Constitution (1973).                                                                                                                                                                                 | Ministry of Health, Environment, Cooperatives and Community Development                                                                                                                                                                                                           |
| Haiti                          | ♦ Constitution (1987): Duty of the State and the citizens to protect the environment.                                                                                                                  | Ministry of the Environment                                                                                                                                                                                                                                                       |
| Jamaica                        | ♦ Constitution (1962).<br>♦ Law of the National Authority for the Conservation of Natural Resources (1995).                                                                                            | Ministry of the Environment and Housing                                                                                                                                                                                                                                           |
| Dominican Republic             | ♦ Constitution (1994).<br>♦ <i>Proposed Quality of Life and Environmental Protection Act</i> (1995).                                                                                                   | National Planning Office<br>Department of the Environment                                                                                                                                                                                                                         |
| St. Kitts and Nevis            | ♦ Constitution (1983).<br>♦ National Conservation and Protection Law (amended in 1996).                                                                                                                | Ministry of Tourism, Culture and Environment<br>( <a href="http://isis.uwimona.edu.jm/cesd/stkitt/skb.html">http://isis.uwimona.edu.jm/cesd/stkitt/skb.html</a> )                                                                                                                 |
| St. Lucia                      | ♦ Constitution (1979).                                                                                                                                                                                 | Ministry of Agriculture, Land, Fisheries, Forestry and Environment<br>( <a href="http://www.slumaffe.org/">http://www.slumaffe.org/</a> )                                                                                                                                         |
| St John, Antigua and Barbuda   | ♦ Constitution (1981).                                                                                                                                                                                 | Ministry of Tourism, Culture and Environment<br>( <a href="http://isis.uwimona.edu.jm/cesd/antigua/anu.html">http://isis.uwimona.edu.jm/cesd/antigua/anu.html</a> )                                                                                                               |
| St. Vincent and the Grenadines | ♦ Constitution (1979).                                                                                                                                                                                 | Ministry of Health and Environment                                                                                                                                                                                                                                                |
| Trinidad and Tobago            | ♦ Constitution (1980).<br>♦ Environmental Management Law (1995).                                                                                                                                       | Ministry of Food Production, Marine Exploration, Forestry and Environment<br>Environmental Management Authority<br>( <a href="http://www.ema.co.tt/">http://www.ema.co.tt/</a> )<br>Institute for Marine Affairs<br>Ministry of Planning and Development (Environmental Division) |

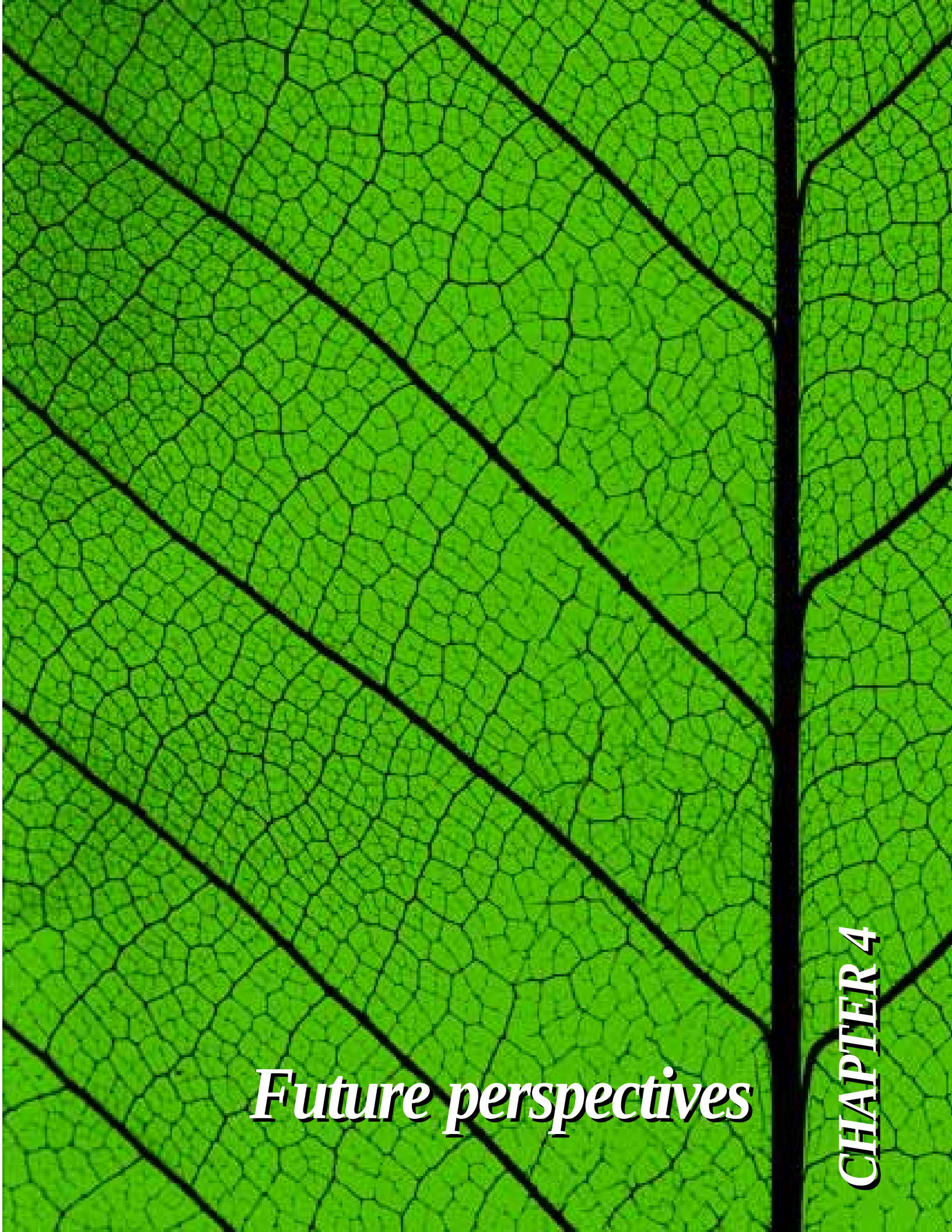
**MESO-AMERICA**

| Countries   | CONSTITUTION AND LAWS                                                                                                                                                                                                                                                                                                                        | INSTITUTIONS                                                                                                                                                                                                                                                        |
|-------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Belize      | <ul style="list-style-type: none"> <li>◆ Constitution (1981): Duty of the State to preserve the environment.</li> <li>◆ Environmental Protection Law (1992).</li> </ul>                                                                                                                                                                      | Ministry of Natural Resources, Environment and Industry<br>( <a href="http://www.belize.gov.bz/cabinet/j_briceno/welcome.shtml">http://www.belize.gov.bz/cabinet/j_briceno/welcome.shtml</a> )                                                                      |
| Costa Rica  | <ul style="list-style-type: none"> <li>◆ Constitution (amended in 1994): right to an adequate environment.</li> <li>◆ Organic Law on the Environment (1995): right to information, and an environmental policy.</li> </ul>                                                                                                                   | Ministry of the Environment and Energy<br>( <a href="http://www.minae.go.cr">http://www.minae.go.cr</a> )                                                                                                                                                           |
| El Salvador | <ul style="list-style-type: none"> <li>◆ Constitution (1983): Protection of the environment is of social interest.</li> <li>◆ Environmental Law (1998): right to a healthy environment, and an environmental policy.</li> </ul>                                                                                                              | Ministry of the Environment and Natural Resources<br>( <a href="http://www.marn.gob.sv">http://www.marn.gob.sv</a> )                                                                                                                                                |
| Guatemala   | <ul style="list-style-type: none"> <li>◆ Constitution (amended in 1998): Protection of the natural heritage is of national interest.</li> <li>◆ Law for the Protection and Improvement of the Environment (1986): Environmental Policy.</li> </ul>                                                                                           | National Environmental Commission (CONAMA)                                                                                                                                                                                                                          |
| Honduras    | <ul style="list-style-type: none"> <li>◆ Constitution (1982): Duty of the State to protect natural beauty.</li> <li>◆ General Environmental Law (1994): right to information, and environmental policy.</li> </ul>                                                                                                                           | Ministry of Natural Resources and Environment                                                                                                                                                                                                                       |
| Mexico      | <ul style="list-style-type: none"> <li>◆ Constitution (1917 and successive amendments): right to a healthy environment, rights of minorities.</li> <li>◆ General Law for Ecological Balance and Environmental Protection (amended in 1996): right to information, and to an environmental policy.</li> </ul>                                 | Secretariat of the Environment, Natural Resources and Fisheries<br>( <a href="http://www.semarnap.gob.mx">http://www.semarnap.gob.mx</a> )<br>Federal Environmental Protection Proctorship<br>( <a href="http://www.profepa.gob.mx">http://www.profepa.gob.mx</a> ) |
| Nicaragua   | <ul style="list-style-type: none"> <li>◆ Constitution (amended in 1995): right to a healthy environment, information, rights of minorities.</li> <li>◆ General Environmental and Natural Resources Law (1996): right to an adequate environment, information, environmental policy, duty of the State to protect the environment.</li> </ul> | Ministry of the Environment and Natural Resources                                                                                                                                                                                                                   |
| Panama      | <ul style="list-style-type: none"> <li>◆ Constitution (amended in 1978): right to an adequate environment.</li> <li>◆ General Environmental Law (1998): Duty to prevent environmental damage</li> </ul>                                                                                                                                      | Ministry of Economy and Finance - National Environmental Authority (ANAM)                                                                                                                                                                                           |

# SOUTH AMERICA

| Countries | CONSTITUTION AND LAWS                                                                                                                                                                                                                                                                                                                                                                                    | INSTITUTIONS                                                                                                                                                                                                                                                                      |
|-----------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Argentina | <ul style="list-style-type: none"> <li>Constitution (amended in 1994): right to an adequate environment, information, rights of minorities.</li> </ul>                                                                                                                                                                                                                                                   | Ministry of Social Development and Environment (Secretariat of Sustainable Development and Environmental Policy)                                                                                                                                                                  |
| Bolivia   | <ul style="list-style-type: none"> <li>Constitution (amended in 1994): rights of minorities.</li> <li>General Environmental Law (1992): right to an adequate environment, information, and environmental policy.</li> </ul>                                                                                                                                                                              | Ministry of Sustainable Development and Environment (1993)<br>( <a href="http://coord.rds.org.bo">http://coord.rds.org.bo</a> )                                                                                                                                                   |
| Brazil    | <ul style="list-style-type: none"> <li>Constitution (1988): right to an adequate environment.</li> <li>Law 6938 (1981): Environmental policy.</li> <li>Law 7347 (1985): public liability for damages to the environment, to the consumer, to goods and rights of artistic, esthetic, historical, tourism and landscape values. Right to information.</li> <li>Environmental Crime Act (1998).</li> </ul> | Ministry of the Environment, Water Resources and the Legal Amazon<br>( <a href="http://www.mma.gov.br">http://www.mma.gov.br</a> )<br>Brazilian Institute of the Environment and Renewable Natural Resources<br>( <a href="http://www.ibama.gov.br">http://www.ibama.gov.br</a> ) |
| Chile     | <ul style="list-style-type: none"> <li>Constitution (1980): right to an adequate environment.</li> <li>Law on the General Bases for the Environment (1994): Environmental Policy for Sustainable Development (1998).</li> </ul>                                                                                                                                                                          | National Environmental Commission (CONAMA)<br>( <a href="http://www.conama.cl">http://www.conama.cl</a> )                                                                                                                                                                         |
| Colombia  | <ul style="list-style-type: none"> <li>Constitution (1991): right to an adequate environment, rights of minorities.</li> <li>Law 99 (1993): right to information, environmental policy.</li> </ul>                                                                                                                                                                                                       | Ministry of the Environment<br>( <a href="http://www.minEnvironment.gov.co/">http://www.minEnvironment.gov.co/</a> )                                                                                                                                                              |
| Ecuador   | <ul style="list-style-type: none"> <li>Constitution (amended in 1996): right to an adequate environment.</li> <li>Decree 1802 establishes basic environmental policies (1994).</li> </ul>                                                                                                                                                                                                                | Ministry of the Environment                                                                                                                                                                                                                                                       |
| Guyana    | <ul style="list-style-type: none"> <li>Constitution (1980).</li> </ul>                                                                                                                                                                                                                                                                                                                                   | Ministry of Health                                                                                                                                                                                                                                                                |
| Paraguay  | <ul style="list-style-type: none"> <li>Constitution (1992): right to a healthy environment, rights of minorities.</li> <li>Environmental Impact Assessment Law (1993).</li> </ul>                                                                                                                                                                                                                        | Ministry of Agriculture and Livestock (Under-Secretariat of Natural Resources and Environment)                                                                                                                                                                                    |
| Peru      | <ul style="list-style-type: none"> <li>Constitution (amended in 1993): right to an adequate environment, rights of minorities.</li> <li>Law on Conservation and Sustainable Use of Biological Diversity (1997).</li> </ul>                                                                                                                                                                               | National Environmental Council (CONAM)<br>( <a href="http://www.conam.gob.pe">http://www.conam.gob.pe</a> )                                                                                                                                                                       |
| Uruguay   | <ul style="list-style-type: none"> <li>Constitution (1997): Duty to not pollute, environmental protection is of general interest.</li> </ul>                                                                                                                                                                                                                                                             | Ministry of Housing, Land Planning and Environment<br>( <a href="http://www.mvotma.gub.uy">http://www.mvotma.gub.uy</a> )                                                                                                                                                         |
| Suriname  | <ul style="list-style-type: none"> <li>Constitution (amended in 1992): Duty to identify environmental potential.</li> </ul>                                                                                                                                                                                                                                                                              | National Environmental and Development Institute                                                                                                                                                                                                                                  |
| Venezuela | <ul style="list-style-type: none"> <li>Constitution (1961): Duty of the State to preserve the environment.</li> <li>Environmental Organic Law (1976): Environmental Policy.</li> <li>Environmental Penal Law (1992).</li> </ul>                                                                                                                                                                          | Ministry of the Environment and Renewable Natural Resources<br>( <a href="http://www.marnr.gov.ve/">http://www.marnr.gov.ve/</a> )                                                                                                                                                |





# *Future perspectives*

## **CHAPTER 4**



# Future perspectives

For a long period of time, the capacity of mankind to undermine the environment was relatively limited and localized. Nowadays, the scope of human activities has grown to the point of being able to affect not only physical systems at the planetary scale but also to have repercussions into the distant future. For this reason, the ulterior impacts of today's decisions are ever more prominent in policy formulation (UNEP 1999a).

This chapter presents a forward-looking view of some of the great environmental problems of Latin America and the Caribbean that were outlined and analysed in the previous chapters. Many are old situations that are rapidly worsening or for which a solution is ever more difficult to find. Others are issues that currently do not occupy a high position on the political agenda of the governments of the region. All of them, however, will demand priority attention in the coming years.

From a political as well as ethical and cultural perspective it is only possible to effectively tend to these priorities if a regional vision exists that grants the

required coherence, depth and support to the actions to be taken. This chapter introduces some of the key elements of this guiding vision, for the purpose of contributing to the construction of the Americas we desire for the 21st century.

## Regional priorities at the dawn of the new century

It is doubtful that sudden and unsuspected scientific discoveries about the state of the global environment will take place at the beginning of the 21st century. The enormous increase in environmental research of the last 20 years makes this type of discovery highly improbable.

The unexpected transformation of known problems is much more likely. Many of the world issues that require particular care in the new century will be aggravated versions of today's difficulties. An example is the increase in the number and severity of natural disasters. Other examples are found in the time-bomb of incorporating toxic chemicals into the environment and a potential invasion of genetically modified organisms. As time goes by, problems such as these will worsen and will pose inescapable global and local challenges, generating an environmental crisis in the 21st century as a result of the absence of preventive actions.

In Latin America and the Caribbean, environmental priorities for the 21st century also belong in this category of 'unattended problems'. As seen in previous chapters, although investment and economic growth in Latin America and the Caribbean recovered during the 1990s, the rhythm of expansion is, in general, unstable and modest compared with the indices reached in the 1950s and 1960s. This is clearly insufficient to reduce poverty and inequality, which – in contrast to the immediate post-war period – have rather increased in parallel with the expansion of the 1990s. Under these conditions, the existing difficulties in assigning environmental problems the priority and funding required in order to



avoid aggravation, or to prevent or mitigate their effects, will continue. It seems likely, therefore, that the environmental deterioration observed in the recent past will continue.

These trends can be counteracted only through decisive efforts at the institutional and management levels, and with the adoption of public policies to substantially improve their efficiency. It is possible, perhaps, that such an effort will be undertaken. Public (citizen) and international pressure, already visible in some countries, will increase significantly in the future. In addition, the region has already experimented for a considerable time with environmental policy and has accumulated valuable experience that should help make progress in this field.

As discussed in previous chapters, the current trend to incorporate environmental considerations into sectoral project and programme design and implementation will be accentuated in the coming years. This will especially be the case for some large infrastructure projects, particularly those related to the advance of trade integration in Latin America and the Caribbean. This type of investment will no doubt have marked environmental impacts on several countries and will require significant international financing. This will lead to a considerable increase in the political debate and to the adoption of regional and sectoral policies where, by the nature of the work itself, environmental matters will play a decisive role. The subsequent impact of environmental knowledge and public awareness within the countries of the region will be notable and very fertile.

It is possible that something similar may occur in the field of national and international tourism, which has increased rapidly and will certainly continue to do so in the future. As stated above, this activity has strong environmental repercussions, particularly on urban growth, on congestion, and on the pollution of ports, beaches, other coastal areas, river margins, lakes and reservoirs of great natural beauty. This eventually translates into the deterioration of these sites and the subsequent displacement of tourism flows towards new areas which, in the absence of effective land planning policies, will no doubt run a similar course. One positive answer to this cumulative phenomenon has been the effort made in the

expansion and improvement of public – and, increasingly, private – national park and protected area management programmes. To some degree, this has also been associated with a new style of sustainable tourism activity, which presupposes respect for the environment and natural beauty.

Impressive progress has been made in recent years in the field of air pollution, particularly in the largest urban concentrations where several mitigation and prevention policies have been implemented. It is very likely these efforts will continue and become more effective in the future, thanks to the experience acquired and the increase in public pressure. In addition, these efforts will expand to medium-sized cities, where problems similar to those of large urban areas are starting to occur. However, the enormous technological and political challenges of confronting the serious environmental impact of unplanned urban growth are still to be resolved. This assumes a far-reaching renovation of urban policies as they relate to spatial distribution of the population and productive or service activities, with corresponding implications for infrastructure and means of transportation.

Also in the field of urban policies, progress has been made in solid waste treatment, at the technological level as well as in management and citizen participation, including involvement of the private sector, all of which should continue in the future. The fundamental medium- and long-term challenges in this field consist of the transformation of production and consumption patterns, with very serious consequences in terms of the generation of industrial and domestic wastes, residues and pollutants. The macro-economic and socio-political implications of such transformations, in terms of income redistribution and redefinition of the development style, are at the core of the issue. Among the most immediate problems is the improvement of sanitation and waste treatment infrastructure, currently on the verge of collapse in many cities of the region, with deplorable sanitary implications. Location of landfill sites must also be resolved, since the availability of sites that are technically appropriate, acceptable to the population, and located at reasonable distances is progressively declining.

One aspect of the pollution problem on which progress has been limited, and where needs are enormous, is in the treatment of sewage. National and international pressure will demand that significant efforts be made to try to overcome the serious inadequacies in this field. The task, however, is not easy, since a huge amount of investment is required. Therefore, it is very likely that this is an area where substantial foreign investment will occur in the future.

Another area where treatment can be difficult is in the impacts of natural disasters, which in recent years have directly and dramatically affected the populations of several countries in the region, particularly the poorest sectors. The frequently devastating effects these events have on the population are due to a great degree to the location of settlements in high-risk areas and to the absence or inadequacy of appropriate housing and infrastructure. There is a widespread lack of effective construction standards and regulations and, particularly, an absence of urban land planning programmes. In this void, it can be foreseen that the vulnerability of lower-income population groups will continue to worsen.

The globalization process and its internal impacts on the Latin American and Caribbean countries will increase the level of demand. Strong evidence of changes in the balance of ecosystems, and the negative effects of these changes on the Earth's ability to sustain life, have led to a cultural reassessment of nature and the rise of what could be called a 'state of environmental alert'. Valuation of nature at the international scale has been made concrete in actions

to preserve biodiversity and tropical forests. As indicated in previous chapters, in Latin America and the Caribbean this basically refers (without prejudice to other important areas) to the Amazon River Basin, given its crucial significance to the global warming process. However, all countries will see an increase in pressure for the redefinition of a development style that fosters living in harmony with nature.

Globalization also has an impact at the economic level. In the developed world, the conversion of consumers to the use of natural products, as well as the interests of farmers and workers with livelihoods at risk, lend strength to the use of environmental restrictions as protectionist instruments to limit market access. These restrictions extend not only to the characteristics of the products exported, but also to the technological processes and even to the preservation of human and natural resources used in their production. A result is the establishment of international certification standards, such as ISO-14000 in the industrial field, the Forest Stewardship Council for forest products, and the Marine Stewardship Council for the sustainable exploitation of marine resources, in addition to a collection of international treaties and agreements that regulate international transportation, foreign trade and foreign investment.

The importance of these new international rules and regulations has given rise to a significant entrepreneurial effort to adapt to the new times and their requirements. In recent years there has been active participation by large companies and some international business associations in the emerging debate on sustainable development. In Latin America and the Caribbean, initiatives by the International Chamber of Commerce and the World Business Council for Sustainable Development – related to the Rio de Janeiro Summit in 1992 – had an impact on the policies and actions of the large corporations. These businesses constituted a regional chapter of this worldwide organization and started to promote environmental management policies within their programmes, to participate in the environmental de-





bate, and to favour the process for technological change with a vision of improving environmental performance.

Demographic dynamics and the level of economic development and growth exert considerable pressure on renewable natural resources. In the past, the development guidelines advanced in Latin America and the Caribbean fostered production-oriented policies and institutions. These were very effective and achieved substantial socio-economic development and modernization, and a considerable improvement in the standard of living for the middle class. However, these policies also caused pronounced social inequalities and were incapable of overcoming the serious problem of poverty. In addition, this socio-economic progress has resulted in reduced availability and higher prices for renewable natural resources, such as agricultural and urban land, water resources, marine biomass, forests and biodiversity.

This reality can be verified by the increase in the number and acuteness of the conflicts unleashed when new investment projects of a certain magnitude are proposed. Thresholds for the use of renewable natural resources appear to be nearly saturated, mandating the change from a production-oriented policy to a policy of managing the ecosystems on which these resources depend. It is therefore imperative to advance towards sustainable development and it is likely that this pressure will be considerably stronger in the future.

## The Americas we want: elements for a regional vision

In order to confront the environmental priorities of Latin America and the Caribbean at the dawn of the 21st century, there is an urgent need to create a vision capable of guiding the required actions in a coherent, effective and equitable manner, and that includes the necessary political will and the participation of the people. The need for a similar vision is not only intellectual and political, but also ethical: to transform regional culture through the dissemination and implementation of a set of values for long-term sustainability.

Following are some key elements of this vision, inspired by the recent discussion on environment and development in the region (PNUMA-PNUD-FCE 1998). The basic elements proposed are:

- first and foremost, the articulation of ethics, economy and ecology around the value of community solidarity;
- within this framework, the advancement of new forms for government and citizenship that strengthen community solidarity, and
- finally, the revitalization of community solidarity values still in existence in the traditional cultures of the region.

## Ethics, economy and ecology

Perhaps the most important cultural transformation for achieving sustainability in the 21st century is the rise of a human activity model that will harmonize the ethical, economic and ecological aspects, focusing them on a vocation of community solidarity (Daly 1989; Daly and Cobb 1994).

*Economy*, in its conventional sense, is the set of regulations required for the efficient management of scarce resources for the purpose of satisfying human needs. *Ecology*, on the other hand, is the real knowledge of the inter-relations and balances between living beings and the natural environment. *Ethics*, finally, regulates human behaviour to direct it towards its higher goal, the common good. It is clear that the balance between ethics, economy and ecology supposes the restitution to ethics of its regulatory and guidance role over that of the economy. The economy, in turn, should be dependent on the ecology as substrate, as its knowledge of the natural limits and balances must be respected.

Within this framework, *community solidarity* constitutes a fundamental value in the harmony between ethics, economy and ecology. In effect, construction of the common good – at the economic level (satisfaction of human needs) as well as at the ecological level (balance with nature) – can only occur through active solidarity with the human community and the biophysical community. That is why when con-

fronted with an economic growth model that generates poverty and inequality, distinguished spiritual guides in the region urgently call for 'the discussion of the moral issues of the economy' to build 'an economy with a heart, decided upon by those who work and those excluded from work' (Arns 1998). However, community solidarity should not only be addressed to the human beings of a global community with whom we interact to achieve the common good. It should also consider care for all living beings and for the delicate balance of nature as a whole. Our survival and development as a species depend on this greater, natural community. As some regional thinkers have stated, an addition should be made to the ten traditional commandments of the Judeo-Christian tradition: 'Thou shall honour Nature, of which you are a part' (Galeano 1998).

## New forms of government and citizenship

This report has shown that public and international pressure, as well as the regional experience with public and private environmental policies, create an unprecedented opportunity to counteract the trend towards growing environmental deterioration. In the order of values and regulations, this implies, however, fostering new forms of government and citizenship. Many of them already exist in their initial stages, but it is necessary to make them broader and more profound.

A fundamental requirement is to advance 'in the promotion of direct participation and political citizenship' (Erundina 1998). In many countries of the region there are significant experiences with the incorporation of citizenship into the most important decisions, such as the definition of government goals and supervision of their actions. Different mechanisms have been explored and must be strengthened – referenda or plebiscites, town meetings or *cabildos*, municipal councils on sectoral policies, special proctorships (for indigenous peoples, women, youth, children, elderly people, sexual minorities), citizen representation in state institutions.

This expansion of direct participation mechanisms must reach the world level. The 'global society' must transcend the globalization of markets, joining in

international co-operation actions on the social and environmental fronts and incorporating new forms of representation in global governance. Only thus will it be possible for 'recovery of market power to respond to the demand for a more decent quality of life' (Dowdeswell 1998).

A new kind of civic behaviour must form the basis for such collaboration. One of the most intriguing proposals in the regional debate discusses the redirection of predominant consumerism from 'having' to 'being', and offers five principles for this (Bárcena 1998):

- Reassessment of basic needs, differentiating them from luxuries.
- Equitable redistribution of resources, as a basis for equitable production and consumption.
- Restructuring the economy to focus it on satisfying basic needs by including social and environmental costs in the prices of goods and services.
- Reduction in the consumption of energy and water, and in the use of collective services and toxic products.
- Maximizing the reutilization and recycling of consumer goods, thus minimizing their environmental impact.

## The value of traditional cultures

Many traditional cultures preserve the idea of a close inter-dependency between humans and nature. From this principle they derive practices of profound respect in the use and care of their resources, applying values such as those presented in this chapter. In Latin America and the Caribbean, these values and practices are evident in the peasants of European ancestry, as well as in African and American peoples, who constitute the *mestizo* regional culture. Their existence constitutes a unique opportunity to learn from them and to construct from them (and with them) a new ethical model of sustainability.

Rigoberta Menchú, the Nobel Peace Prize winner from Guatemala, clearly summarizes this possibility for the case of indigenous cultures. We close the chapter with her call of hope for the Americas we want (Menchu 1998).

*'From the beginning, we indigenous peoples have considered the Earth to be sacred. She gives us life and is the center of our cosmic vision, and for this we respect her and revere her. The heritage from our grandfathers is to live in harmony with nature, far from trying to subject her as if we were its owners.*

*For us, our mother Earth is not only a source of wealth that offers us corn, that is to say, life. The Earth is also the root of our culture. It contains our memories, shelters our forefathers and requires that we honor her and give back with*

*tenderness and respect any goods she offers us. We have to care for our mother Earth so that our children can continue receiving her benefits. (...)*

*We have the opportunity to reconsider our relationship with nature; to re-establish the balance lost for more than five centuries and to again consider ourselves an integral part of the Earth. (...) The wisdom of the indigenous peoples has much to contribute in the form of technologies that respect the environment.*

*The community is not a myth or a vestige of the past. It is full of vitality and can project itself, as it is not incongruous with development. The wisdom and wealth that emanate from the community could contribute to restore true hope for the future.'*

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The following individuals contributed to the publication:

## GEO-LAC co-ordinating team

*United Nations Environment Programme, Regional Office for Latin America and the Caribbean (Mexico)*: Norberto Fernández, Kaveh Zahedi; *Observatorio del Desarrollo (Universidad de Costa Rica)*: Edgar E. Gutiérrez-Espeleta, Álvaro Fernández-González; *Centro de Análisis de Políticas Públicas (Universidad de Chile)*: Osvaldo Sunkel, Marisabel Romaggi; *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis, Brasil*: João Batista D. Câmara, Marília Marreco Cerqueira; *University of the West Indies*: Al Binger, Nella Stewart; *Island Resource Foundation*: Bruce Potter, Ed Towle.

## GEO-LAC support team

*United Nations Environment Programme, Regional Office for Latin America and the Caribbean (Mexico)*: Isabel Martínez, Miriam Urzúa; *Observatorio del Desarrollo (Universidad de Costa Rica)*: Hazel Brenes, Karine Izquierdo, Ana Lucía Hernández, Victoria Hernández, Marjorie Mora; *Centro de Análisis de Políticas Públicas (Universidad de Chile)*: Francisco Brzovic Parilo; *Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (Brasil)*: Antonio Barbosa, Izaías Bezerra, Fernando Carvalho, Moema De Sá, João Bosco Dias, Gaetan Serge Dubois, Roberto Messias Franco, Helvécio Mafra, Adriana Moreira, Márcio Veloso; *Centro Internacional de Agricultura Tropical (Colombia)*: Manuel Winograd, Andrew Farrow.

## Regional consultation for Latin America

(Santiago de Chile, 12-14 May, 1998)

*Argentina*: Melina Carla D'Auria and Marina Mansilla Hermann (Misión Rescate Planeta Tierra); *Bolivia*: José L. Gómez Reintsch (Ministerio de Desarrollo Sostenible y Planificación); *Brasil*: Marília Marreco Cerqueira and Claudia Maria Mello Rosa (Ministerio de Medio Ambiente de Recursos Hídricos de Amazonía Legal), João Batista Câmara and Roberto Messias Franco (IBAMA); *Colombia*: Pablo Leyva (Instituto de Hidrología, Meteorología y Estudios Ambientales); *Costa Rica*: Randall García Viquez (Ministerio de Ambiente y Energía), Edgar E. Gutiérrez-Espeleta (Universidad de Costa Rica); *Cuba*: Aida C. Sánchez González (Ministerio de Ciencia, Tecnología y Medio Ambiente); *Chile*: Ximena Abogabir Scott, Juan Escudero Ortúzar, Patricia Frenz Yonechi, Guillermo M. García Cornejo, José Leal, Vicente Paele Marañón, Carlos Piña Riquelme and Hugo H. Saldivar Canales (Comisión Nacional del Medio Ambiente - CONAMA), Nicolás E. Gligo Viel (CEPAL), Kyran

Thelen (FAO Regional Office for Latin America and the Caribbean), Galileo Violín (UNESCO-OREALC), Pedro Maldonado Grunwald, Marisabel Romaggi Chiesa and Osvaldo Sunkel (Universidad de Chile), Carmen E. Schlotfeldt Leighton (Pontificia Universidad Católica de Chile), Stefan Larenas Riobo (Consumers International-Chile), María Soledad Frías Tapia and Ivonne Emma Lacombe Lemaitre (Misión Rescate), Francisco Brzovic Parilo (consultant), Thomas Reich Ball and Liliana de Pauli (United Nations Development Programme-UNDP), Hernán Sandoval Orellana (Corporación Chile Ambiente), Rodrigo L. Mellado Espinoza (Comité Nacional Pro-Defensa de la Fauna y Flora, CODEFF), María Angélica Beas Millas (United Nations Environment Programme-UNEP); *Ecuador*: Fabián Valdivieso Eguiguren (Comisión Permanente del Pacífico Sur); *El Salvador*: Ernesto López-Zepeda (Ministerio de Medio Ambiente y Recursos Naturales); *Guatemala*: Raúl Antonio Velásquez Ramos (Comisión Nacional del Medio Ambiente, CONAMA); *Kenya*: Kaveh Zahedi (United Nations Environment Programme); *Mexico*: Yosú Rodríguez Aldabe Z. (SEMARNAP), Raúl Brañes (Asociación Latinoamericana Derecho Ambiental), Matilde Díaz-Almazán, Isabel Martínez Vilardell and Norberto Fernández (United Nations Environment Programme); *Panama*: Dimas Isaac Arcia González (Instituto Nacional de Recursos Naturales Renovables); *Paraguay*: José Francisco Fracchia C. (Ministerio de Agricultura y Ganadería); *Peru*: Mariano Castro Sánchez-Moreno (Consejo Nacional del Ambiente); Tom Jolly (Misión Rescate Planeta Tierra); *Uruguay*: Federico Burone Magariños (IDRC, Regional Office for Latin America and the Caribbean), Luis Mario Batallés Rivas (Ministerio del Medio Ambiente); *Venezuela*: Maritza Reechinti (Ministerio del Ambiente y de los Recursos Naturales Renovables).

## Subregional consultation for the Caribbean

(Kingston, Jamaica, 12-14 January, 1999)

*Antigua and Barbuda*: Dianne Black Layne (Ministry of Planning, Implementation and Environment); *Barbados*: John R. A. Wilson (Ministry of Health and Environment) and Henry Schillingford (Dominica Conservation Association); *Belize*: Marel H. Van Hopstal (European Commission); *Cuba*: Jorge Mario García Fernández (Ministerio de Ciencia, Tecnología y Medio Ambiente); *Dominica*: Peter Carbon (Ministry of Agriculture and the Environment); *Jamaica*: Easton Douglas (Ministry of Environment and Housing), Franklin J. McDonald (Natural Resources Conservation Authority), Anastasia Calnick (Ministry of Environment and Housing), David Bowen (FAO), Thor Leif Jackson (European Commission), Ken Shimizu (UNDP), Steven Stone (IDB), Ralph

A. Chen (United Way of Jamaica), Isabelle Van Tol (Royal Netherlands Embassy), Nelson Andrade, Lloyd Gardner, Kenneth D. Corporal and Heli Johanna Tounonen (United Nations Environment Programme), Al Binger, Anthony Clayton, Heata M. Miller, Patricia Northover, Nella Stewart, Earle Sutherland and Michael White (University of the West Indies – Mona); *Kenya*: Kaveh Zahedi (United Nations Environment Programme); *Mexico*:

Norberto Fernández (United Nations Environment Programme); *Dominican Republic*: Julio Moisés Álvarez (Oficina de Planificación Nacional); *Santa Lucia*: James Louis Fletcher (Ministry of Agriculture, Fisheries, Forestry and Environment), Vincent Sweeney (Caribbean Environmental Health Institute); *Trinidad and Tobago*: Hazel McShine (Institute of Marine Affairs), Erick Bloomstein (ECLAC).

### Editorial production team

*Original translation from the GEO 2000 and Caribbean Environment Outlook reports, additional research and editor for the Spanish version*: Álvaro Fernández-González (Observatorio del Desarrollo, Universidad de Costa Rica); *Translators for the English version*: Cynthia Diez and Leticia Sáenz (CARDISO, S.A.), María Emilia Chaves, Álvaro Fernández-González (Observatorio del Desarrollo, Universidad de Costa Rica); *Editor for the English version*: Martyn Bramwell (Anagram Editorial Service, UK); *Design, layout and illustration*: Roberto and Roxana de Burgos (Costa Rica); *General review*: Ricardo Sánchez, Norberto Fernández and Kaveh Zahedi (United Nations Environment Programme, Regional Office for Latin America and the Caribbean, Mexico); *General supervision*: Edgar E. Gutiérrez-Espeleta (Observatorio del Desarrollo, Universidad de Costa Rica).