

LATIN AMERICA AND THE CARIBBEAN: ENVIRONMENT OUTLOOK

GEO LAC 3

SUMMARY FOR DECISION MAKERS

UNEP



This Summary for Decision Makers synthesizes the findings of the main report "Latin America and the Caribbean: Environment Outlook" and is prepared by UNEP with:

Technical Coordination:
Graciela Metternicht, Regional Coordinator, Division of Early Warning and Assessment, United Nations Environment Programme, Regional Office for Latin America and the Caribbean. Panama.

Prepared by: Armando Carballido Gómez from the document Latin America and the Caribbean: Environment Outlook. GEO LAC 3
UNEP: Mara Angélica Murillo Correa, Graciela Metternicht, Johanna Granados.

Design: Rocio Milena Marmolejo Cumbe
Photos: Albatros Media

Published by the United Nations Environment Programme (UNEP).

DISCLAIMER
The contents of this publication do not necessarily reflect the views or policies of UNEP, or contributory organizations concerning the legal status of any country, territory, city or area or its authorities, or concerning the delimitation of its frontiers or boundaries.

For further information:

United Nations Environment Programme (UNEP)
Regional Office for Latin America and the Caribbean
Division of Early Warning and Assessment
Avenida Morse, Edificio 103. Clayton, Ciudad del Saber - Corregimiento de Ancón
Panama City, Panama
P.O. Box 03590-0843
Tel. (+507) 305-3100
Fax: (+507) 305-3105
http://www.unep.org
e-mail: rolac.dewalac@unep.org



LATIN AMERICA AND THE CARIBBEAN: ENVIRONMENT OUTLOOK

GEO LAC 3

SUMMARY FOR DECISION MAKERS

UNEP



Key messages

1. Latin America and the Caribbean is a region rich in diversity of environments, ecosystems, species and cultures; today this richness finds itself under threat due to the norms of the dominant models of economic development in the region.

2. The growing tendency toward urbanization in the region is a generalized phenomenon with major environmental, social, economic, and political consequences. Latin America and the Caribbean have the largest proportion of urban population (79%) of all developing regions on the planet. Small and medium-sized cities are the fastest growing, and are those that represent the opportunity to implement ecological and sustainable land use planning of the regions and cities.

3. Climate change, the loss of biodiversity, environmental degradation, the emergencies caused by natural disasters, water scarcity, and accelerated urbanization make urgent the need for strong and decisive changes in environmental management, but in particular in the integration of these changes in each country's development programs.

4. Despite the region's advances in environmental matters, important challenges still persist to achieve a model of sustainable development. The present model of development has generated economic growth, but also environmental degradation and societal breakdown, to the degree that currently Latin America and the Caribbean is the region with the greatest inequality in the world.

5. In the region, it is necessary to design and implement environmental policies that strengthen the investment toward a sustainable development and a sustainable society, in a way that is crosscutting and integrated with sectorial and development policies. Also needed are greater financial and technological investment applied to environmental matters, and improved access to standardized, up-to-date, intercomparable, and quality data that support informed decision-making.

6. One of the principal challenges to environmental policy in the region is the need for profound modification of patterns of production and consumption; it is essential to strengthen the role of civil society in environmental management, and develop a greater consciousness and commitment to the environment.

7. It is crucial to highlight the dependent relationship that human populations have with ecosystems and the goods and services that these provide. To guarantee intergenerational well-being in the region additionally requires framing a new debate centered around the concept of sustainability in a planet of six billion inhabitants, which will reach more than nine billion in 2050. It is critical to internalize the benefits of ecosystems and the services they provide, as well as the costs of their degradation, in the process of decision-making about development.

Predominant development models in Latin America and the Caribbean: pressures for environmental changes

The currently prevailing development model in the countries of Latin America and the Caribbean is the product of physical and social determinants that have historically influenced the region's development. Due in large part to the region's environmental complexity —rich, diverse and varied in its natural resources— the region has established itself as a provider of food, raw materials and as a reserve of resources. The emergence of new social groups linked to the market economy, the expansion of the boundaries of natural resource exploitation and marked growth in urbanization, among other social factors, have increased the importance of environment-related conflicts.

This development model has produced inconsistent and uneven results. The region has seen periods of rapid economic growth and higher levels of wellbeing for its people, as well as other periods of limited or even negative growth with heavy social and political consequences. Then again, there have been periods during which, despite economic recovery, inequalities have increased. All of these combinations have shared a common factor: high levels of pressure and progressive and sustained degradation of the physical environment and the loss of ecosystems.

Driving forces and pressures on environmental change

The Environmental Outlook assessment for Latin America and the Caribbean (GEO LAC) is based on an analysis of the interlinkages between the Driving force-Pressure-State-Impact-Response (DPSIR) framework model. The major driving forces and pressures that cause the environmental change that is affecting Latin America and the Caribbean are: demographic change, the demand for commodities and trade, increasing globalization, climate change, technological advances, or socio-political and institutional aspects.

The growing interest and treatment of the environment in the agendas of various sectors —national and local Governments, civil and corporate organizations, universities and research institutions— offer an opportunity to address environmental degradation and lay the foundations for progress towards a more sustainable development model.

Demographic growth. In the past 40 years, the region's population has grown by 51%, tripling its urban population, which is estimated to reach 470.5 million persons (79% of the total population) in 2010, according to the United Nations Economic Commission for Latin America and the Caribbean (ECLAC). The continuous growth of cities, particularly intermediate cities (one to five million inhabitants), combined with a lack of land use planning and increased poverty and inequality, have created a series of environmental impacts and conflicts, among which the following stand out:

- Rising levels of pollution that cause numerous deaths each year.
- Precarious and densely populated settlements that generate segregation.
- Absence of public services and infrastructure, such as safe drinking water, sewage, waste collection and pavement.
- A growing demand for water.
- Increased production of solid waste per inhabitant.
- Increased coverage of drinking water and rising demand for electricity.

Social situation: poverty and inequality. With almost 50% of its population living in poverty and extreme poverty, and with an income distribution that ranks among the

worst in the world, the most important challenges facing the region are poverty and inequality reduction (UNEP, 2007).

The region's economic growth is highly vulnerable and influences the behaviour of poverty and indigence indicators. Positive economic data (3% average annual growth in per capita GDP between 2003 and 2007) has been largely the result of the increased exploitation and exporting of natural resources, also known as raw materials or commodities, the international prices of which have been on the rise.

However, this income growth has been interrupted by the international financial crisis. Some estimates indicate that a 15% increase in food prices could lead to 10 million people facing extreme poverty and indigence.

Table 1

Latin America and the Caribbean: Simulation of Food Price Increas on the Incidence of Poverty and Extreme Poverty, 2007 and 2008[a]

		Percentages			Millions of people		
		Effective incidence	Simulated incidence[a]	Difference in percentage points	Effective incidence	Simulated incidence[a]	Difference in percentage points
2007							
	Extreme poverty	12,6	11,9	0,7	67,0	61,2	3,6
	Poverty	34,1	33,4	0,7	183,9	180,0	3,9
2008 (projection)							
	Extreme poverty	12,9	10,9	2,0	70,8	59,6	11,2
	Poverty	33,2	31,2	2,0	181,6	170,7	10,9

Source: Economic Commission for Latin America and the Caribbean (ECLAC), based on special tabulations from household surveys in the respective countries.

[a] *It is assumed that the rise in food prices was equal to the rise in CPI for the other goods and services from December 2006.*

Globalized trade and economy

The economies of Latin America and the Caribbean are more open today than in past decades. In an increasingly globalized world the region has concentrated its economic growth on the exploitation and exporting of its natural resources (basic raw materials) and on manufacturing.

With production aimed at foreign markets —especially China— the demand for investment has focused on productive sectors that make particularly intensive use of a few natural resources. This has led to heavy dependence on foreign markets, given that the region does not have the instruments or carry enough economic weight to influence world trade.

Meanwhile, economic and technological development and demographic growth continue to draw tighter the relationship between trade and the environment. The technological growth of the telecommunications and transport sectors has set the stage for trade expansion that, because of the materials that undergird those sectors, will only increase the demand for natural resources, placing enormous pressure on them.

Ecuador, in seeking to make structural changes that would strengthen environmental components within its institutional framework, promoted a constitutional reform wich for the first time in Latin America and the Caribbean recognizes nature as being endowed with rights. The reform also recognizes the rights of natural resources to be restored, making these rights central to policy decisions and setting a new trend for environmental legislation (Guydnas, 2008).

Likewise, the region's agro-industry has also experienced strong growth as a result of increased global demand and international prices for both agro-foods and raw materials for biofuel production.

Vulnerability in the face of climate change. Though Latin America and the Caribbean's burden of responsibility for causing global warming is minimal —despite its area and population accounts for only 11.78% of greenhouse gas emissions— the impact of global warming on the region is evident. Among other effects, climate change has increased the intensity and frequency of hurricanes in the Caribbean; it has caused

Increased trade with Asian countries: more pressure on natural resources

A key factor is the role of China and other countries of Southeast Asia as buyers of commodities from Latin America. Growing demand for inputs by these emerging economies has significantly impacted exports from the region and further explains the persistent commercial importance of natural resource extraction. In 2000, trade between Latin America and China was at US$ 13 billion. In 2007, it reached US$ 103 billion. Over 50% of China's foreign direct investment went to Latin America and Caribbean.

This situation has important consequences from an environmental standpoint, because it tends to reinforce a development model that places heavy pressure on natural resources. Demand by Asian countries reinforces exports of resources, such as coal, hydrocarbons, steel, copper, cement and other energy commodities, whose exploitation have serious environmental impacts. This demand is triggering significant changes in both energy sources and other markets, such as biofuel-related agriculture.

changes to the distribution and intensity patterns of precipitation and temperatures, and has caused a rise in droughts (UNEP, 2009, Magrin and others, 2007; UNEP and SEMARNAT, 2006).

The region's vulnerability can be seen not only in the increase and frequency of weather events, but also in the ever-growing exposure of different systems to those threats (population, farming, fishing, tourism).

Energy. Energy production faces serious problems that tend to become exacerbated by increasing demand. Some deficit-ridden countries seek to intensify the use of their resources, often in ways that are environmentally unsustainable. Two factors underlie this situation: high dependence on imported hydrocarbons and inefficient energy consumption.

However, the region has significant potential for generating renewable energy. Hydroelectric, geothermal, wind, biomass and other sources of energy are widely available. Other sources of energy could also consitute a platform for economic growth without compromising sustainability, in a context of better planning and more efficient energy consumption patterns (State of the Region, 2008).

Science, technology and innovation. Though investment in research and design (R&D) has increased, it does not yet match the need. R&D expenditures in the agriculture sector, which are mostly financed by the public sector, are concentrated more heavily in technology and to a lesser degree in the exploitation of land and environmental control and protection.

The countries of Latin America and the Caribbean have also advanced in the use of information and communications technology (ICT) over the past few years. The extent of those advances varies according to access to those technologies and digital gaps exist between more-developed and less-developed countries as well as within the countries themselves.

Governance. Today's globalization is also causing the "deterritorialization" of the nation-state. This limits the capacity of States to regulate the use of their territory, enforce the law, control environmental impacts and handle the productive extraction of vast areas.

The administrative capacity of environmental institutions in the region is limited not only because of an absence of legislation —in recent years extensive legislation has been introduced to address everything from environmental policy to environmental management and instruments, as well as the sustainable management of ecosystems, diversity, wildlife, forest resources, and soils and water— but because of a lack of political strength to enforce those laws.

Furthermore, despite progress in implementing institutional and legal frameworks, the environment continues not to be given the political and budgetary priority it deserves. Implicit policies based on the short term only add to the deterioration of the environment.

Challenges and obstacles

- Important steps have been taken on environmental issues by developing environmental strategies, creating specialised organisations, passing laws, regulations and rules and ratifying international conventions. However, the lack of support to help countries gain access to resources and technology and the difficulties in making environmental policy that is crosscutting continue to stand in the way of efforts to effectively counter the driving forces of the region's economic model.
- The current productive pattern needs to be replaced with a more sustainable long-term pattern so that social improvements might become long-term, permanent improvements.
- Appropriate legal and institutional frameworks are needed to mitigate predatory behaviour by economic agents, which have devastating consequences on ecosystems and on the sustainability of the environment as a whole.
- The major challenge for scientific strategies and policies lies in developing new and deeper research about the natural heritage.
- At the same time, research is needed about alternative development models that promote a new way of using natural resources engenders a more harmonious relationship between society and its physical surroundings.
- Mechanisms must be developed to encourage local research and research on local natural resources, incorporating traditional knowledge of empirical sciences of the region's autochthonous cultures.
- The economies of Latin America and the Caribbean need greater financial and technological resources for adapting to and mitigating the effects of climate change.
- But this task should not lose sight of the need to keep working on issues such as deforestation, the loss of biodiversity and soil degradation, which could have negative impacts on the environmental sustainability of the Latin American and Caribbean territory.
- In recent years, the region has made progress in the area of renewable energy. The implementation of national programmes and technologies to promote energy efficiency represents an important tool for mitigating the negative effects of consumption and for managing the growing demand for energy.
- Building capacity and infrastructure for science, technology and innovation are key to economic growth and to making progress in productivity, international competitiveness and social and environmentally sustainable development of the countries.
- Civil society needs to be strengthened and bodies need to be created that will positively engage citizens in addressing environmental demands.
- The region continues to face challenges when it comes to implementing and enforcing environmental law. This presents opportunities for:
  - Improving the distribution of Governmental competencies
  - Strengthening mechanisms for citizen involvement
  - Improving environmental transparency
  - Greater consistency in environmental and economic policies
  - Expand and strengthen education in environmental law
  - Raise institutional credibility
  - Increase scientific awareness and awareness of technological possibilities
  - Access to environmental law compliance and enforcement technologies
  - Ongoing strengthening of institutions responsible for enforcement of environmental laws and policies, which in many cases do not have the resources needed to do their jobs and, even when they do, have profiles that fall way below those of other ministries or equivalent institutions (UNEP, 2007).

Some important data

- 35% of the population of Latin America and the Caribbean (189 million people) are poor, and 14% are indigent.
- Latin America and the Caribbean experience persistent inequality of income distribution. The average Gini coefficient for the region is 0.526 (ECLAC, 2009c).
- In 2010, 79% of the population (some 470.5 million persons) will be massed in urban areas, with only 21% living in rural areas (ECLAC, 2008).
- Between 1970 and 2006, the region tripled the average consumption of electricity (from 427 to 1688 kilowatts/hour per capita) (ECLAC, 2009a).
- The demand for water in Latin America and the Caribbean has increased by 76% (from 150 to 264.5 Km^3/year between 1990 and 2004) as a result of demographic growth.
- In Latin America and the Caribbean 35,000 deaths are attributed to air pollution each year, but the real figure is possibly even higher (CEPIS, 2005).
- The production of solid waste per inhabitant has doubled in the past 30 years (ILAC, 2004).
- In the Caribbean alone, more than 26 million people were affected by natural disasters between 1950 and 2007, with approximately 22,000 deaths (UNEP, 2008).
- Cumulative economic losses due to hydro-meteorological events totalled US$ 81 billion for the period 1970-2008 (ECLAC, 2009).
- In 2008, the countries of Latin America and the Caribbean consumed 749.5 million tons of petroleum, or 6.6% of the world total (BP, 2009).
- The region's consumption of global resources is mostly reflected in energy consumption, namely, hydroelectric (22.5% of the world total), petroleum (9.2%), natural gas, coal and nuclear.
- R&D investment in 2006 was approximately US$ 18 billion, 60% more than in 1997, accounting for 2% of the total investment in the world (Ricyt, 2008).
- Approximately 54% of the region's exports are commodities.
- Except for Mexico, 73% of the region's exports are natural-resource-based commodities (mining and agriculture).
- About 64% of the forests lost on the planet between 2000 and 2005 were located in Latin America and the Caribbean (FAO, 2005).
- Climate change could cause the region's ecosystems to suffer losses of between 20% and 30% of researched endangered species (IPCC).
- Petroleum continues to be the most important energy source for the region (41.7%), followed by natural gas (26%) and energy from renewable sources (23%).
- Public spending on the environment, as a percentage of GDP, for 2005, was 0.3% in Mexico and 0.06% in Brazil. It was between 0.01% and 0.05% of GDP in Argentina, Belize, Chile, Colombia and Uruguay. In the OECD countries, it equalled between 1% and 2% of GDP (United Nations, 2010).

The state of the environment in Latin America and the Caribbean II

The Latin America and Caribbean region has a great diversity of environments, ecosystems, species and cultures. The region has great environmental wealth. Six of the world's 17 megadiverse countries lie in South America and the Caribbean (the Bolivarian Republic of Venezuela, Brazil, Colombia, Ecuador, Mexico, and Peru). Though promising environmental protection experiments and processes have been implemented, this rich diversity is currently at-risk due to a range of threats.

This chapter takes a look at the state of the region's environment, focusing on the analysis of seven components: Land, forests, biodiversity, water and hydrobiological resources, seas ando coastal areas, air quality and urban areas.

Land

As is the case in other areas of the planet, Latin America and the Caribbean is undergoing changes in soil use because of agricultural development, extractive mining activities, exploitation of fossil fuels, forest activities and urban and tourist development in coastal areas. The nature of rights to land ownership must also be borne in mind when considering these issues.

Agriculture and livestock

Demand by foreign and domestic markets for products such as grains and soybean are causing the surface area dedicated to farming to expand. This change is undermining basic food production and obligating countries to increase their imports of these farm product lines. (FAO, 2007e). Thus, per capita production of crops such as yucca, potatoes, wheat and rice is declining while the production of oils (soy, sunflower and palm), corn (especially for industrial use), tropical fruits, vegetables and, to a lesser extent, sugar is increasing (Seixas and Ardila, 2002; ECLAC, 2007a).

Soy farming as a paradigmatic case

Since 1995 the land area dedicated to soybean production in Argentina has tripled (Binimelis and others, 2009). The rise in the price of a ton of soy (which increased from US$ 291.15 in 1997 to US$ 418 in 2007) places the Argentine economic development model near the top among world's foremost providers of soy derivates. Argentina is currently the third largest producer of flour and biodiesel in the world.

However, this economic growth has been the result of an agriculturization process. In other words, it is the result of converting lands that historically were for cattle grazing into farmland, or monocultures lands that had once been used for rotation crops or turning the open fields of the "pampas" into soy production lands, with significant consequences, such as deforestation.

Additionally, today's farming activities are closely related to livestock, which also have negative consequences on the environment. A comparative analysis of the amounts of deforestation and increased cattle production shows that the rise in cattle headcount in countries such as the Bolivarian Republic of Venezuela, Brazil, Colombia, Ecuador, Guatemala, Nicaragua, Paraguay, Peru and the Plurinational State of Bolivia is inversely proportional to the decline in forest coverage (ECLAC, 2007a).

Mining and hydrocarbons

Latin America and the Caribbean have a long mining tradition that generates significant revenues for some countries. Extraction of products such as copper, coal, nickel, gold, silver or sand accounts for an average of 4% of GPD for the region, though in countries such as Chile or Jamaica the figure can range from 6% o 25% of GDP.

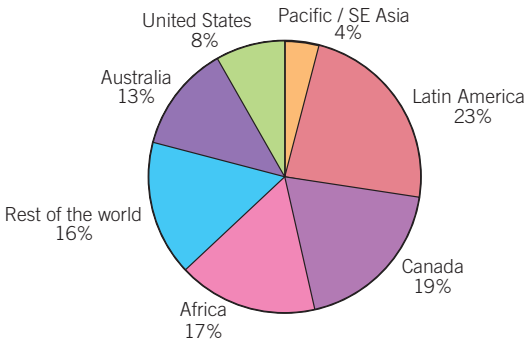
However, mining alters ore reserves and impacts other natural resources, such as water, forests and soils. It also generates large quantities of residual pollutants. In addition to the impact mining has on ecosystems, the mining industry often sees land ownership and traditional systems of government as "obstacles" to their development (Camimex 2008, Cortina and Zorrilla, 2009), which creates inequities and inherent potential social conflicts.

Another highly important activity for countries such as the Bolivarian Republic of Venezuela, Brazil and Mexico is the exploitation and commercialization of fossil hydrocarbons. Oil extraction is predicted to increase because of the prospects of large and yet-unexplored fossil fuel fields.

As with mining, petroleum extraction has high environmental costs that range from the irreversible alteration of land and marine ecosystems to the severe effects of spills. The environmental and social consequences of oil and gas extraction create a need for better environmental regulations.

Figure 1

Investment in Prospecting: Percentages by region (2005)



Source: PricewaterhouseCoopers 2006. Mine: let the good times roll. Review of global trends in the mining industry

Land degradation

All countries in Latin America and the Caribbean are affected by one or more soil degradation processes. In arid, semi-arid and sub-humid regions, this degradation is being caused by erosion from deforestation and overgrazing, soil overexploitation, the failure to rotate crops or monoculture and improper intensive-irrigation practices.

The intensive use of fertilizers and pesticides also degrades and pollutes the soil, air and water and is linked to problems of environmental pollution and human health. This problem is particularly significant in areas of intensive vegetable production.

Colombia has the world's largest open-pit export mining projects. In 2007, Colombia reported having open-pit mines covering an area greater than 70,000 hectares and annual export volumes of 29.8 million tons, from just one of its coal production areas (El Cerrejón). Among Latin America's coal producers, Colombia is the largest; it is the fourth largest exporter of coal in the world, with reserves of approximately 7.063 million tons.

One extreme manifestation of soil degradation is desertification, which accounts for 30% of the region's total land surface and is estimated to cause losses of approximately US$ 27,525 million (ECLAC, 2007a). Argentina, Brazil and Mexico have the greatest losses.

Forests

The forest cover of Latin America and the Caribbean is decreasing. Approximately 24 million hectares of forest area were lost in the region as a whole between 2000 and 2005.

Deforestation of the region also has consequences in CO_2 emissions. It is estimated that deforestation is responsible for 48.3% of total global emissions, almost half of which originate in Brazil, particularly in the Amazon basin (UNEP, 2007).

Cattle farming and expanding croplands are the major threats to forests in the continent's tropical countries, whereas in island countries the growth of urban infrastructure and tourism are the major causes of deforestation.

Also, small changes happening in the forest microclimate and extreme events, the trend toward intensive rainfall followed by dry days are early warning signs for Latin America and the Caribbean's forests about the effects of climate change.

Biodiversity

The region has great biological wealth. Central America and the tropical portion of South America are home to some of the world's most densely populated land-mammal habitats. The Caribbean Sea and central Pacific Ocean host a wide diversity of marine mammals. And the Gulf of California is so

Promising practices

Because the forests of Latin America and the Caribbean are valuable ecosystems that shelter a significant biodiversity of species, the region has implemented a variety of strategies to conserve and protect forest ecosystems. These strategies include:

- Protected areas. The establishment of protected areas is one of the most important policies for biodiversity conservation in Latin America and the Caribbean. This comprehensive effort has placed more than 20% of the total territory under protection (UNStats, 2009). These policies have increased the total size of protected nature areas by almost 200 million hectares in just over a decade. The region's land that is being designated as protected land is often owned by original communities, and laws that designate protected nature areas should include, as priority rights, the rights, needs and interests of their inhabitants.
- Certified forest production and community forest management. Another process that has shown positive results is the increasing area designated for certified forest production. These areas have grown by an average of one million hectares per year. Also, community forest management has been promoted as a viable strategy for reconciling conservation goals with the practices and lifestyles of local populations.
- Programmes of payment for environmental services. Though these programmes should be expanded, in comparison with developing regions Latin America and the Caribbean has a higher number of schemes for payment for environmental goods and services.
- Costa Rica is a clear example of the nexus between research and the evaluation of public policies. In this country, a number of important conservation programmes have been implemented, the objective of which is to modify the way people use land so as to reduce the negative impact on ecosystem services.

rich in species that it has been called "the aquarium of the world". Additionally, the world's most densely populated habitats for amphibious species are in southern Mesoamerica and in the tropical portion of South America.

However, the region is suffering habitat losses and fragmentation because of a variety of socio-environmental factors. Two of these factors stand out: deforestation and forest degradation due to forest fires, selective logging and hunting (Group II of the Intergovernmental Panel on Climate Change) and the great expansion of large-scale commercial farming for export products such as soy, biofuels, beef cattle, fruit, vegetables and cut flowers (World Bank, 2007).

Recent assessments and studies also show that the immense diversity of species is being lost or seriously endangered because of human activities.

Although recent evaluations and studies demonstrate that the immense biodiversity of species is being lost or it is seriously threatened by human activities; in 2010 new spices of amphibians have been found in Colombia and Ecuador and fish species in the Gulf of California and South America.

Table 2

Latin America and the Caribbean; Protected areas, total extension and percentage of global total. (Millions of hectares)

Year	Millions of Hectares	Percentage of global land area
1995	303.3	17.5
2000	394.4	20.4
2007	500.3	23.2

Fuente: UNEP- WCMC, 2008.

Water and hydrobiological resources

Despite the many difficulties involved in implementing an approach to environmental sustainability on the planet, the countries have committed to share responsibilities for developing Integrated Water Resources Management (IWRM). This is a process wich "promotes the coordinated development and management of water, land and related resources, in order to maximize the resultant economic and social welfare in an equitable manner without compromising the sustainability of vital ecosystems" (GWP, 2000a).

Latin America and the Caribbean, as a region, have a large amount of water. It is estimated that the region contains one-third of the planet's freshwater resources. It is presumed that, on average, each of the region's inhabitants uses a larger per capita volume of water each year than the rest of the people of the world.

Examples of progress in integrated water resources management.

- Environmental protection and sustainable development of the Guaraní aquifer system (Brazil).
- Wetlands corridor initiative for fluvial and coastal area (Argentina).
- Application of an ecosystem approach to the Lake Titicaca basin (Plurinational State of Bolivia and Peru).
- Poverty reduction by improving natural resource management in the Pastaza River basis (Ecuador and Peru).
- Formulation of a wetlands management plan with an ecosystem approach for the Fúquene, Cucunubá and Palacio lagoons of the Ubaté River basin (Colombia).
- Integrated management of the basins associated with the watershed unit of Barra de Santiago-El Imposible, Ahuachapán (El Salvador).

Source: (Guerrero and others, 2006)

The basins that extend across borders hold the largest amount of the continent's fresh water. The other sources that are vitally important to the continent's freshwater supply are the region's 64 aquifers.

However, disparities exist even within individual countries that have areas facing critical water shortages. For example, the inhabitants of the Caribbean islands have less than one-third of the world's per capita water average. Some countries, such as those that are home to the region's deserts (Chile and Mexico), have huge contrasts within their own borders.

Water for domestic use is not expected to be a problem for the region. However, some areas could be vulnerable to critical shortages, making it difficult to meet the Millennium Development Goals that have to do with sustainable access to safe drinking water and basic sanitation.

This situation is exacerbated by the marked increase in demand for water. If the volume of available water is compared with the total renewable water resources (TRWR) available, the Caribbean and Mesoamerica are seen to be more vulnerable, while the Andean countries and Brazil have greater water reserves.

In addition to the increase in human water consumption, the region's water availability might be hurt by its use in productive processes, such as:

- Expansion of irrigated farmland.
- Flows of untreated industrial wastewater.
- Hydroelectric power generation.

Climate change could also affect the availability of water, especially as a result of lost glaciers. According to the Fourth Report by the Intergovernmental Panel on Climate Change, between 79 million and 178 million persons in Latin America and the Caribbean will be affected by the rising water deficit.

Seas and coastal areas

- Currently, the common denominator for the region's coastal areas is the shortage of resources, which is largely the result of over exploitations. Significant ecological extinctions have resulted from overfishing, presumably even greater than those caused by pollution, habitat degradation or impacts resulting from changing temperatures.
- Fishing has increased excessively because of a lack of knowledge about sustainable fishing and growing demand from international markets. This problem is exacerbated by the fact that large numbers of population are moving to large cities and to coastal areas. Furthermore, the number and size of protected marine areas is minimal and mangroves are being lost as their soils are being used for tourism and aquaculture.
- The main threats to coastal marine ecosystems in the region can be summarized as follows:
- Increased beach erosion due to the promotion of, for example, nautical tourism, which means building marinas, levies and other port structures.

- Growing urbanization of coastal areas to build tourism complexes that could have negative ecological and social impacts, such as the destruction of coastal ecosystems and land privatization.
- Pollution by wastewater coming from urban and industrial sources.
- The introduction of invasive marine species, which have adverse effects on ecosystems and on economic activities such as fishing.
- The degradation of coral reefs as a result of human activities, such as coastal development, sedimentation, overfishing and marine pollution.

Air quality

Problems caused by air pollution blend with complex urban and environmental problems that are growing steadily in many areas of Latin America and the Caribbean. Traffic congestion, land use change, regional climate change, ecosystems degradation, reduced visibility and noise pollution all affect the quality of life and wellbeing of the population.

Air pollution is a persistent environmental problem that imposes significant costs on society, in terms of health and economy. Large metropolitan areas such as São Paulo, Santiago, Mexico City and Buenos Aires have serious air pollution problems as a result of rapid demographic growth, uncontrolled urban expansion, unsustained economic growth, increased energy consumption and the increased motorization.

Vehicle emissions are the main cause of air quality problems and the trend for the region is that these emissions will become the largest contributor of air pollution. The age and improper maintenance of vehicles and buses, the lack of emissions control technology and fuel quality all influence vehicle emissions.

Other sources of air pollution are:

- Power plants that generate electricity using coal or heavy oil.
- Intensive mining, such as petroleum extraction.
- Controlled burns and forest fires.
- Increased use of pesticides.

A rise in air pollution could have health consequences for those who live in Latin America and the Caribbean.

The Vehicle Emissions Control Programme (PROCONVE), which began in 1986 in the metropolitan area of São Paulo, established emissions standards for new vehicles. Since the programme began, the emission of pollutants has been significantly reduced and air quality has improved.

Premature mortality, increased respiratory diseases and their symptoms are associated with higher levels of air pollution, especially among the very young and older adults.

Urban areas

The growing trend of urbanization in Latin America and the Caribbean is a widespread phenomenon that has major environmental, social, economic and political consequences. Currently, the cities with the highest growth rates are the intermediate and small-sized cities. This carries with it new challenges, such as how to deal with the urbanization of poverty and with increased inequality.

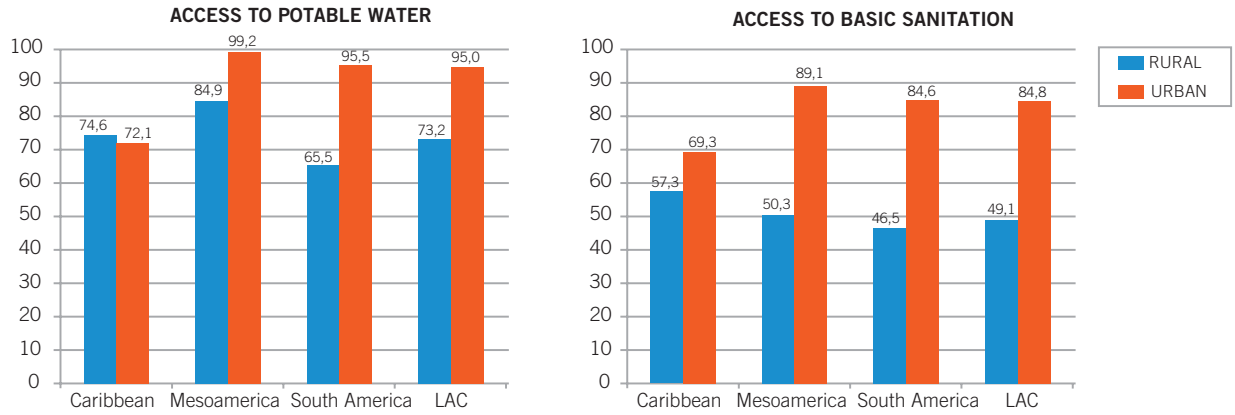
The overall environmental situation of cities is worrisome. One manifestation of the imbalances present in urban systems is the persistence of environmental problems, which include the lack of land use planning, unplanned land use changes, and air, water and soil pollution.

One of the undesirable effects of unplanned growth would be for environmental impacts to extend outward from the cities and beyond the city limits. A large city's needs for water, food, construction materials and energy are usually met at the expense of areas that lie just outside the city. Likewise, the refuse from cities often impacts neighbouring areas, directly or indirectly.

In order for Latin America and the Caribbean to meet the MDG targets, 10 million persons must gain access to sanitation each year. If current trends continue through 2015, the number of persons with no access to improved sanitation in the region will decline by 24 million (OMS/UNICEF 2007).

Figure 2

Latin America and the Caribbean: Proportion of population with access to potable water and basic sanitation in rural and urban areas, by sub-region, 2004 (Percentage)



Source: Prepared by UNEP with data from the GEO Data Portal http://geodata.grid.unep.ch. AccessedFebruary 2010. Data from WHO, 2006.
Note: Percentages calculated for 46 economies.

Additional consequences to this accelerated and unplanned urban growth include:

- Water shortages and limited supplies of safe drinking water.
- Reduction in number of persons with sustainable access to improved sources of safe drinking water.
- Though the water supply and sewage infrastructure has improved in many cities, marginal areas continue to face critical basic sewage problems, a lack of drinking water services and garbage collection services and other problems.
- There is no generalized treatment of wastewater.
- Increased solid waste production. This issue has seen advances in legislative terms and in the design and implementation of programmes and projects over the past decade, though these have been on a limited scale and in isolated cases.
- Greater vulnerability to extreme weather and natural events. Though investments have been made in prevention programmes and developing early warning systems, the results are still limited because of the restrictions imposed on them by political, cultural, financial and technological aspects.

Best practices

- In just 30 years, Curitiba, Brazil, went from having 1 m^2 of green area per inhabitant, to 52 m^2 per inhabitant, distributed among urban parks and forests, which places Curitiba among the cities with the highest amounts of green area in the world. One of the keys to this successful green-area programme has been the participation of the population and environmental education campaigns.
- Urban tree-planting programmes are underway in Santo Domingo, Dominican Republic, as is the Urban Parks Programme, in Santiago, Chile.
- Some examples of special programmes for conservation of green areas, with participation of neighbours, social organizations and NGOs are: the Environmental Education for Parks and Green Areas programme, in Panama; a programme to recover degraded areas in São Paulo, Brazil; and the PRU-GAM programme in San José, Costa Rica.
- In Santiago, Chile a programme is underway to remove pollution from the waters of the Mapocho River, called Clean Urban Mapocho, part of a plan to make Santiago the first Latin American capital to recycle all of its wastewater, by 2012.
- In Peru, the National Environmental Council (currently the Ministry of Environment) launched the Recycle Programme as part of the SENREM/USAID project, working successfully with 800 high schools to promote the segregated handling of solid waste from campuses. Furthermore, the nongovernmental organization, FUNDADES, along with the Owens Illinois in Peru, a corporation, successfully recycled glass to raise funds with which to finance skill development for children with disabilities.

Challenges and obstacles

- Address biodiversity conservation and protection projects from the standpoint of local governance of ecosystems.
- Develop common regional policies that regulate petroleum-related activities.
- Encourage consistency between the goals of conservation policy for protected areas and the goals established by economic and/or agricultural policies.
- Community management should be given greater importance in the forest production sector.
- Recognize the inclusion of forests in climate change negotiation processes in order to make progress in governance of forest resources.
- Design and implement efficient strategies for the sustainable use of water.
- Joint management of transborder basins and aquifers, resolving political obstacles among countries that share watersheds.
- Perform simultaneous analyses of water and energy use on a regional scale, which could lead to substantial energy savings and ease the demand for water.
- Apply an energy efficiency approach to decisions about water policy, both for individual countries and for the region, to better preserve and handle aquatic ecosystems affected by hydroelectric energy projects.
- Implement or improve plans for sustainable development and management of aquiculture.
- Address the problem of poor air quality in cities that are growing rapidly.
- Create a geographic data information system for industrial sources of emissions and anthropogenic activity in countries that do not have an environmental monitoring network.
- Improve air quality while ensuring the transport and mobilization of people and cargo.
- Develop biodiversity conservation programmes in urban, semi-urban and peri-urban areas.
- Long-term, effective socio-economic programmes and processes are needed for handling solid waste. These programmes should consider the economic and health conditions of the population, as well as education levels and community participation.

- Assign resources that allow infrastructure, sources of work and basic services available in urban centres in order to take care of, the massive flow of population as a result of climate change.
- Move forward, regionally and nationally, in designating land and marine protected areas, and implement sustainable use processes for natural resources.
- Improve current legal deficiencies and enforce laws related to tourism so as to prevent environmental costs.
- Drive urban growth toward sustainability and toward greater equity, primarily on the basis of lessons learned from the experiences of large Latin American metropolitan areas.
- Develop strategies for the management of solid waste, and sewage and for particulate emissions into the atmosphere. These strategies should aim to reduce soil, air and water pollution on the continent, as well as in the oceans.
- Integrate air quality goals with climate change mitigation goals when designing environmental policies.
- Address inequality in all urban settlements in the region.
- Strategic urban planning should include consideration of urban vulnerability and mitigation and adaptation measures in planning and land-use instruments.
- The small and intermediate cities are those that grow the most and are those that represents the opportunity to start up an ecological and sustainable land and urban planning.

Data access

One challenge that is faced across the board in Latin America and the Caribbean is that of gaining access to data that is homogeneous, up to date and comparable. These data are needed for an objective analysis of the environment and for making decisions that are supported with the best scientific and technical data available. The production of data and knowledge is fraught with challenges, not the least of which are financial. This problem makes it more difficult to determine the state of the environment at the regional, sub-regional, national and local levels, which affects decision-making. Furthermore, a lack of good data increases the likelihood that unsustainable practices could be implemented, which can cause serious harm to region's natural capital and adversely affect the wellbeing of its inhabitants.

Some relevant data

- Agriculture's contribution to the region's economy as a whole stabilized in 2005, at 6.3% of GDP (ECLAC, 2007a).
- From 1990 to 2005, the surface area dedicated to soy production increased by 22.3 million hectares, largely at the expense of native forests.
- From 1990 to 2007, the region's cattle herd increased by 66.3 million head, mainly in South and Central America (FAO, 2009c).
- Latin America and the Caribbean is the region of the world that attracts the highest percentage of capital investment in mining: some US$ 10 billion per year.
- Foreign investment in the mining sector has grown by 400% since 2000 (Bebbington, 2009).
- Latin America and the Caribbean have over 10% of the world's petroleum reserves, approximately 14% of oil production, while accounting for a mere 8.3% of global consumption.
- The region has over 4% of the world's natural gas reserves, close to 6% of the world's production and 6% of the world's consumption (IEA, 2008: Omar Farouk, 2007).
- In Latin America, over 6 million km^2 of land (approximately 30%) is desert (FAO, 2008).
- Losses due to desertification in 11 countries of the region are estimated at US$ 27,525 million (ECLAC, 2007A).
- Approximately 45% of the region's land area is forest cover (FAO, 2005).
- From 1990 to 2005, the region's share of the world's forest cover dropped from 24.1% to 23.2% (United Nations, 2010).
- Protected areas in Latin America and the Caribbean are estimated to have increased from 303.3 million hectares in 1995 to over 500 million hectares in 2007.
- Protected forest areas have increased by over 60%, from 82.5 million hectares in 1990 to 133.2 million hectares in 2005 (FAO, 2007c).
- South American has the largest expanse of forest area set aside for biodiversity conservation in the world.
- The number of hectares designated as certified forest production areas has gone from slightly less than 4 million hectares in 2002 to almost 10 million hectares in 2007 (FSC, UNEP 2008).
- Between 2000 and 2004 approximately 3.3 million hectares were lost due to forest fires (FAO, 2007c).
- Latin America and the Caribbean contain 20% of the world's recognized land, freshwater and marine eco-regions.
- Of the 20 countries that have the largest number of endangered fauna species, five are in Latin America and the Caribbean, as are seven of the 20 countries that have the highest number of endangered plant species (IUCN, 2008a).
- It is estimated that the region contains 31% of the 35 million cubic kilometres of freshwater resources on the planet.
- In the region there are approximately 50 million people who do not have access to safe drinking water, though this service reaches 80% of the population.
- Over 125 million people do not have access to adequate sanitation facilities (WSP, 2007).

- The consumption of bottled water in Mexico is twice that of the United States (Biswas, 2007).
- As a result of climate change, by 2020 between 12 million and 81 million people will be affected by water shortage (Arnell, 2004).
- The Andean countries contain 95% of the world's tropical glaciers, which cover an estimated surface area of 2,500 km^2.
- Chile, Ecuador and Peru contribute about 20% of the world's fish captures (Agüero, 2007).
- In Latin America, 86% of wastewater reaches rivers and oceans without having been treated; in the Caribbean this figure may be as high as 90% (UNEP, 2007).
- It is estimated that 7% of the world's coral reefs are in the Caribbean Sea (CARSEA, 2007).
- Over 100 million people live in urban areas that do not meet minimum standards of environmental quality (INE, 2004; OPS, 2005).
- Between 1990 and 2005, the vehicle fleet in Mexico, Brazil and Chile grew by 211%, 230% and 219%, respectively (ECLAC, 2007a).
- The industrial sector is responsible for producing 19% of the region's CO_2 emissions (Latin American Energy Organization).
- It is estimated that 31,000 annual deaths due to cardiovascular disease occur in the region because of air pollution (Cohen and others, 2004).
- Cities with populations of between 100,000 and 500,000 inhabitants account for the largest percentage of urban-dwelling population (39%). This is a higher percentage that is found in any other developing region (Asia, 18% and Africa, 16%). Nearly half of all newcomers to urban centres move into cities of this size (UN Habitat, 2008).
- • About 50% of the population lives less than 100 km from the coast (GEO Data Portal), which means nearly 290 million people are vulnerable to sea levels rise due to climate change.

The relationship between environmental change and human wellbeing in Latin America and the Caribbean III

The ecosystem approach

In 2000, the Convention on Biological Diversity introduced the notion, at the level of global policy, that human beings and their actions are a single unit. Thus, it was suggested that an "ecosystem approach" be employed as a strategy for the integrated management of natural resources. This approach, though still being perfected, is now used to illustrate the interrelationships that exist between people and the environment, whether to obtain benefits from it (for example, food, fuel, water) or to illustrate the relationship between human actions and their impacts and consequences (for example, management of waste and nutrients in water).

The principles of the ecosystem approach are used to evaluate relationships and associations among environmental changes and human wellbeing in Latin America and the Caribbean, by identifying or using ecosystem services indicators. As example, the forest, marine and coastal ecosystems will be used. Though the region has other ecosystems that are equally important (dry land, savannahs, deserts, grazing land, moorlands), these have been selected because of their geographic scale and distribution and because of the large number of people who depend on them for survival.

Ecosystems: goods and services

Ecosystem goods and services are the benefits people obtain from the direct or indirect use of ecosystems. Most ecosystem services are the result of long-term natural, ecological and physical processes.

Environmental goods and services

The following are considered environmental goods and services, among others:

- Provision: products obtained from ecosystems, such as water, timber and non-timber forest products or genetic resources;
- Regulation: benefits obtained from ecological regulation processes, such as climate, food and disease control;
- Cultural: non-material benefits, such as cultural, recreational or spiritual values;
- Support: services that are necessary for the production of services in the three other categories, such as primary production or recycling of nutrients.

Source: Millennium Ecosystem Assessment, 2005

Table 3

DEFINITIONS OF TYPES OF GOODS AND SERVICES RELATED TO FOREST AND COASTAL / MARINE ECOSYSTEMS

Type	Good/Service	Definition	Examples
Provision	**Food**	Animals or plants for human consumption obtained from ecosystems.	Food (fish or meat) Salt, minerals and oil resources
	Materials	Animal or plant by-products extracted from ecosystems for multiple purposes, but not intended for human consumption.	Construction materials (sand, rock, lime, wood, timber) Biofuels, fuel wood Non timber forest products such as raw materials (colorants, dyes), crafts or utensils
Regulation	**Gas and Climatic**	The balance and maintenance of the chemical composition of the atmosphere and oceans provided by forest or marine living organisms.	Regulation of climate Local microclimate (shade, surface cooling, etc) Photosynthesis
	Disturbance Prevention	The dampening of environmental disturbances by biogenic structures.	Regulation of floods and diseases
	Bio-recovery of waste	Removal of pollutants by way of storage, burying and recycling.	Regulation and recycling of wastes and improvement of water quality through filtering and water recycling (through evapo-transpiration, etc
Cultural	**Recreation**	Stimulation of human body and mind through the interaction with living organisms in their natural environment.	Vacation destinations, cruises and stay-over visitors. Ecotourism, bird watching, whale watching, hiking Hunting
	Cultural heritage and identity	Benefit of biodiversity that is of utmost significance or bears witness to multiple cultural identities from a community.	Cultural heritage, sacred sites
	Cognitive benefits	Cognitive development, including education and research, resulting from organisms.	Genetic resources Medicinal plants Pharmaceuticals
Support	**Resilience and resistance**	The extent to which ecosystems can absorb recurrent natural and human disruptions and continue to regenerate without degrading or unexpectedly flipping to alternate states.	
	Biologically mediated habitat	Habitat which is provided by living organisms.	Pollinators
	Nutrient cycling	Storage, cycling and maintenance of nutrients by living organisms	C cycle, N cycle, etc.
Options and Use	**Option, use values**	Unknown future use of ecosystems	Biodiversity genetic stock that has potential application for biotechnology and medicine

Source: Modified from Beaumont and others (2006)

Ecosystems and human wellbeing in Latin America and the Caribbean

This report takes a multidimensional approach, similar to that applied in the most recent Global Environmental Outlook report, GEO 4, (UNEP, 2007a) to define human wellbeing. This is gauged by the capacity of ecosystems to provide human services that range from basic needs such as food, energy, water and shelter, to other equally important needs, such as security and health.

Forest, marine and coastal ecosystems in Latin America and the Caribbean contribute a wide spectrum of environmental goods and services, including food, shelter, air and water purification, coastal defense, genetic, spiritual and cultural diversity and others.

The effects of climate change, deforestation, biodiversity loss, the worsening of air quality, water and soil pollution, improper land use, desertification and fish overexploitation of fish are the major change factors in the region's forest, coastal and marine ecosystems.

Identifying goods and services in the forest, marine and coastal ecosystems

Goods and services from forests

In Latin America and the Caribbean the composition and types of forest are varied. Though the region tends to be known for its considerable amount of humid tropical forests, there are also vast expanses of other types of forest. The wide and diverse forest types in Latin America and the Caribbean generates a series of goods and services that range from wood, lumber and/or medicinal plants, to services such as erosion control, flood and climate regulation and recycling of nutrients.

Wood, which is used for commercial and non-commercial purposes, is one of the major goods extracted from forests. Still, timber and non-timber forest products are the most important in terms of both local consumption and economic contribution.

For centuries the local population of the region has used the goods derived from the forest as part of its traditional medicine, especially rural and indigenous communities. Dry tropical forests also provide an important range of goods and services and are a reserve of genetic resources.

Forests also provide regulatory services such as temperature, shelter and habitat for many species that are vital to human wellbeing. Additionally, forests play a role in global and regional climate regulation by capturing and storing carbon.

Though the Latin America and the Caribbean region is following the global trend in altering its ecosystems, there are some examples of successful efforts to sustainably manage natural resources. Various actors have participated in these efforts —civil society, indigenous and local communities, the private sector and Governments— which demonstrates the degree of institutional response that exists in the region.

Cultural services provided by the forests range from the spiritual or religious value they hold for many indigenous communities to the economic contribution they make through recreational activities in countries such as Costa Rica, Belize, Guyana and Puerto Rico.

The region's forests also contribute to human wellbeing through support services that provide primary production, water recycling and photosynthesis. South America has the highest amounts of all types of biomass in Latin America and the Caribbean, due to the region's large surface area of forest-cover.

Goods and services from marine and coastal ecosystems

Regionally, these ecosystems contribute to human wellbeing by providing various types of services, including fishing and tourism. In particular, the Caribbean Small Island Developing States rely on ecosystem services for tourism, the main source of revenue for their economies.

Support services provided by the region's seagrass make it one of the world's largest contributors to primary production, by sustaining secondary production of species that are important to the economy, such as fish and crustaceans.

Mangroves play an important role in the erosion and accumulation cycle along the shores, as well as buffering the effects that marine currents, wind and waves would otherwise have on shoreline. They also offer a variety of provision-type goods and services to rural coastal communities, as a source of food and additional revenue generated by the extraction of non-wood forest products, such as medicinal plants.

Coral reefs provide fish resources, biochemical components that have medicinal applications, recreational areas of high economic value, oases for environmental education, coastal protection and serene spaces for contemplation. Indirectly, they provide a

refuge for an immense number of species and a habitat for organisms that are in larval, youth and adult stages, which can migrate to other regions.

Pressures

Population growth, agricultural expansion, the growing demand for forest products, illegal logging, industrial development and rapid economic growth are some of the major human-driven factors that are putting pressure on forests. Phenomena such as climate change are also associated with the loss of forests.

Pressures on coral reefs and seagrass are related to tourism, which continues to grow in many countries of the region. Red tides, sedimentation, overexploitation of associated resources (marine species), pollution, coral extraction and human presence have been identified as some of the major causes of the degradation of coral reefs in Latin America and the Caribbean.

In addition to the sources of pressure that are of human origin, hurricanes and the effects of climate change are putting pressure on forests and on marine and coastal ecosystems. The sea level rise associated with climate change could affect the islands and low-lying land areas of Latin America and the Caribbean.

Consequences of environmental change and its relationship with human wellbeing

The forest, marine and coastal ecosystems of Latin America and the Caribbean play an invaluable role on behalf of both the region and the planet. Therefore, pressures on these ecosystems have direct and indirect consequences on human wellbeing, both short- and long-term.

The impact of climate change on the availability of ecosystem services

Human activities aside, it is probable that events related to climate change will magnify the damage to many aspects of forest, coastal and marine environments that are directly linked to human wellbeing.

Deforestation and global warming are threatening biodiversity. An average global increase in temperature of between 1º and 2ºC (above pre-industrial levels) could lead to the disappearance of between 15% and 40% of species.

This temperature change could also affect agriculture and endanger native crop pollinator species and soil microorganisms responsible for maintaining fertility and productivity. Pollination is essential to the reproduction of many wild plants and crops, with an estimated global economic value of between US$ 30 billion and US$ 60 billion (Stern, 2007).

The El Niño phenomenon and climate change have been identified as factors contributing to the decay of coral reefs. Also, studies show that mangrove forests on some Caribbean islands would disappear as a result of rising sea levels.

Threats to Caribbean countries as a result of climate change

- Increased salt-water intrusion.
- Flooding.
- Soil degradation.
- Destruction of crops, households and lifestyles.
- Destruction of vital physical and social infrastructure.
- Contamination of fresh water.

Vulnerability of populations to the impacts of environmental change

Health and altered ecosystems

Human activity has also caused the reappearance of disease vectors that could potentially affect people. Environmental changes also impact the natural populations of predators that prey on species that support or carry disease. Changes to the forest ecosystems as a result of deforestation could, potentially, cause the transmission of yellow fever and the recurrence of diseases such as leishmaniasis and malaria.

Though the countries of Latin America and the Caribbean have seen declines in the number of reported cases of cholera in the region, 30% of the rural population in Latin America and the Caribbean do not have access to basic sanitation services. In addition to inadequate access to water, climate change could increase the temperature of bodies of water, making them more amenable to microbial activity that favors the reproduction of the cholera strain.

Not only is water important from the standpoint of quality, but also quantity. For example, there is an observed correlation between reduced volume of water flow and droughts and higher incidence of risks related to malaria, dengue and chagas disease.

Health and climate change

Another major threat arising from climate change is the substantial increase in the number of annual droughts in Latin America and the Caribbean, which has grown from one per year to four per year, with indirect implications on human vulnerability. The loss of soil fertility makes crops more susceptible to pests and can have repercussions in the production and availability of food.

Obstacles and challenges

- Much greater emphasis needs to be placed on making communities and decision-makers aware of the dependent relationship that exists between human populations and the quantity and quality of ecosystem services.
- Scientific studies should establish the bases for identifying and classifying services ecosystems provide to the regions, an area that has not yet been sufficiently researched.
- It is essential that decision-makers, local populations and resource managers work together to overcome the obstacles that stand in the way of improving the wellbeing of people and promoting sustainable development.
- Policies and institutions play a critical role in mitigation actions and adaptation strategies, by establishing goals that are in line with national priorities and social and cultural values.
- Policies that cut across all sectors must continue to be strengthened so as to encourage the sustainable use of ecosystems. The capacity for quantifying environmental goods and services provided by these ecosystems must also be strengthened.
- It is essential that efforts continue to educate, train and acknowledge the importance to human beings in ensuring the proper functioning, conservation and economic value of ecosystems.
- Continue efforts to develop and implement formal and informal policies and fiscal incentives that encourage conservation and the sustainable use of ecosystems.
- The opportunities for local populations to incorporate new technologies and alternative and sustainable land uses need to continue to expand, including opportunities for income-generating non-agricultural activities that can ease the pressures on the environment.
- Efforts to build the capacity and experience of individuals, communities and institutions must continue, to better conserve and sustainably manage the ecosystems of Latin America and the Caribbean.

Some important data

- Latin America and the Caribbean contain 23% of the world's total forest area and approximately 916 million hectares of the world's reserves (FAO, 2006).
- Between 2000 and 2005, an average of approximately 450 million m^3 of forest products were extracted per year (FAO, 2006).
- Wood extractions amounted to US$ 7 million for South America, in 2005. 74% of this was roundwood for industrial use (FAO, 2006).
- Non-timber forest products account for 3.3% of total extraction, with profits estimated at US$ 234 million per year.
- Brazil leads as the country with most forest product extraction, with 290 million m^3, 58% of which is round wood for industrial use.
- Latin America and the Caribbean store 32% of the world's forest carbon (FAO, 2006).
- The region has 48% of the world's biomass in dead leaves, 34% of underground biomass and 31% of surface biomass (FAO, 2006).
- Coral reefs protect over 20% of the Caribbean shorelines from storms, wind and waves (UNEP, 2008).
- It is estimated that the annual value of coral reef contribution to the fishing and tourism industries and to shoreline protection is between US$ 3.1 billion and US$ 4.6 billion (CARSEA, 2007).
- 34% of Honduras' coral reefs are endangered because of stress from human activities.
- Global warming, which is the result of the greenhouse gas effect, is expected to cause sea levels in the Caribbean to rise by 5 mm per year during the next 100 years (Nurse and Sem, IPCC, 2007).
- Though probably underestimated, the total value of goods and services provided by the region's coastal ecosystems is US$ 6.48 million per year.
- One-fifth the diseases reported in Latin America and the Caribbean can be attributed to environmental changes (Periago and others, 2007).

Scenarios IV

In what ways might the economic, socio-political and environmental situation of Latin America and the Caribbean change by 2050? What are the driving forces or key factors for those changes? What implications would those potential changes have on the region's sustainable development? This chapter provides answers to these questions by building and analyzing potential scenarios for the region.

These scenarios, according to Global Environmental Outlook (GEO) methodology, are alternative models of how the future could unfold under different plausible combinations of key factors and driving forces. In environmental issues, the use of scenarios helps decision-makers to take timely action in developing strategies to mitigate and adapt to environmental threats.

Chapter 4 in GEOLAC is a continuation of prior studies performed by the UNEP Regional Office for Latin America and the Caribbean. This effort complements and updates information contained in Chapter 4 "Regional development scenarios" of the GEO Report for Latin America and the Caribbean. Environmental Outlook 2003.

This chapter also explores four alternative trajectories that introduce turning points midway through the period 2000-2050. These four alternative trajectories were selected from a set of possible combination as being representative cases for evaluating sustainability.

As was true for the GEO-4, the guiding theme of this chapter is sustainability as a strategic objective. This analysis perspective is preceded by the evolution of the debate on the link between the environment and development during the 20 years that have passed since publication of the report Our Common Future, by the United Nations World Commission on Environment and Development (1987).

Key uncertainties and basic ideas that support the hypotheses of the scenarios

The basic assumptions of the scenarios for the region were defined using as a benchmark the methodological basis of the GEO-4 Report (2007) and incorporating adjustments that reflect the situation in Latin America and the Caribbean. In this analysis, the five basic dimensions used in the GEO-4 Report (2007) are maintained. These are: (1) institutional and socio-political framework; (2) population trends; (3) economics and markets; (4) science and technology and (5) values system. These dimensions summarize the driving forces of the scenarios and are examined in the context of a set of key uncertainties for the four basic scenarios.

The table below shows a comparative summary of the behaviour of a set of crosscutting issues contained in all four basic scenarios defined for Latin America and the Caribbean.

Table 4

Transversal themes in regional scenarios

Transversal Themes	Relegated Sustainability (RS)	Sustainability Reforms (SR)	Unsustainability and Increased Conflicts (UIC)	Transition to Sustainability (TS)
Economic dimension				
• Energy sustainability	--	+	---	++
• Regional integration	--	+	---	++
• External debt	++	++	+++	+
Social dimension				
• Equity	--	+	---	++
• Poverty	++	-	+++	--
• Food security	--	+	---	++
• Deregulated urbanization	+++	-	++	---
• Migratory pressures for socio-economic reasons	++	-	+++	---
Environmental dimension (challenges)				
• Land degradation	++	+	+++	-
• Limited access to water (quantity and quality)	++	+	+++	-
• Vulnerability to climate change	+++	++	+++	--
• Habitat loss and fragmentation	+++	+	++	--
• Coastal degradation and pollution	+++	+	++	-
• Air pollution	++	-	+++	---

Note:
+++: Significant increase; ++: Medium increase; +: Small increase
- - - : Significant reduction; - - : Medium reduction; - : Small reduction.
Source: Prepared by the authors.

Four futures

It should be mentioned that it is not always possible to gather all data necessary to support the consequences of the various combinations of driving forces that are synthesized in the scenarios. The attempt has been made to supplement the statistics provided by the models used with qualitative analysis and argumentation. Nevertheless, this evaluation of implications of the four plausible futures falls far short of being a finished product.

Table 5. Major findings of the four future scenarios

	Relegated Sustainability (RS)	Sustainability Reforms (SR)	Unsustainability and Increased Conflicts (UIC)	Transition to Sustainability (TS)
Economic dimension	• Privatization and deregulation of markets continues. • Per capita GDP grows. • Raw materials and specialized industries continue to depend heavily on extraction and exports of natural resources • Tourism continues to grow. • Remittance flows increase. • The region's foreign debt continues to be high. • Episodes of economic crisis are increasingly devastating. • Penetration of foreign technology increases. • Large-scale production of liquid biofuels using agricultural commodities.	• New policies and regulations are introduced to mitigate the adverse impacts unregulated market expansion policies. • Budget revenues increase and fiscal policies are introduced to relieve the most serious social and environmental problems. • The region's economic structure changes gradually toward products that have higher value added and services. • Economic growth is strong and is of better quality. • Some forms of tourism that are less aggressive on the environment are introduced. • Global financial trends continue to affect economic, social and environmental development. • Research and development capacity grows, as do technology transfers within the sub-regions. • The high prices of energy persist but regional initiatives are implemented to encourage energy cooperation, connectivity and integration.	• Regional context is marked by socio-economic and political fragmentation. • The prevailing development style is market-focused and exacerbates social and environmental problems. • Commodities production continues to be the most important economic sector. • Foreign debt increases rapidly with contractive effects on fiscal policy. • Marked loss of GDP growth accompanied by a dramatic increase in the informal economy. • Basic and applied research considerably weakened. • The intensive use of fossil resources and the trend toward exhaustion of high-quality petroleum resources, as well as increased tension and conflicts over control of remaining hydrocarbon reserves leads to large-scale production of liquid biofuels.	• The economy continues to dematerialize and there is a greater emphasis on local socio-economic development. • Per capita GDP grows steady and strong. • Population growth slows down. • Greater priority is given to the assessment of land and soil use planning. • A sustainable approach is applied to agriculture. • Forms of tourism that are less aggressive on the environment are developed. • Greater socio-economic integration in key areas, such as the energy sector, on the basis of new regional and sub-regional efforts. • Significant investment in alternative energy sources and energy efficiency. • Biofuel production adheres to a precautionary focus and ethical criteria. • Several countries in the area promote research and development of advanced technologies for using bioenergy in is various forms. • Equitable treatment is given to technology transfers.

	Relegated Sustainability (RS)	Sustainability Reforms (SR)	Unsustainability and Increased Conflicts (UIC)	Transition to Sustainability (TS)
Socio-political dimension	• Poverty increases through 2035 and unequal income distribution grows. • Increased privatization of social services. • Respect for human and labour rights tends to erode. • Population growth slows down and ageing continues. • Urbanization expands out of control. • Migratory pressures increase. • Corruption, institutional weaknesses and the lack of financial resources affect the capacity of Governments to implement sustainable policies.	• Less disparity among countries, in terms of socio-economic development and per capita income. • Policies are applied that move toward achievement of the MDGs. • Social security coverage improves. • Discrimination of women decreases and there is greater inclusion of marginalized ethnic and social groups. • The quality of water and sanitation services improves, though it continues to be a significant challenge. • Population growth slows, but the urbanization process continues, though less chaotic. • Governments play a more active role in implementing development policies that meet the needs of the majority. • Culture is recognized not only for its commercial value, but also for its social value.	• Violent crime becomes endemic, exacerbated and strengthened by an escalation of regional, ethnic and religious conflicts. • Government and corporate elite feel their interests are being threatened and come together to form alliances with the military forces, in order to preserve their privileges. • Repressive policies increase, with a build-up of military and police technologies. • Poverty and inequity increase substantially. • Mortality rises and a drastic slow-down in population growth is expected, including the possibility of zero growth as of 2050. • Migratory pressures increase considerably in border regions, such as the United States/Mexico border. • Institutions become weaker and have less capacity to implement cohesive policies. • Politicians increase their participation in business and phenomena such as nepotism, corruption and clientelism increase. • Sub-cultures emerge, especially among those who are excluded, and family and community values are reinforced within these sub-groups. • Social mobility becomes very restricted.	• Growth in meeting basic needs while not endangering the conservation of natural resources. • Notable progress in the application of policies aimed at achieving the MDGs. • Income distribution policies are implemented, with a significant increase in social expenditures. • Equity in income distribution reaches the highest levels in history because of the application of a differentiated and fair fiscal collection system. • Significant poverty reduction. • Demographic growth slows and migration is optional, not necessary. • Cities apply long-term planning and vision to development. • Decision-making structures are more balanced and political parties become more representative of social interests. • Increased coordination among national and local Governments; local authorities have greater prerogative and receive resources commensurate with their responsibilities. • Regional organisations are restructured and revitalised. • Increased access to pubic information. • Civil organisations have representative capacity in political life when formulating environmental policy.

	Relegated Sustainability (RS)	Sustainability Reforms (SR)	Unsustainability and Increased Conflicts (UIC)	Transition to Sustainability (TS)
Environmental dimension	• Environmental and landdegradation and the pressures on natural resources continue to increase. • Deforestation increases. • Air and chemical pollution increase, as does the per capita amount of waste generated. • Coastal degradation and pollution increase, as does environmental deterioration of marine ecosystems and watersheds. • Worsening of quality and quantity of surface and underground water. • Demand for water increases. • Very limited capacity for response to vulnerabilities related to climate change. • Extreme events, such as hurricanes, become more intense and more devastating.	• Governments and societies are more conscious of the urgency of environmental problems and of the need to implement social and environmental policies that are effective and fair. • Governments consider environmental protection to be one of the priority issues for their programmes aimed at improving equity. • But policies continue to lack integrated strategy planning and continue to target isolated actions. • ISO standards, voluntary regulations and certification schemes are used more. • Increased use of economic instruments and regulations to control solid waste pollution and for solid waste management. • Moderate reduction in soil degradation, deforestation and habitat fragmentation. • Regional initiatives arise for negotiating solutions to conflicts related to shared watersheds. • Demand for water increases but is offset by investments in new water-saving technologies. • Stimulus for sources of renewable energy reduces the region's vulnerability. • To a certain extent the development of liquid biofuels produced from food and other agricultural commodities is controlled. • Some Governments in the region encourage research and development in advanced technologies for using bioenergy in its various forms. • Awareness of the impacts of climate change increases and Governments make greater efforts to increase adaptation capacity.	• There is no concern about environmental sustainability. • The control and property of natural resources are retained by the power elite and large corporations, while not complying with many international agreements on the environment. • Environmental degradation worsens, but natural resources that are of interest to the elite and to transnational corporation are preserved. • Outside the protected areas, deforestation increases, and ther is an accelerated loss of habitats and disappearance of species. • Massive production of liquid biofuels causes serious social and environmental impacts. • There is an increase in the frequency and intensity of extreme events and soil and shoreline degradation intensifies in many areas. • Pollution of surface and underground water worsens because of non-compliance with national regulations • Precipitation in arid and semi-arid regions declines. This, together with increased water consumption, places pressure on availability of aquifer resources. • There are notable increases in the number of people living on water basins suffering severe water shortages and in the volume sewage discharged into rivers.	• Significant progress is observed in solving environmental problems. • A point of dynamic equilibrium is reached in managing natural resources. • Economic instruments are applied to ensure payment for environmental services. • The utilization of economic instruments to control environmental pollution and damage increases. • Local resources are administered by their respective communities. • Sustainability is adopted as a dimension of development strategy design. • Governments adopt policies to stimulate applied research and implement monitoring and early warning systems in matters of conservation, health and natural disaster preparation. • Increased flows of resources going to sustainable development. • The sustainable use of natural ecosystems is encouraged. • Effective mechanisms are put in place to ensure fair and equitable access to shared resources. • There is a slow-down in the increase in demand for water. • Significant improvement in the management of protected area system. • A well-structured regional network of genetic banks is established. • Better compliance with international environmental conventions and protocols. • An regional Agenda 21 is prepared for the Johannesburg Plus 20 World Summit on Sustainable Development (2022), which mentions the major regional priorities in matters of equity, access to energy and sustainable development.

Implications of the four futures

Socio-economic implications

- Population. Population grows in all four scenarios presented, though the trend is for it to slow down. The least population growth takes place in the Transition to sustainability (TS) scenario, as a result of the impact on birth rates due to the education of women and the diversification of women's roles in.
- Rate of urbanization. Population growth is accompanied by a significant increase in urban populations in all four scenarios.
- Per capita GDP. Per capita GDP rises in all of the scenarios, more than tripling in scenarios RS, SR, and TS. In these latter two, growth of this indicator reflects the positive impacts social and environmental investments have on the economy.
- Government expenditures on health and education, as a percentage of GDP. These show growth in each of the four scenarios, but with differing dynamics. The highest rates occur in the TS scenario.
- Poverty. The UIC and RS scenarios show higher levels of poverty, though the number of poor begins to decline between 2030 and 2035, as a result of Government assistance actions aimed at reducing social conflicts.
- Indigence. The evolution of the number of persons living in indigence is very similar to that for the number of poor.
- Equity. Equity improves in the TS scenario as a result of policies that improve income distribution. It remains relatively stable in SR and worsens in RS and UIC.
- Infant malnutrition. Decreases rapidly in the TS and SR scenarios.
- Military spending as a percentage of GDP. Remains relatively stable in SR and TS, but increases in the RS and UIC scenarios.
- Remittances. These show sustained growth in each of the four scenarios, though the highest growth rate happens in the RS scenario.
- Regional demand for primary energy. Shows significant changes in each scenario. The RS scenario shows the greatest increase and the TS scenario, the least, with the percentage of fossil fuels reducing from 78% in 2000 to 60% in 2050.
- Water stress. The number of persons living in conditions of water stress increases in all scenarios, with the UCE and RS scenarios showing the highest increases.

Environmental implications

- Wastewater. The scenarios reveal significant differences in the volume and extent of wastewater treatment. In the UIC scenario, 70% of wastewater will go untreated in 2050. Wastewater volume will increase less in the TS scenario (30%) than it will in the other scenarios, largely because of conservation actions taken and the large-scale construction of treatment plants.
- Biodiversity. The "average abundance of original species" indicator shows the greatest declines in the RS and UIC scenarios. The lesser declines happen in the SR (8%) and TS (9%) scenarios. In both scenarios the agriculture sector and climate change are the main factors that influence the loss of species.
- Emissions of carbon equivalents. The evolution of emissions clearly shows how each scenario contributes to the generation of greenhouse gas emissions and, consequently, to climate change. Only scenario TS shows a decline, as a result of changes to energy production and consumption patterns so as to increase the sources of renewable energy and improve energy efficiency.
- Anthropogenic emissions of sulphur oxide (SOx). Only two of the scenarios (RS and TS) show downward trends in this indicator, the most significant being the downtrend in the TS scenario.
- Fisheries Depletion Index. The greatest exhaustions took place in scenarios RS and SR in the two FAO areas located on the region's Atlantic coast (FAO 31 and FAO 41). In these two areas, the degree of exhaustion is less than in the TS scenario. In the two areas located on the Pacific coast (FAO 77 and FAO 87), the exhaustion indicator shows marked deterioration of fisheries in each of the four scenarios.

Four alternative futures with turning points

In addition to evaluating the four regional trajectories of the four scenarios built on a global scale for the period 2000 to 2050 (see GEO-4), four alternative regional trajectories are explored. These introduce turning points in the middle of the period under consideration (2025). With sustainability as the strategic objective, this exercise constructs four alternative trajectories that are plausible and that reveal that the economic, social and environmental benefits (or costs) of each depends to a large extent on speed (or slowness) and on the degree of integration (or fragmentation) with which the objectives of sustainability and human wellbeing are incorporated into the decision-making process.

Table 6

Alternative trajectories with turning points

From 2000 to 2025	From 2025 to 2050	Sustainability / Human well-being as objectives of the decision making process
A. Relegated Sustainability	*Sustainability Reforms*	At first significantly underestimated and then gradually included.
B. Relegated Sustainability	*Unsustainability and Increased Conflicts*	At first significantly underestimated and then ignored.
C. Unsustainability and Increased Conflicts	*Transition to Sustainability*	Ignored to begin with, then recognized as a desired alternative. Very costly trajectory towards sustainability.
D. Sustainability Reforms	*Transition to Sustainability*	Gradually included, then considered in a more integrated manner, as a trend.

Source: Prepared by the authors.

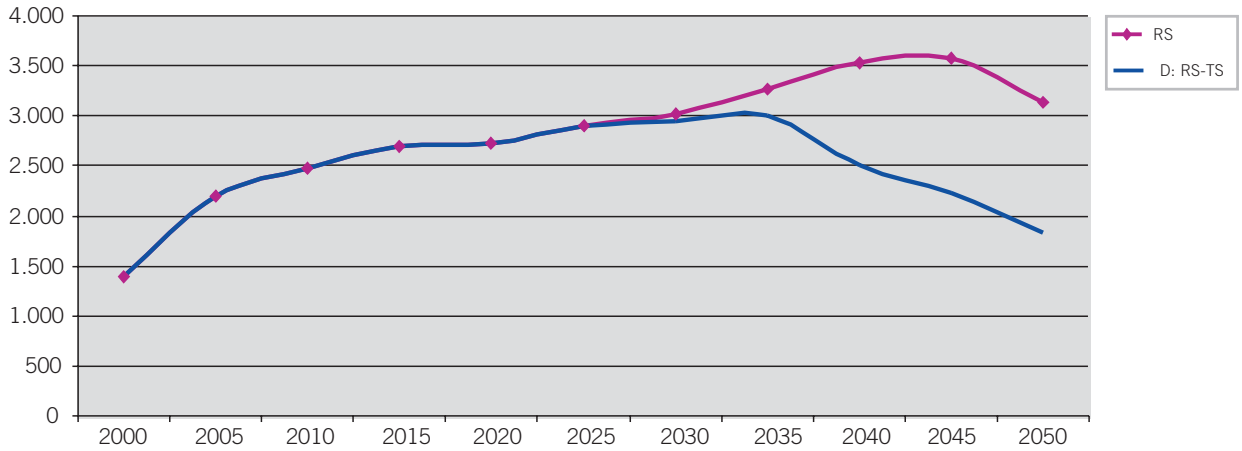
Analysis of the main outcomes shows that trajectory D (the step from Sustainability Reforms to Transition to Sustainability) reveals the best outcomes in terms of emission reductions (as of 2035). This is the result of applying an approach that incorporates sustainability as an objective gradually at first, and then more comprehensively.

Trajectory B (from Relegated Sustainability to Unsustainability and Increased Conflicts) is the only in which there is practically no interruption to the increase of CO_2 emissions over the course of the 50 years, and which shows the highest levels of regional emissions.

Figure 3

Latin America and the Caribbean: Alternative Trajectories 2000-2050

Initial scenario: Sustainability Reforms (SR) (In millions of tons of CO_2)



Source: prepared by the authors

Challenges and obstacles

- The economic, social and environmental benefits (or costs) derived from each of the described trajectories depend to a great extent on speed (or slowness) and the degree of integration (or fragmentation) with which sustainability and human wellbeing are incorporated as objectives in the decision-making process.
- Investments that have social or environmental purposes often have positive effects on the long-term quality and soundness of economic growth, as the Transition to Sustainability scenario demonstrates.
- Response strategies for national, regional and global environmental challenges that affect a region require mitigation and adaption actions in a sustainability-oriented context that combines economic, social and environmental aspects.
- Isolated or fragmented policies and programmes intended to confront environmental challenges are condemned to failure or, in the best of cases, would have very limited results.
- The unsustainable expansion of agricultural boundaries, through monoculture, the introduction of invasive species or other actions of this sort (the Sustainability is Relegated scenario) seriously affect the health of those ecosystems and have negative repercussions on socio-economic development. The same is true with other activities such as tourism, fishing and mineral extraction.
- The development of socio-economic and environmental scenarios reveals to decision-makers the need to consider the inertia of ecological and socio-economic systems when designing sustainable development strategies.
- There is a need for technical and institutional capacities for multidisciplinary work in these areas, both for the qualitative component (preparing narratives) and in the quantitative component (employing models as tools of analysis) to the integration of both aspects.
- A culture of using scenarios in decision-making should be encouraged.
- The dynamic way changes are occurring in the world today and the increasing understanding of driving forces and the links among them make it advisable to constantly update the scenarios in order that they might preserve their usefulness and functionality.

Some relevant data

- In the UIC scenario, the region's population reaches 786 million (42% more than in 2005), whereas in the TS scenario, it is 7% less than in the UIC scenario.
- Urban population accounts for between 77% and 78% of the total population in all scenarios.
- The TS scenario shows the highest amounts of spending on health and education (10.4% of GDP in 2050).
- Poverty drops by between 76% and 83% in the SR and TS scenarios.
- Infant malnutrition reaches 4.9% and 5.2% of the region's total child population, respectively, in TS and SR, compared to 6.9% in 2005.
- In the SR scenario, the demand for energy quadruples and the percentage of fossil fuels in the energy balance grows from 78% in 2000 to 86% in 2050.
- The percentage of the population experiencing water stress grows by 23% in the TS scenario, which is the least amount of increase of the four scenarios.
- The factors that most influence the losses of species in SR and TS are the agricultural sector (accounts for 53% of the problem) and climate change (the cause of 41% of disappearing species in scenario TS, and 30% in SR).
- In TS, carbon emissions drop by 30% between 2000 and 2050.
- The trends for anthropogenic emissions of sulphur oxides (SOx) show cumulative reductions of 50% by 2050, in the TS scenario.

Policies and options for action V

The current situation faced by the region and the planet as a whole requires severe adjustments to the development policies that have prevailed until now.

Chapter V in GEOLAC 3 suggests a few elements that could broaden the discussion about the framework of policy development and deliver some instruments that could prove useful. Furthermore, it explores new pathways, points to lessons learned from specific experiences and identifies opportunities that could boost actions taken by Governments in the region.

The Global Green New Deal

The Global Green New Deal of UNEP proposes the following three spending categories for the investments to address this emergency situation: 1) spending on incentive measures in 2009-2010; 2) changes in domestic policies; and 3) changing the way international policies are devised, recognizing that many less developed countries do not have their own resources and, therefore, will have to rely on foreign aid and support, both financial and non-financial.

Among the tax incentives proposed in the first category it is suggested that priority be given to investing in: sustainable transport and renewable energy in developing countries; measures to improve agricultural productivity; managing freshwater resources and sanitation because of their demonstrable and exceptional social benefits.

In the area of national policy reforms it is proposed to substantially reduce perverse subsidies (e.g. for fossil fuels) and instead create positive and appropriate tax incentives to encourage a greener economy and address some common issues pertaining to land use, urban policy and integrated freshwater resources management. Domestic policy responses should be based on effective monitoring and responsibility and should also include the principles of environmental accounting.

Among the proposed changes about how international politics are devised, it is suggested attention be paid to the areas of trade, aid, improving the global carbon market, creating global markets for ecosystem services, and coordinating technology and policy.

Environmental policy: from a sector approach to a crosscutting approach

It cannot be denied that over the past 20 years Latin America and the Caribbean have made significant gains in terms of establishing a legal framework that has grown in scope and complexity, developing policies, plans, programmes and projects derived from those legal frameworks and creating institutions to assume the responsibility of moving forward with proposed actions. Numerous national and sub-national global environmental outlook (GEO)[1] reports have addressed these advances, but they have also pointed out numerous difficulties, insufficiencies or inconsistencies that could affect the sustainability of environmental management.

Despite these advances, in most cases today environmental policy has been confined to being a sectoral aspect of public policy, not yet having become crosscutting enough to make it an obligatory and

[1] *Since 1999, UNEP has supported countries in the region in the preparation of global environmental outlook reports (GEOs) at the national and sub-national levels. These reports are available at [www.pnuma.org/deat1/publicaciones.]*

permanent component of all other sectoral policies and instruments. Therefore, the overall challenge is to establish crosscutting environmental policies while maintaining the integrated and holistic character of the environmental vision in general development policies.

Environmental work requires the forging of new and more solid alliances among the various stakeholders, both public and private. To ensure that public policies are integrated it is equally important to consider innovative practices and scientific findings that society at large has developed in all areas. This means that experience sharing and reciprocal learning should be practiced more consistently.

Tools for action

Land use planning approach. Land use planning allows an integrated view of the resources and dimensions of a development process. It includes three inseparable elements: the land, the resources, and the participation of all relevant stakeholders. Land use planning seeks to encompass as many potential resources as possible that are susceptible to being harnessed for local development. This includes natural resources (renewable and non-renewable), water sources, current use, historical use, existing services, terrain, landscape, accessibility, history and culture. Lastly, regarding the social component, land use planning means identifying how a population occupies and relates to a particular territory; how it is organized, its authority and management structures and the risks derived from improper use of existing resources.

But what specifically characterises this methodology is its participative approach. It presumes the application of bottom-up procedures and revisions to the roles played by institutions that have traditionally been in charge of planning. Several countries in the region, such as Mexico and Costa Rica, have used this tool to institutionalize their own land use models.

In cities, urban land use planning lends a sense of integration to the way physical, demographic, social, economic and environmental aspects are addressed, as well as to the areas of basic services, roads, urban landscapes and cultural matrix, among other variables. One paradigmatic and successful case of land use planning and management at the local level, with an environmental focus, is the city of Bogotá.

In the case of rural territories, land use planning should turn to local stakeholders when seeking solutions to problems and it should value rural development policies. To accomplish this, there must be a systematic and inclusive vision of land use that:

Several countries have engaged in significant processes of constitutional reform. Examples of this can be found in the new constitutions of Ecuador and the Plurinational State of Bolivia, which recognize as foundational values the plurality of nature and culture. Both constitutions contain extensive chapters dedicated to raising awareness of, valuing and recognizing the rights of indigenous peoples and environmental rights in a context that, for the first time, takes on the challenge of building States whose juridical, political and economic plurality reflect their natural and socio-cultural diversity.

- Values the multifunctional nature of agriculture and the rural area.
- Transcends sectoral approaches, recognizing the important roles played by all stakeholders.
- Aims to preserve productive diversification, institutional innovation, the conservation of natural resources and social inclusion.

The first step is to decentralize the decision-making system and replace it with a "network of networks" made up of rural societies, particularly communities (Barril, 2009).

The ecosystem approach. According to the definition given by the Convention on Biological Diversity, this approach has the following characteristics:

- It is integrated, because it considers the widest range possible of goods and services and attempts to maximize the blend of benefits for a single ecosystem and the shared benefits for several ecosystems. Its purpose is to ensure that offsets are efficient, transparent and sustainable.
- It redefines traditional limitations to ecosystem management. It is understood that ecosystems function as complete entities and must be managed as such, not in parts. This often involves crossing over jurisdictional lines, given that ecosystems reach across borders between States and countries.
- It adopts a long-term view, with respect for the processes of an ecosystem and the temporal scales for those processes.
- It includes the people. Social and economic data

is integrated with environmental data on the ecosystems. Thus, human needs are explicitly related to the capacity of ecosystems to meet those needs.

- It maintains the productive potential of the units. Using this approach, management isn't correctly done unless it preserves or increases an ecosystem's capacity for future production of the desired benefits.

One of the most important areas in which the ecosystem approach is applicable is in water resources management. Current methodologies and instruments such as Integrated Water Resource Management and Integrated Watershed Management are closely aligned with this approach.

The study of conditions and trends for ecosystem goods and services (Chapter II. GEOLAC 3); of relationships between ecosystem services, pressure factors and human wellbeing (Chapter III GEOLAC 3); and the creation of scenarios (Chapter IV GEOLAC 3) are part of the range of instruments necessary for implementing the ecosystem approach.

Payment for environmental services and green enterprises. The concept of "environmental accounts" arises in response to the need to include the environmental subsystem's contribution to the concept of development. An unprecedented and significant effort is also needed to move toward a "green" economy, such as that proposed by UNEP in 2008.

The UNEP Green Economy Initiative

This initiative seeks to accelerate the transition to an environmentally sustainable economy. The initiative has three core documents: (i) the Green Economy Report; (ii) the Green Jobs Report; and (iii) the evaluation report by The Economics of Ecosystems and Biodiversity (TEEB).

Five sectors are estimated to be responsible for generating the most economic growth, environmental sustainability and jobs: (1) clean energy and clean technology, including recycling; (2) rural energy, including renewables; (3) sustainable agriculture, including organic; (4) ecosystem infrastructure; reduced emissions due to deforestation and damage to the environment; and (5) sustainable cities, including planning, transport and green buildings.

Management and handling of protected areas and biological corridors. The instruments used for managing protected areas include ecotourism and sustainable tourism programmes, payment for environmental service p systems or programmes aimed at selective extraction of a resource. They also include services for capturing and sequestering CO_2, safeguarding schemes and environmental canons to be used in the management and conservation of water resources, among others.

The region has been a pioneer in the world in developing instruments for paying for environmental services as an economic instrument for promoting protection of biodiversity and for conservation of ecosystems. Some promising examples are being developed in Colombia, Costa Rica, Mexico and the Plurinational State of Bolivia (Echavarría, 2002; Rosa and others, 2003; ECLAC, 2007; FAO, 2007a). In Mexico, over 500,000 hectares had been designated for this market in 2005 (ECLAC, 2007.

Another notable advance for the region has been the design of biological corridors, both land and marine, at the national level, and the design of binational and regional/supranational corridors. However, there are still some challenges. For example, national and binational policies for the management of biological and marine corridors still need to be synchronized with initiatives of the local governments.

Tourism. Sustainable tourism could be considered an important support instrument for environmental management. Ecotourism, nature tourism, cultural tourism and other variants have been promoted as alternatives that benefit local populations. However, one of the main challenges lies in making tourism sustainable, which involves developing and maintaining standards of excellence in environmental quality, in community participation and respect for cultural integrity and diversity (Cox, 2010).

Certified forest management and community management. This is another instrument that has shown great potential when it comes to making the most of the sustainable economic opportunities of the natural heritage while also ensuring its preservation. As

GEOLAC 3 Chapter II has shown, despite its relatively short history, certified forest production of natural tropical forests has grown sustainably both in State-owned areas and in private concessions, indigenous territories and community lands. Though its potential is yet to be fully developed, so far it has shown positive results, not only in the amount of forest area under certified management, but also in the volume of business, the opening and expansion of new markets and, most importantly, the multiple actors involved.

Management strategic infrastructure investment. Focusing on the priority, direction and quality of infrastructure investments is a strategic task requiring multidimensional vision in which the criteria of scientists, technicians and experts is as important as are the voices of social actors who will be positively or negatively affected by the projects.

Water management. Watershed management policies in the region have been modest in scope. However, Strategic Environmental Assessment instruments have recently begun to be employed to resolve socio-environmental conflicts and to determine the avenues for implementation of hydroelectric production megaprojects that reduce the potential for conflicts over the structure and composition of watersheds.

One aspect that should be considered critically is the issue of maximising the performance of management systems and maintaining networks for water storage and distribution in urban and rural areas. Losses due to the absence of these networks could eventually compromise over half the volume of water that circulates through them. Another issue that has only begun to be addressed, but which is fundamental, is waste water recycling.

Sustainable energy. Despite the fact that that region's natural resources would permit an energy grid transformation like no other region in the world, the Latin America and the Caribbean region faces challenges in developing renewable energy source. Some of the major barriers are the lack of public policy supporting clean energy, the need for qualified human capital and the lack of investment in new technology. The challenges lie in a variety of areas, such as: the use of renewable energy sources, the sustainable production of biofuels, energy efficiency and the carbon market.

Sustainable management of extractive activities. Despite advances in some countries that have established environmental and community safety standards for granting exploration and exploitation permits, various factors suggest that supervision and control mechanisms for projects authorized far in advance are notably weak. One of the few examples that can be mentioned about efforts to design mining policy that considers environmental aspects is the "Framework Agreemento on Cleaner Production – Greater Mining Sector", signed in Chile by a large number of public and private actors.

Protection and management of coastal areas. From the standpoint of regional cooperation, these areas occupy a place of privilege. Evidence of this can be seen in the institutional bodies that have been created to work on this issue, including the Permanent Commission for the South Pacific (CPPS) and the Central American Alliance for Sustainable Development (ALIDES).

Fiscal policies and incentives. There is a broad range of economic instruments that operate in a decentralized fashion and apply economic logic to solve environmental problems. These include fees for causing pollution, the creation of markets for tradable permits and payment for environmental services. However, the region has relatively little experience in utilizing these instruments.

Strengthening and revising environmental law. Some countries have implemented specific initiatives that seek to give competent bodies significant levels of legitimacy and to ensure that their resolutions are seen as binding. However, the number of initiatives and actions on behalf of environmental justice are very few and there is much that needs to be done to streamline the mechanisms and establish long-term strategies.

Socio-environmental policy. Most actions that focus on creating an environmentally conscious culture or on educating about sustainable development take the form of changes or partial revisions to primary and secondary school curricula, in an attempt to introduce students to key environmental problems, such as recycling and the reutilization of solid waste, valuing the natural surroundings, utilization of water resources or the waste disposal and treatment. However, there are no programmes that give continuity to this process over the long term, which means that these programmes tend to disappear as soon as the administrations that proposed them and launched them leave office.

Sustainable consumption. The Regional Council of Government Experts on Sustainable Consumption and Production, the technical body created by the Forum of Ministers of the Environment of Latin America and

The Regional Seas Programme of UNEP has defined a strategy that includes the following (CPPS, 2002):

- Promoting conventions, guidelines and international and regional measures to control marine pollution so as to protect and manage water resources;
- Assessing sources and trends in marine pollution and the impact on human health and on marine ecosystems' aesthetic and reactive values;
- Coordinating environmental management measures to protect, develop and exploit marine and coastal resources, and
- Supporting education and training measures designed to enable developing countries to fully participate in protecting, promoting and developing marine and coastal resources management.

The CPPS has developed a comprehensive Action Plan and created scientific mechanisms to enable participating countries (Panama, Colombia, Ecuador, Peru and Chile) to engage in extensive and interdisciplinary joint action to anticipate and mitigate the effects of ocean, meteorological, climate and hydro-biological events.

Source: CPPS, 2002

the Caribbean, has identified effective and efficient mechanisms for implementing integrated polices, strategies and programmes that promote and facilitate the adoption of sustainable patterns for consumption and production in our societies. These include the following:

- Integrate and engage the issue of sustainable consumption and production (SCP) in development policies, programmes and strategies.
- Strengthen processes that inform, educate and train the population on SCP issues.
- Create or strengthen economic mechanisms and instruments that support the sustainability of the productive sectors and improve their productivity and competitiveness.
- Define specific SCP indicators within the framework of the Latin America and Caribbean Initiative for Sustainable Development (ILAC).
- Promote sustainable Government procurement.
- Incorporate environmental and sustainable criteria in processes of contracting priority goods and services.
- Strengthen the REDPYCS Information Network (Sustainable Production and Consumption Network)[2].

Environmental actions and initiatives aimed at organizing arrangements or forms of interaction with the private sector in order to reduce levels of environment damage can be classified into four large categories: (a) accession to green regulations and certification schemes; (b) ecoefficiency and coprocessing of solid waste; (c) actions aimed at implementing clean technology and changing production modes; and (d) development of corporate environmental responsibility schemes.

Among the region's relatively more developed countries there is some balance of actions across these four categories, while the remainder countries major efforts go toward industrial and forest certification schemes and actions that target the reutilization of resources (Mladinic and Ruz, 2005).

The issue of design and implementation of corporate environmental responsibility schemes in the region deserves special mention. These efforts introduce a new perspective when formulating cooperation agreements with private agents, by including environmental conservation objectives (Amit and others, 2004).

Creating and updating statistical data according to international standards. The region has consistently had short supply of important and current data and knowledge. Information needs range from basic data on ecosystems, the goods and services they provide, the pressures exerted on them by productive activities and human wellbeing indicators to more elaborate data and knowledge inputs for developing forecast models

[2] *Recommendation to the Forum of Ministers of the Environment in Latin America and the Caribbean by the 5th Meeting of Experts in SCP, Colombia, 2009.*

Corporate social responsibility (CSR) in Brazil

The Brazilian Business Centre for Sustainable Development (CEBEDS, the Brazilian affiliate of the World Business Council for Sustainable Development), which brings together fifty of Brazil's largest corporations, headquartered in Rio and the ETHOS Institute for Social Responsibility, which is made up of over 700 businesses and is headquartered in São Paulo, are examples of efforts by the business community to make manifest their commitment to environmental policy (Correa and others, 2004).

Another worthy example is the Federation of Industry of the State of São Paulo, the country's largest trade organization, which plays an important role in promoting environmental issues, such as cleaner production and creating legislation and policy, and in promoting environmental certification standards.

Also, the São Paulo stock exchange has had a Corporate Sustainability Index since 2005.

Source: Correa and others, 2004

for building scenarios and trends and for supporting and bringing transparency to decision-making.

Advances in statistical data-gathering should adhere to international environmental statistics data quality standards. UNEP and ECLAC have worked with the countries on the regional Statistics Conciliation Agenda for monitoring the Millennium Development Goals (MGDs)[3] , and on coordinating and harmonizing the indicators of the Latin America and Caribbean Initiative for Sustainable Development (ILAC)[4] with those of the Seventh MDG.

Information and communications technologies (ICTs) can play a pivotal role in ecosystems management. ICTs are particularly important when it comes to very large ecosystems located in areas that are difficult to reach and that are shared among countries and that face a variety of threats to sustainability. The Amazon region is one example of such an area.

Opportunities and obstacles for effective policies and instruments

Latin America and the Caribbean have made substantial progress in environmental legislation and in establishing institutions that have responsibilities directly tied to the environmental issue. But there are still significant challenges to implementation of institutional mandates and new laws, as well as to integrating sustainable development principles into the decision-making and policy-making processes of all sectors.

The effective incorporation of sustainable development principles and programmes is a long and complex process that must take into consideration the particular situations of each country, each Government and each type of policy. The report on the Seventh Millennium Development Goal, published by the United Nations, stresses the following lines of action for addressing this (United Nations, 2010):

- Work to increase the awareness of decision-makers on the economic and social importance of the environment as part of each country's heritage.
- Improve coordination and cohesiveness of public actions to ensure sustainable development.
- Lay the foundations for a development model that would internalize external costs of environment damage, as well as the external benefits of activities that do not harm to the integrity of ecosystems.

Climate change. Climate change is currently one of the most serious challenges —a driving force for change, as is acknowledged in Chapters 1 and 4— facing the countries of the region as they make their way towards sustainable development. In Chapter 3 climate change is presented as significantly affecting ecosystem goods and services and human wellbeing, influencing production and consumption patterns. It is, therefore, of foremost importance that development, environment and sectoral public policies and applied instruments incorporate this issue.

Implementation of policy frameworks chosen by Governments of the region should be supplemented by actions and assistance from international and donor bodies, which demands that developed countries commit

[3] *www.cepal.org/mdg*
[4] *www.geodatos.org*

to adaptation activities. Though international, regional and national financing for adaptation is on the increase, it is not nearly enough to cover estimated need.

One of the adaptation mechanisms that could be most effective would be to require insurance for the safe production and operation of infrastructure (ports, highways, transport, telecommunications). It is important for the region that mechanisms for payment for environmental services recognize the contribution forest conservation and proper land management make to climate security and to the effort to mitigate emissions. The reduction of emissions due to deforestation and forest degradation should be a component to climate regime market mechanisms.

Additionally, the region has an unequal presence in the international arena and its coordination mechanisms need to improve. This would allow participation in global negotiations with a regional agenda that can engage in coordinated economic-environmental improvement initiatives and establish shared priorities for access to international cooperation funds for adaptation and mitigation.

Migration and urban growth. This situation demands that countries of the region significantly increase investments to improve basic services and housing conditions and to create jobs. It also requires engaging in efforts among central, provincial and municipal Governments, civil society and the private sector, but most importantly it will require the engagement of the stakeholder population.

Trade and the environment. Environmental deterioration is increasing in Latin America and the Caribbean despite the efforts of Governments and international cooperation. To reverse this trend, greater political will is needed to ensure that more resources are allocated and that the private sector becomes more involved in solving environmental problems.

Governments have the responsibility to create adequate incentives and economic instruments that will create the conditions needed for better environmental management. The private sector must build better environmental management into the fabric of its companies to ensure the benefits this can bring to its international competitiveness.

In many of the region's countries the involvement of these actors is inconsistent or seen as antagonistic. This fact notwithstanding, to the extent that dialogue among these social actors can be improved, solutions to environmental challenges will become more sustainable, cheaper and easier to implement.

Science and technology. For scientific strategies and policies related to environmental sustainability in Latin America and the Caribbean, the major challenge has to do with conducting new and deeper research into the natural heritage in order to detect new development potential.

Alongside this research should be research and teaching about alternative social behaviours and new ways of using natural resources that will help society relate more harmoniously with its physical surroundings. Current environmental threats call for a research and training agenda that must be embraced if progress is to be made on these issues. Larger-scale development of alternative energy sources or the implementation of nuclear power plants are some examples of the needs that could lead to sustainable development, but which require significant long-term effort in terms of research, training and technological development, both nationally and regionally. It is also of fundamental importance that local research be supported and that regional research programmes be developed on the basis of academic and institutional integration.

As far as technology is concerned, there should be a push for ICTs related to spatial data infrastructure and innovations in remote sensing technology, energy technology, water management and alternative farming technology and clean production technology.

Challenges and obstacles

- Achieving greater integration and cohesiveness among sector policies and environmental polices in the countries of the region is essential, strengthening investment in environmental and social sustainability. Not only will these initiatives not place economic growth at risk, they will ensure it, drive it and make it sustainable.
- The Governments of the region must get a jump on current migratory movements to prevent and mitigate eventual environmental and social impacts. To do this, they must, among other steps, focus a significant portion of investment on developing local conditions that will help stabilize rural populations so they can enjoy dignified living conditions and opportunities to develop and fulfil themselves.
- It is essential that Governments effectively implement policies and instruments for land use planning that cover both urban and rural territories.
- The following are of fundamental importance: energy sources must be diversified (moving beyond fossil fuels), efficiency must be improved and regional cooperation on energy issues must be supported.
- Keeping in mind the cost-benefit analysis for the environment and opportunities that might open for poor rural populations living on degraded lands, it is recommended that research and development continue on some appropriate crop-based fuels that do not compete with food production.
- The Governments of the region must seek ways to prevent and mitigate adverse impacts, implementing good practices that maximise savings and the sustainable use of water. The land use planning approach to rural development provides invaluable tools for properly addressing this problem, in a context that considers the whole set of needs of local communities and the potential benefits offered by the sustainable use of resources.
- One of the main environmental policy challenges is determining how to overhaul production and consumption patterns while still providing opportunities to meet the needs of social reproduction with environmental goods and services, clean and sustainable resource management and development of a culture of inter-generational solidarity that is based on an ethic of respect for nature.
- It is desirable that the changes taking place in the countries of the region will foster greater decentralization of the decision-making process and encourage the recognition of emerging social actors and the institutionalization or strengthening of participation mechanisms.
- Legislation on protected areas still faces significant challenges on issues such as the diversity of management models, supplementary economic benefit schemes and inclusion of the valuation of protected biodiversity in national accounts, among others.
- It is recommended that the monitoring and generation of data related to early warning systems and that instruments for good land use be strengthened.

Some outstanding experiences

Land use planning in Bogotá

The experience of Bogotá is a successful case of land use planning and territorial management at the local level, with an environmental focus. Authorities of the Capital District, together with citizens and representatives from a cross-section of sectors formulated the Environmental Management Plan 2001-2009. This plan has made it possible to manage the territory in a way that brings together the demands of the population while incorporating environmental standards into urban management. Also, by creating a Capital District Environmental System that lists a set of focuses, rules, activities, resources and institutional competencies, and by implementing an Environmental Information System, it has become possible to monitor the plan's land use planning component, primarily as it relates to soil use. These initiatives have received financial support from FOFIGA, which obtains its revenue from charging penalties, fines, redistributive fees, countervailing fees, fees for the use of water, transfers and other sources.

Soure: DAMA and UNEP, 2003 and UNDP, 2008.

The forest incentive programme (PINFOR) in Guatemala.

The objective of this economic instrument is to encourage sustainable forest production in that country, stimulating investment in reforestation and natural forest management activities. The programme consists of direct payments to landowners (forest investment certificates) who perform reforestation or natural forest management activities for protection purposes. Through 2006 approximately US$ 81.6 million had been paid out, of which over 50% was invested in the local work force. The programme achieved an increase of 53,700 hectares of unforested land now incorporated into forest activity for forest plantations and managed natural regeneration. Most of these lands were being used for growing corn or for grazing pasture. Additionally, 130,000 hectares of natural forest have been integrated into sustainable management plans.

Source: Revolorio, 2007

Program for payment of environmental services in Costa Rica

The National Forest Financing Fund (FONAFIFO) funds reforestation, forestation, forest nurseries, agri-forest systems, recovery of denuded areas and technological changes in exploiting and industrializing forest resources. The fund works primarily with small and medium-sized producers, through credits of other mechanisms of support for forest management. The programme adopted an innovative scheme that led to the signing of 6,062 contracts for forest protection, forest management, reforestation and the creation of plantations, covering 532,668 hectares, between 1997 and 2006. Forest protection accounted for 471,392 hectares during that period.

Source: FONAFIFO, 2005, regional report (2008)

The Plurinational State of Bolivia: the world's first carbon capture experiment

The Climate Action Project in the Noel Kempff Mercado Park (PAC-NKM) located in Santa Cruz, marked a "before" and "after" in the history of valuing environmental services. This initiative was the world's first experiment to establish a mechanism for mitigating climate change —such as avoided deforestation— which creates benefits for maintaining forests and avoiding deforestation.

The Government of the Plurinational State of Bolivia, three energy companies (American Electric Power Co., BP Amoco and PacfiCorp), the Nature Conservancy (TNC) and the Fundación Amigos de la Naturaleza [Friends of Nature Foundation] (FAN) began implementing this programme in 1997 by quantifying carbon stored in the area of the project and avoided greenhouse gas emissions.

In 2005, the international certifying company, Société Générale de Surveillance (SGS), evaluated and certified the design and reduction of PAC-NKM emissions by over 1 million tons of carbon dioxide, which were translated into tradable credits that the Government is committed to convert and share with communities.

Source: La otra frontera, UNDP, 2008

Recycling in Brazil

In 2006, Brazil collected some 10,300 million aluminium cans, more than any other country in the world. The amount saved through recycling that many cans, rather than spending to make new ones, was 1.976 GWn/year of electricity, enough to supply a city of over 1 million people for an entire year.

Recycling aluminium cans provides jobs for almost 170,000 people. In 2006, Brazil hit a recycle rate of 94%, more than Japan (91%), the Scandinavian countries (88%) or Eastern Europe as a whole (approximately 58%).

In 2004, Brazil recycled 49% of steel cans, 48% of PET plastics, 46% of crystal containers, 39% of tires and 33% of paper. SEBRAE and CEMPRE estimate that the recycling industry provides jobs for some 500,000 people in Brazil.

Source: UNEP and others, 2008; FAO, 2007b; Brazilian Aluminium Association, 2007; Brazzil Magazine, 2005.

Organic farming in Mexico

While the demand for organic products grows in the industrialized countries, organic farming methods are also visible in the developing world. In Mexico, Coyote Rojo is a bioregional organic label that began to certify farmers in 2007. Its purpose is to safeguard and promote biodiversity, support traditional practices of seed care and exchange, protect typical production methods and foods, and conserve natural resources and sustainable harvesting methods. Coyote Rojo's bioregionalism focuses on meeting the needs in local areas, making use of renewable water sources, promoting and preserving organic farming, and developing local enterprises that are based local skills, knowledge and capacity.

Source: UNEP and others, 2008; FAO, 2007b.

The Efficient energy action programme in hotels of the Caribbean

This program applies efficient energy practices and microgeneration to renewable energies in the hotel sector of the Caribbean. The purpose is to improve competitiveness of small, medium and large hotels through improved energy consumption. The project also allows for interrelationships among energy efficiency, reduced greenhouse gas emissions, microgeneration of renewable energies and the introduction of ozone-friendly technologies.

The programme is called CHENACT and is managed by the private and public sectors. The body responsible for executing the programme is the Caribbean Tourism Organization (CTO), which will conduct the activities with the operational and technical support of the Caribbean Hotel and Tourism Association and the Caribbean Alliance for Tourism (CHTA and CAST). The Inter-American Development Bank (IDB), the Government of Barbados (MFIE), United Nations Environmental Programme (UNEP), the Deutsche Gesellschaft für Technische Zusammenarbeit (GTZ), the Central de Desarrollo Empresarial [Business Development Centre) (CDE) and Barbados Light and Power (BL & P) are also directly involved in this project.

Energy Strategy in Uruguay

In 2006, Uruguay put forth its Energy Strategy Guidelines in order to accelerate the process of transitioning the use of energy sources and reducing its dependence on petroleum. These guidelines promote the use of alternative energy sources, especially biofuels, wind energy and biomass as a thermal energy source for industry. Some local initiatives deemed to be successful include:

- Projects for generating electricity from waste from forests and the rice industry, with a 30MW generation capacity.
- Wind generation projects with a 15 MW generation capacity.
- A project in Las Rosas, Maldonado with 1 MW generation capacity based on biogas drawn from a landfill.
- Several biofuel mini-plants that use oilseed grains and animal fats.

Source: GEO Uruguay 2008

The UN-REDD programme to reduce emissions from deforestation and forest degradation

The objective of the United Nations Collaborative Programme to Reduce Emissions from Deforestation and forest Degradation (UN-REDD), which was

implemented jointly with UNEP, UNDP and FAO, aims to build capacity in the countries for participation in a future mechanism to reduce deforestation and forest degradation. The programme seeks to create conditions that will allow carbon that is stored in forest systems to have an economic value both for the country and for local populations. The UN-REDD programmes work in some of the following areas:

- Identify deforestation scenarios, in the absence of a REDD mechanism.
- Establish a system for monitoring and reporting carbon conservation in forest systems.
- Lay out a country strategy that reduces emissions from deforestation and forest degradation.
- Integrate actions against deforestation and forest degradation in national and sector planning.
- Define a transparent and cost-effective system for distributing benefits.
- Create local technical capacity to implement REDD programmes.

The UN-REDD programme is being implemented in the following countries, as pilot programmes:

The Democratic Republic of Congo, Indonesia, Panama, Papua New Guinea, Paraguay, the Plurinational State of Bolivia, Tanzania, Vietnam and Zambia.

Source: www.un-redd.org

References

Chapter I

British Petroleum "*Statistical Review of World Energy*. Available at: www.bp.com/statisticalreview. [Accesed October 2009].

CEPIS, 2005. *Evaluación de los efectos de la contaminación del aire en la salud de América Latina y el Caribe.* Washington, D.C. 2005. Available at: www.bvsde.ops-oms.org/sde/opssde/bvsde.shtml [Accesed 13.03.06].

ECLAC (Economic Comission for Latin America and the Caribbean), 2008. *Inversión Extranjera Directa en América Latina y el Caribe 2007*.

ECLAC, 2009. *Cambio Climático y Desarrollo en América Latina y el Caribe. Una Reseña*. Available at: http://www.eclac.cl/publicaciones/xml/5/35435/28-W-232-Cambio_Climatico-WEB.pdf

ECLAC, 2009b. *ECLACSTAT: Estadísticas de América Latina y el Caribe.* Available at: http://websie.eclac.cl/sisgen/ConsultaIntegrada.asp?idAplicacion=2

Estado de la Región, 2008. *Estado de la Región en Desarrollo Humano Sostenible 2008. Un informe de Centroamérica y para Centroamérica*. Available at: www.estadonacion.or.cr.

FAO, (Food and Agriculture Organization of the United Nations), 2007. *State of the World's Forests. Food and Agricultural Organization of the United Nations.* Rome, 2007.

Magrin, G., Gay García, C., Cruz Choque, D., Giménez, J.C., Moreno, A.R., Nagy, G.J., Nobre, C., & Villamizar, A., 2007. *Latin America. Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 581-615. Available at: www.ipcc-wg2.org (Chapter 13: Latin America).

Naciones Unidas, 2010. *Objetivos de Desarrollo del Milenio: Avances en la sostenibilidad ambiental del Desarrollo en América Latina y el Caribe*. Available at: http://www.cinu.org.mx/especiales/2010/Avances_en_la_sostenibilidad_ambiental/docs.htm

PNUMA, (Programa de las Naciones Unidas para el Medio Ambiente), 2007. *Perspectivas del medio ambiente mundial: GEO-4. Medio ambiente y desarrollo. Nairobi.* Available at: www.unep.org

PNUMA, 2009. *PNUMA Anuario: Avances y progresos científicos en nuestro cambiante medio ambiente.* Available at: www.unep.org/geo/yearbook/

PNUMA and SEMARNAT (Secretaría del Medio Ambiente y los Recursos Naturales), 2006. *El Cambio Climático en América Latina y El Caribe*. Ciudad de México, México.

UNEP (United Nations Environment Programme) & WB (World Bank), 2004. *Latin America and Caribbean Initiative for Sustainable Development. Follow-up Indicators. ILAC 2004 Indicators*. United Nations Environment Programme / World Bank.

UNEP, 2008. *Climate change in the Caribbean and the challenge of adaptation*. Available at: http://www.pnuma.org/deat1/publicaciones.html

RICyT (Red de Indicadores de Ciencia y Tecnología - Iberoamericana e Interamericana), 2008. *El estado de la ciencia.*

Chapter II

Bebbington, A and Bury. 2009. *Institutional challenges to mining and sustainability in Peru. Proceedings of the National Academy of Sciences*. Available at: http://www.pnas.org/content/early/2009/09/23/0906057106.full.pdf+html

Camimex, 2008. *Situación de la minería mexicana. Informe anual 2008, primera parte.* Cámara Minera de México, LXXI Asamblea General Ordinaria. Available at: http://www.camimex.org.mx/informe/situacion2007.pdf. Accesed January 2009

Cortina, S. & Zorrilla, M., 2009. *Capacidades para la implementación de políticas públicas en: México: capacidades para la conservación y el uso sustentable de la biodiversidad*. PNUD-CONABIO. México.

ECLAC, 2007. *Agricultura, desarrollo rural, tierra, sequía y desertificación: resultados, tendencias y desafíos para el desarrollo sostenible de América Latina y el Caribe*. Foro sobre Aplicación Regional del Desarrollo Sostenible. LC/L.2831

FAO, 2005. *Global Forest Resources Assessment 2005*. Food and Agriculture Organization of the United Nations, Rome

FAO, 2007. *Situación de los bosques del mundo 2007*. Organización de las Naciones Unidas para la Agricultura y la Alimentación. Roma, Italia. Available at: http://www.fao.org/docrep/009/a0773s/a0773s00.HTM

FAO, 2007e. *The state of agricultural comodities market*. Rome, Italy: Organización de las naciones unidas para la agricultura y la alimentación (FAO).

FAO, 2007. *Situación de los bosques del mundo 2007*. Organización de las Naciones Unidas para la Agricultura y la Alimentación. Roma, Italia. Documento en línea: http://www.fao.org/docrep/009/a0773s/a0773s00.HTM

Guerrero, E., De Keizer, & R. Córdoba, 2006. *La aplicación del enfoque ecosistémico en la gestión de los recursos hídricos: un análisis de estudios de caso en América Latina*. UICN, Quito, Ecuador. 78 pp. En http://data.iucn.org/dbtw-wpd/edocs/2006-003.pdf [Accessed october 2008].

GWP (Global Water Partnership), 2000a. *Manejo integrado de recursos hídricos*. Primera impresión, Estocolmo, Suecia. 80 p. Available at: http://www.gwpforum.org/gwp/library/TAC4sp.pdf [Accessed October de 2008].

IEA (International Energy Agency), 2008. Available at: http://www.iea.org/. [Accesed September 2008].

Naciones Unidas, 2010. *Objetivos de Desarrollo del Milenio: Avances en la sostenibilidad ambiental del Desarrollo en América Latina y el Caribe*. Available at: http://www.cinu.org.mx/especiales/2010/Avances_en_la_sostenibilidad_ambiental/docs.htm

OMS (Organización Mundial de la Salud) / UNICEF (Fondo de las Naciones Unidas para la Infancia), 2007. *La meta de los ODM relativa al agua potable y el saneamiento: el reto del decenio para zonas urbanas y rurales.* Organización Mundial de la Salud, Fondo de las Naciones Unidas para la Infancia. Ginebra, Suiza. 41 p.

Omar Farouk, I.,2007. *Annual Report. Austria: Organization of the Petroleum Exporting Countries.*

PNUMA, 2009. *PNUMA Anuario: avances y progresos científicos en nuestro cambiante medio ambiente.* PNUMA, Nairobi. Available at: www.unep.org/geo/yearbook.

Seixas, M. A., & Ardila, J., 2002. *La Agricultura de América Latina y el Caribe, sus Desafios y Oportunidades, desde la Óptica del Cambio Tecnológico*. Unpublished manuscript, Brasilia.

UNStats, 2009. *Indicadores de los Objetivos de Desarrollo del Milenio*. Available at: http://mdgs.un.org/unsd/mdg/Home.aspx [Accessed December, 2008].

World Bank. 2007. *WDR/Latin America and the Caribbean: developed country subsidies, an obstacle for agricultural development. Agrobusiness and biofuels are transforming the sector*. Series No. 2008/080/DEC. Available at: http://www.worldbank.org/

Chapter III

Beaumont, N., Townsend, M., Mangi, S. & Austen, M.C., 2006. *Marine Biodiversity. An economic valuation.* Building the evidence base for the Marine Bill. s.l.: Department for Environment. Food and Rural Affairs UK.

CARSEA (Caribbean Sea Ecosystem Assessment), 2007. *Caribbean Sea Ecosystem Assessment (CARSEA). A sub-global component of the Millennium Ecosystem Assessment (MA)* (eds. J. Agard, A. Cropper, K. Garcia), Caribbean Marine Studies, Special Edition, 2007.

FAO, 2008. *FAOSTAT Base de Datos Estadísticos.* Available at: http://faostat.fao.org/

Farnsworth, E.J. & Ellison, A.M., 1997. *The global conservation status of mangroves. Ambio*, vol. 26, no. 6, pp. 328–334.

IPCC (Intergovernmental Panel on Climate Change), 2007. *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change.* [Core Writing Team, Pachauri, R.K. y Reisinger, A., (eds.)]. IPCC, Geneva, Switzerland. Available at: www.ipcc.ch/ipccreports/ar4-syr.htm

Nurse, L.A., & Sem, G., 2001. Small Islands States. En *Climate Change 2001: Impacts, Adaptation, and Vulnerability*, eds. J.J. McCarthy, O.F. Canziani, N.A. Leary, D.J. Dokken y K.S.

White. Contribution of Working Group II to the Third Assessment Report of the Intergovernmental Panel on Climate Change. Press Syndicate of the University of Cambridge, Cambridge, UK.

Periago, M.R., Galvão, L.A., Corvalán, C. & Finkelman, J. 2007. Environmental Health in Latin America and The Caribbean: at the crossroads. *Saúde e Sociedade*, vol. 16, no. 3, pp. 20-25

UNEP, 2007. *Global Environmental Outlook, GEO 4, environment for development*. Progress Press Ltd, Valletta, Malta. Available at: http://www.unep.org/geo/geo4/media/

UNEP, 2008. *Coastal degradation leaves the Caribbean in troubled waters*. Environment Alert Bulletin no. 11. United Nations Environment Programme, DEWA/GRID-Europe. Available at: http://www.grid.unep.ch/product/publication/download/ew_caribbean_runoffs.en.pdf.

Chapter V

Associação Brasileira do Alumínio 2007. *"Brasil Confirms Leadership in Aluminum Can Recycling*" 14 August 2007. Available at: www.abal.org.br/english/noticias/lista_noticia.asp?id=79

Brazzil Magazine 2005. *"Brazil's Recycling Map Shows Close to 2,500 Firms Working in the Sector"* Brazzil Magazine, 4 October 2005. Available at: www.brazzilmag.com/content/view/4138/54/

ECLAC. Identificación de áreas de oportunidad en el sector ambiental de América Latina y el Caribe. Casos exitosos de colaboración entre industrias para formular alianzas. Chile, 2005. 84 p. Available at: http://www.eclac.org/publicaciones/xml/4/21104/lcl2249.pdf

ECLAC, 2007. *"Panorama de la inserción internacional de América Latina y el Caribe, 2006 Tendencias 2007"*. Santiago de Chile, September. Publicación de las Naciones Unidas.

Cox, R., 2010. *"Los desafíos de la sustentabilidad para el turismo comunitario"* La Paz, Bolivia.

CPPS, (Comisión Permanente del Pacífico Sur). 2002. "*Plan de Ordenamiento Ambiental de las Zonas Costeras y Áreas Marinas del Pacifico Sudeste"*. Available at: http://www.cpps-int.org/spanish/planaccion/planorden.pdf

Correa, E. y otros, 2004. *"Responsabilidad social corporativa en América Latina: una visión empresarial"*. Serie Medio Ambiente y Desarrollo Nº 85. ECLAC, Chile, 81 p. Available at: http://www.eclac.org/publicaciones/xml/4/14904/lcl2104.pdf

DAMA (Secretaría Distrital de Ambiente) y PNUMA. 2003. *"Perspectivas del medio ambiente urbano: GEO Bogotá"*. PNUMA, Bogotá, 179 p. Available at: http://www.pnuma.org/geociudades/PDFs/completobogot%C3%A1.pdf

FAO, 2007b International Conference on Organic Agriculture and Food Security, 3–5 May 2007, Available at: ftp://ftp.fao.org/paia/organicag/ofs/OFS-2007-INF-rev.pdf

IARNA (Instituto de Agricultura, Recursos Naturales y Ambiente), 2006. *"Perfil Ambiental de Guatemala 2006"*. Universidad Rafael Landívar, Guatemala. 2006. Available at: www.perfilambiental.org.gt/perfam2006/PERFAM2006.pdf

Mladinic, H. & Ruz, A. M. 2005. *"Identificación de áreas de oportunidad en el sector ambiental de América Latina y el Caribe. Casos exitosos de colaboración entre industrias para formular alianzas"*. Serie Medio Ambiente y Desarrollo Nº 93.

Naciones Unidas, 2010. *"Objetivos de Desarrollo del Milenio: Avances en la sostenibilidad ambiental del Desarrollo en América Latina y el Caribe"*. Available at: http://www.cinu.org.mx/especiales/2010/Avances_en_la_sostenibilidad_ambiental/docs.htm.

PNUD (Programa de las Naciones Unidas para el Desarrollo) 2008. *"Informe sobre Desarrollo Humano: La Otra Frontera"*. La Paz, Bolivia.

PNUMA, 2009b. *"Nuevo Acuerdo Verde Global – Informe de Política"*, March; "Empleos verdes: Hacia el trabajo decente en un mundo sostenible y con bajas emisiones de carbono".

PNUMA, OIT (Organización Internacional del Trabajo), OIE (Organización Itnernacional de Empleadores) y CSI (Federación Sindical Internacional). 2008. *"Empleos verdes: hacia el trabajo decente en un mundo sostenible y con bajas emisiones de carbono"*. PNUMA. Available at: www.unep.org/labour_environment/features/greenjobs.asp

PNUMA and CLAES (Centro Latino Americano de Ecología Social), 2008.*GEO Uruguay*. *"Informe del Estado del Ambiente 2008"*. Montevideo. 352 p.

Uitto, Juha & Duda, Alfred. 2002: *"Management of transboundary water resources: Lessons from international cooperation*". En: The Geographical Journal; Dec 2002; 168, Academic Research Library p. 365

AMERICA AND THE CARIBBEAN: ENVIRONMENT OUTLOOK GEO LAC 3

GEO

United Nations Environment Programme (UNEP)
Regional Office for Latin America and the Caribbean
Division of Early Warning and Assessment
Avenida Morse, Edificio 103. Clayton, Ciudad del Saber
Panama City, Panama. P.O. Box 03590-0843
Tel. (+507) 305-3100 / Fax: (+507) 305-3105
http://www.unep.org e-mail: rolac.dewalac@unep.org

www.unep.orp

United Nations Environment Programme (UNEP)
P.O. Box 30552 Nairobi 00100, Kenya
Tel: +254-(0)20-762-1234
Fax:+254-(0)20-762 3927
Email: uneppub@unep.org
Web: www. unep.org

UNEP