Project Document

Harmony and Dissonance between Human Settlements and the Environment in Latin America and the Caribbean

Lucy Winchester

Economic Comission for Latin America and the Caribbean (ECLAC)

This document has been prepared by Lucy Winchester, Consultant, Division of Sustainable Development and Human Settlements, ECLAC, within the activities of the project ECLAC/UN Habitat Nairobi: "State of the World Cities Report (SWCR) 2008" and printing has been financed by the German Agency for Technical Cooperation (GTZ) and Germany's Federal Ministry for Economic Cooperation and Development (BMZ).

The author thanks Raquel Szalachman the valuable commentaries to this document.

Julia Marinkovic prepared the statistical information used for the appendixes in this report. Without her assistance and diligence, the breadth and detail of the data presented would not have been possible.

Publication from the United Nations

LC/W.204

Printed in the United Nations, Santiago, Chile

Contents

Index of tables

Index of tables Appendix 1

List of Boxes

Summary

This paper analyzes the interaction between the city and the environment in the context of sustainable development in Latin America and the Caribbean, by examining the positive and negative consequences that urbanization and development are posing to natural environments. It presents a diagnostic of the current policy challenges in the regional urban system in the context of urban growth, development and environmental change. The paper surveys issues by topic – drinking water, basic sanitation and solid waste; air pollution, transport and energy concerns; urban mitigation and adaptation activities in the context of climate change; sustainable cities; among others –, presenting qualitative and quantitative data regarding urban environmental burdens, at household, city-wide, and/or global scales, as well as achievements and effective policy responses in these areas. Best practices are highlighted wherever possible, as are the myriad of policy constraints to improved practices in the region.

Within urban areas, the primary concern from the perspective of human well-being is whether urban settlements provide a healthy and satisfying living environment for residents. Urban development can easily threaten the quality of the air, the quality and availability of water, the waste processing and recycling systems, and many other qualities of the ambient environment that contribute to human well-being. Certain groups (for example low-income residents) are particularly vulnerable, and certain services (such as those not easily traded, for example recreational services from urban parks), are of concern to all urban dwellers. From a sustainable development perspective, the implications for quality of life for future generations well being living in urban settlements must be considered as well. It is also useful to distinguish among the linkages between urban systems and the ecosystem services that exist within urban areas, between urban centers adjoining non-urban ecosystems, and between urban centers and distant ecosystems. Moreover, to appreciate the importance of relations between urban systems and ecosystem services, it is important to consider the negative as well as the positive effects that urban systems can have on ecosystem services. This paper highlights many of these concerns, from an overall regional perspective, as well as through the analysis of city specific, and sector or issue specific urban case studies.

1. Introduction and Regional Overview

The Latin American and Caribbean (LAC) region faces significant developmental challenges in the area of sustainable development and urban change.[1] In a context of pressing and apparently competing urban demands, a scarcity of both human and financial resources, and atomized urban, sectoral and national governance structures, policy making is particularly difficult for urban managers and planners, and even more so, when decision making and implementation need to incorporate environmental considerations into other urban development priorities.[2]

This paper analyzes the interaction between the city and the environment in the context of sustainable development in Latin America and the Caribbean, by examining the negative and positive consequences that urbanization and development are posing to their natural environments. A diagnostic of the current policy challenges in the regional urban system in the context of urban growth, development and environmental change is presented. The paper surveys issues by topic – drinking water, basic sanitation and solid waste; air pollution, transport and energy concerns; urban mitigation and adaptation activities in the context of climate change; sustainable cities; among others –, presenting qualitative and quantitative data regarding urban environmental burdens, at household, city-wide, and/or global scales, as well as achievements and effective policy responses in these areas. Best practices are highlighted wherever possible, as are the miriad of policy constraints to improved practices in the region. Regional, subregional, national and city specific data are presented and reviewed. In Appendix 1, urban national level data is presented for sustainable development indicators, where available. Time series data is presented where available (1990 to 2005).

Urban environmental burdens may be examined at three scales. On a household level these burdens are expressed as environmental hazards in and around people´s homes and workplaces (for example, inadequate household water and sanitation, indoor air pollution, neighborhood waste accumulation, pest infestation). These burdens are particularly accute and dramatic where persistent poverty and precarious conditions have been geographically concentrated (for example,

[1] During the last three decades of the previous century, the region's urban population has grown by 240%, while its rural population grew by a mere 6.5% (ECLAC/UNEP, 2002). In the 1990s and the early 2000s, however, the trend towards a slowdown in the growth of the region's urban population became more pronounced.

[2] Sustainable development paradigms incorporate social, environmental and economic dimensions to the policy making arena, understanding development decisions also as intergenerational, that is, that today´s decisions will affect future generation´s opportunity sets.

in slums or ghettos) or socially concentrated among groups (indigents or ethnic groups, for example). At the urban scale, the most visible urban burdens are those caused by the environmental and ecological degradation that occurs in and around urban centers, resulting from the concentration of productive and consumption activities, including especially industry and motorized transport, in urbanized territories. Examples include air pollution, urban ground and surface water abstraction and pollution, urban waste dumping, the expansion of built up areas and its effect on natural areas, agriculture, and biodiversity. Lastly, global environmental burdens are associated with urban consumption patterns especially in affluent urban settlements and neighborhoods. The global burden of urban activity, however, is often measured through aggregate indicadors such as ecological footprints; global burdens are related to climate change resulting from greenhouse gas (GHG) emissions.

The World Health Organization´s Global Burden of Disease (GBD) project identified environmental risks as a significant component of the overall burden of disease in Latin America and the Caribbean (Prüss-Üstün and Corvalán, 2006). Depending on gender and on the health impact measure used, environmental risks are roughly 4 to 5 percent of the total burden of disease risk for a group of relatively higher income countries in Latin America and the Caribbean (including Argentina, Brazil, Chile, Mexico, Uruguay, among others), and 7 to 9 percent for a group of relatively lower income countries (including Bolivia, Ecuador, Guatemala, Haiti, Nicaragua, and Peru).[3] The largest single environmental component is unsafe water, sanitation, and hygiene – especially in the poorer group. Urban air pollution is a smaller component of the overall environmental risk.

When the GBD looks globally, and not just in Latin America, at leading causes of disease, lower respiratory disease ranks second, right after human immunodeficiency virus (HIV). Since dirty urban air can aggravate sensitivity to airborne health threats (including smoking and dirty cooking fuels), interventions to improve air quality have overall impacts beyond their direct effects by reducing the severity of other health insults. The GBD study reports 58,000 annual premature deaths due to urban air pollution, and 507,000 years of life lost (disability adjusted) in Latin America and the Caribbean. The same 2002 WHO study reports, for LAC in the year 2000, 54,000 annual premature deaths due to water, sanitation and hygiene factors, and 2,045,000 years of life lost (disability adjusted).[4.] Indoor air pollution statistics are: 26,000 premature deaths and 773,000 years of life lost (Prüss-Üstün and Corvalán, 2006).

Studies indicate that the monetary costs of environment-related health problems can reach several percentage points of GDP. In 2004, the cost of the damage caused by particulate emissions in Latin America and the Caribbean was 0.5 percent of the regional gross national income (World Bank, 2004).

1.1 The Context for Urban Environmental Decision Making in Latin America and the Caribbean

Low and heterogeneous levels of national economic development. The region´s per capita gross domestic product (GDP) (for 2005, at constant 2000 prices) is just over 4,000 dollars: it ranges from less than, or close to, 1,000 in Bolivia, Haiti, Honduras, and Nicaragua, to more than 5,500 in Argentina, Chile, Mexico, and Uruguay.[5] Perhaps the greatest source of frustration regarding the

3 This makes environmental risks roughly comparable to childhood and maternal under-nutrition and ahead of sexual and reproductive health risks, though behind (for men) addictive behaviors like smoking.

4 The disability adjusted or DALY, figure is a summary indicator that combines the impact of illness, disability, and mortality on population health.

5 See Table 1.3, Appendix 1.

current economic performance of the region has been the growing divergence between the region´s and the developed world´s per capita GDP levels (ECLAC, 2005). This trend first appeared in the early 1970s, and the gap has been widening in recent years. Renewed economic growth in 2003, 2004 and 2005 is a positive sign, but has not brought about any radical change in the situation. This trend has been accompanied by increasing income-distribution disparities within the region. Economic growth has been slow, and volatile. In spite of the considerable headway the region has made in controlling inflation and fiscal deficits, the macroeconomic fluctuations of the 1990s generated a great deal of instability.[6]

High levels of poverty and indigence, concentrated in urban areas. According to ECLAC (2006), 39.8 percent of Latin America´s population is living in poverty (34.1 percent in urban areas), and 15.4 percent of these people are extremely poor, or indigent (10.3 percent in urban areas).[7] This means that almost 235 million people in the region are poor and almost 91 million people are extremely poor. These percentages, at national and urban levels, have decreased since 1990.[8] This progress is encouraging, but it also falls short of what will be required to meet the Millennium Development Goals, since more than 50 percent of the period set for achieving poverty targets has already elapsed. Average income growth in most countries of the region has been insufficient to overcome problems of poverty. Low growth rates have had negative effects on employment[9] and the creation of new jobs, particularly in urban areas. More than 40 percent of the urban population in Latin America is employed in low productivity sectors of the labor markets; this is a relatively constant characteristic of urban labor markets during the last 15 years in the region.[10]

The region shows important deficits in health (an infant mortality level of 25.6 per 1,000 live births), education (around 25 percent of Latin Americans aged 15 and over have not completed their primary education) and housing (approximately 128 million slum-dwellers in the region)[11] and a high percentage of its population living in overcrowded dwellings (more than 30 percent of the population in 9 out of 14 countries lives in overcrowded conditions (that is three or more people to a room) (ECLAC, 2006)).

Urban environmental degradation is the most serious problem facing the region in this area of development. Generally speaking, the causes of the increase in air, soil and water pollution in the region are associated with unplanned urbanization processes, the use of unsustainable techniques and agrochemicals in agriculture and poor environmental management. The uncontrolled growth of cities has exposed a large proportion of the population to deteriorating air and water quality, solid and hazardous waste contamination and coastal degradation. Overcrowding, lack of infrastructure and urban sprawl heighten exposure to pollutants, with the result that the poorest sectors are usually the primary victims of pollution. Cities, and particularly, slums areas and poor neighborhoods, show increased vulnerability to technological and natural disasters.

In the context of climate change, the vulnerability of urban settlements to extreme climatic events will increase, especially in the Caribbean countries, and in other coastal cities in the region. Urban areas concentrate more than three-quarters of the Latin American and Caribbean region's population, around 90 percent of its economic activities, most of the region's greenhouse gas emissions, and a very large part of the population most vulnerable to the direct and indirect effects

6 This economic instability occurs in a context of historical political and social instability (Solanes and Jouralev, 2006). Latin America´s political history, with the exception of certain periods, has frequently suffered long periods of instability and interruptions in the processes of democratic development, reflecting an endemic incapacity to meet social demands.

7 See Table 1.4, Appendix 1.

8 See Table 1.4, Appendix 1.

9 See Table 1.5, Appendix 1.

10 Nicaragua, Ecuador, Venezuela, El Salvador, Guatemala and Honduras all show percentages between 50 and 60 percent for this indicator. While Paraguay, Peru and Bolivia, show levels of employment in low productivity sectors of more than 60 percent. See Table 1.5, Appendix 1.

11 See Table 1.6, Appendix 1.

of climate change who will carry the burden of adapting to a warming climate. Urban areas also concentrate people and enterprises that, in time, must change their ways if greenhouse gas emissions are to be reduced.

Inadequate governance structures. Environmental regulatory frameworks improved in the region during the 1990s, particularly with respect to land-use management, impact assessment, economic instruments, and legal actions to protect the environment. Norms were developed to regulate and establish controls for environmental quality, emissions, and solid waste disposition, among others. Complementary to this direct regulation paradigm, the use of economic instruments for environmental management as well as participatory models have begun to be implemented in the region. Current governance challenges refer to strengthening enforcement capacities, as well as reviewing current environmental norms. In general, the incorporation of the concept of the sustainable use of resources and the conservation of natural resources in the different productive and service areas (including housing and urban development) is incipient. The integration across sectors of the environmental, social and economic dimensions of sustainable development, on national levels, is not generally observed in the region. Sub-national governments, particularly municipalities have increased responsibilities in key sector areas related to sustainable development and human settlements, creating a great potential for territorial based perspectives and interventions in this area.

1.2 Urbanization in LAC

Although urbanization rates slowed during the last decades, urbanization levels rival that of many industrialized nations. The Latin American region's urbanization level rose from 73.2 percent in 1995, to 75.8 percent in 2000 and to 77.8 percent in 2005, at which time its urban population amounted to 459 million, as against 131 million rural inhabitants (Tables 1.1 and 1.2, Appendix 1). In 2001, Canada´s urbanization level reached 79.7 percent, and in 2000, the United States registered urbanization levels of 79.0 percent (United Nations, 2003). The Caribbean region's urbanization level rose, from 61.4 percent in 1995, to 63.3 percent in 2000 and to 64.7 percent in 2005, at which time its urban population amounted to 26.4 million, as against 14.4 million rural inhabitants (Tables 1.1 and 1.2, Appendix 1). Region-wide figures mask wide differences across countries –and within them as well, at the sub-national level– in terms of both the degree of urbanization and the current speed of the process. At the one extreme are countries at an advanced stage of urbanization (Argentina, Brazil, Chile, Uruguay and Venezuela), whose urban population in 2005, accounted for 92, 83, 87, 92 and 93 percent, respectively, of the total. At the other extreme are very rural countries, such as the Central American countries and Paraguay, where the urban population makes up less than 60 percent of the total. The level of the Andean sub region is very close to the average for the region as a whole (Table 1.2, Appendix 1).

Moreover, a large proportion of the urban population in the region lives in large cities. The region accounts for only 8.6 percent of the world's population, yet it accounts for some 14 percent of the population living in settlements of more than a million inhabitants (Mac Donald, 2004). The ten most populated cities in Latin America are Mexico City, Sao Paulo, Buenos Aires, Rio de Janeiro, Lima, Bogota, Santiago de Chile, Belo Horizonte, Guadalajara, and Porto Alegre. The first two cities house more than 15 million people each; the following two, each with more than 10 million; in Santiago, Bogota and Lima live more than 5 million persons, each; and the rest are inhabited by between 4 and 5 million persons, each.

TABLE 1
NUMBER OF URBAN POPULATION CENTERS AND RELEVANT POPULATION ACCORDING TO SIZE AND POPULATION, IN THE LATIN AMERICAN AND CARIBBEAN REGION

Population Centers	Population sub centers (Nº of inhabitants)	Number of population centers	Population (1 000 inhabitants)
Large	more than 1 000 000	42	111 991
	from 500 001 to 1 000 000	54	37 876
	from 200 001 to 500 000	204	63 036
Total Large		300	212 903
Medium	from 100 001 to 200 000	305	42 725
	from 50 001 to 100 000	526	36 745
Total Medium		831	79 470
Small	from 15 001 to 50 000	2 036	53 731
	less than 15 000	5 106	31 626
Total Small		7 142	85 357
Total Latin America and the Caribbean		8 273	377 730

Source: PAHO (2005a).
Note: Includes thirty six countries from LAC: Anguila, Antigua and Barbuda, Argentina, Bahamas, Barbados, Belize, Bolivia, Brazil, British Virgin Islands, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Guatemala, Guyana, Haiti, Honduras, Jamaica, Kitts and Nevis, Mexico, Nicaragua, Panama, Paraguay, Peru, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Uruguay and Venezuela.

Just under forty five percent of the LAC urban population live in small and medium size cities of less than 200,000 inhabitants. Twenty three percent of the region´s total population lives in small population centers. In the last two decades, medium size cities have had high growth rates and a number of these cities have started having the same kinds of urban problems as large cities, due to demographic pressures and more intense economic activity. According to United Nations population projections, by 2015, 80 percent of Latin America will be urban. Sixteen percent of the total population will live in 9 large metropolitan areas. Twenty eight percent will live in 122 large cities between 500,000 inhabitants and five million. Thirty six percent will live in small and medium urban settlements, including tens of thousands of small towns with less than 20,000 inhabitants. Twenty percent of the total population will live in rural areas (PAHO, 2005a).

Cities are centers of economic development. The United Nations Environmental Programme (UNEP, 2003) reports the following regarding city share of national GDP, for the year 2000: Buenos Aires contributes 50 percent to national GDP; Bogota, 23 percent; La Habana, 42 percent; Santiago, 47 percent; and Mexico D.F., 22 percent.

By mid 2001, the region had approximately 128 million people living in urban slums, 32 percent of the urban population in the region.[12] Countries with more than 25 percent of their urban population living in slums include Argentina (33 percent), Belize (62 percent), Bolivia (61 percent), Brazil (37 percent), Dominican Republic (38 percent), Ecuador (26 percent), El Salvador (35 percent),

[12] See Table 1.6, Appendix 1.

Guatemala (62 percent), Haiti (86 percent), Nicaragua (81 percent), Panama (31 percent), Peru (68 percent) and Venezuela (41 percent). Absolute magnitudes of the number of persons living in slums are daunting in some countries. In Brazil almost 52 million people live in slums; in Mexico almost 15 million; and in Peru 13 million people are living in these precarious settlements. Slums, comprising a wide-range of low-income settlements, from deteriorated inner city dwellings to informal settlements with inadequate housing, infrastructure and services, overcrowding, in risk areas and with a variety of tenure arrangements, are in many cities, the only option available for the urban poor. These areas are often located on peripheral areas, outside of official city limits; they may be squatter communities or more consolidated settlements where buying and selling of houses ocurrs through unregulated informal land markets. Common to the majority of slums are precarious living conditions: poor or inexistent basic sanitation, limited access to drinking water, accumulation of waste and local dumps, indoor air pollution due to increased use of biomass for cooking and heating,[13] and quite often locations near to urban environmental conflicts (for example, final disposal sites for solid waste).

13 Overcrowding and lack of physical space preclude proper ventilation, and burning biomass for cooking affects those who stay indoors for long periods – usually women, children and the elderly.

2. Urban Growth, Development and Environmental pressures

2.1 Urban Drinking Water and Basic Sanitation

In the year 2004, 96 percent of the region's urban households had access to safe drinking water and 86 percent, to basic sanitation. In rural areas, access levels are 73 percent and 49 percent, respectively (PAHO/WHO/UNICEF, 2006). Wastewater treatment is far less widespread: less than 15 percent of the region's municipal wastewater is treated.

While regional figures paint a positive image of the region, they mask the diversity of situations across countries, cities and parts of cities, as well as serious deficiencies in the quality and level of supply. What does access to safe drinking water imply for city inhabitants in LAC? Cities in LAC face immediate problems of access to clean water and sanitation and mounting problems of supply, with respect to the resource water. These issues have implications regarding how water is provided in cities, by whom, and for whom.

International standards define access to safe drinking water as the proportion of people using improved drinking water sources, including household connections; public standpipes, boreholes, protected dug wells, protected springs and/or rainwater. According to World Health Organization (WHO) standards, to be considered accessible, this source must be less than 1 kilometer away from its place of use, and it must be possible to reliably obtain at least 20 liters per member of a household per day from this source. Safe drinking water is water with microbial, chemical and physical characteristics that meet WHO standards or national guidelines on drinking water quality. In the sanitation area, this might mean in situ sanitation (of varying quality levels), without connections to sewers; regarding drinking water, this may mean access to water without household connections, and/or an intermittent supply of water.

In tables 1.7 and 1.8 in Appendix 1, disaggregated figures for different types of connections to both drinking water and basic sanitation, are presented for the region. In the year 2004, 70 percent of the region's inhabitants living in urban areas had household connections to drinking water and 48 percent had household connections to basic sanitation. Improvements in access since 1995 have been seen in all countries in the region.[14] The region´s weighted average for drinking water coverage hides significant variability across countries and subregions. According to the WHO statistics, in 2004, eight countries show coverage levels greater than regional averages (Argentina, Brazil, Colombia, Dominica, Mexico, Surinam, Uruguay, and Venezuela). Twenty-four countries show average coverage levels less than the regional average; in Haiti in 2004, just over 9 percent of the total population living in urban areas had domiciliary connections to drinking water. Central American countries show a subregional average of 47 percent coverage (with household connections), while the Caribbean shows a subregional average of 49 percent. South America shows better performance levels (73 percent).

The situation is similar regarding the percentage of total population living in urban areas, with domiciliary connection to basic sanitation systems. Six countries show performance levels greater than the regional average: Colombia, Chile, Mexico, Peru, Uruguay and Venezuela. Twenty-seven countries show levels less than the regional average. A number of these later countries, however, use in situ technologies (septic systems), for example, Argentina. Nevertheless, a large portion of the in situ solutions are tecnologically inappropriate for urban areas, and in some cities are causing ground water pollution problems (Jouralev, 2004).

BOX 1
EXAMPLES OF INADEQUATE WATER AND SANITATION SERVICES IN SOME CITIES IN LAC

Cochabamba (Bolivia). Fifty three percent of the urban population has internal or external household connections to drinking water, and 23 percent of those that are connected to urbanized water systems receive services 24 hours a day. The Municipal Drinking Water and Sewage Service (SEMAPA) has not be able to keep up with city growth and expansion. While in the older areas of the city, drinking water systems reach 99 percent of the inhabitants, in some northern and southern suburban areas, where, according to 1992 statistics, half the urban population lives, less than 4 percent of households had access to drinking water system connections; 18 percent had access to drinking water outside of their homes; and between 80 and 90 percent obtained drinking water from trucks servicing the area. Just 46 percent of the inhabitants of these areas are connected to sanitation services.

La Paz (Bolivia). The Metropolitan Area of La Paz El Alto has an urban population of more than 1.3 million people. Poor and precarious neighborhoods are often the most recent within cities, many times lying outside of formal city limits. The timing of the extension of public services to these areas is often much later than the physical settlement of inhabitants and housing construction. Sixty six percent of households of La Paz are connected to urban sewage systems; between 30 and 40 percent of households in El Alto are connected. Of those who do not have household connections, 4 percent in El Alto use septic systems (21 percent in La Paz).

In **Montego Bay, Jamaica**, two thirds of the population are reported to use pit latrines or septic systems or do not have access to any type of sanitation system. The more densely settled areas share latrines.

Source: UN-Habitat (2003). “Agua y saneamiento en las ciudades del mundo: acciones locales para alcanzar objetivos mundiales”, Earthscan Publications Ltd., Londres.

The part of the population that does not have access to drinking water supply services is obliged to adopt alternative solutions (public sources, individual wells, illegal connections to the drinking water network, rainwater collection or taking water from rivers, lakes, etc. without prior treatment). Many of these options offer no guarantee of the quality of water obtained, as increasing levels of water pollution are affecting many bodies of water in the countries of the region. The majority of the persons without access to drinking water supply and santiation services belong to low-income groups. Many of them are concentrated in periurban areas, mainly in the poverty belts that exist on the periphery of many of the cities in the region. It has proven to be very difficult to provide these marginal areas with services of acceptable quality. The main problems encountered in efforts to expand services to marginal populations have been due, on the one hand, to the high poverty levels and the low level of payment capacity and culture, and on the other hand, to high construction and operating costs. These urban areas have very often experienced explosive growth

[14] See Tables 1.7 and 1.8, Appendix 1.

and have developed in a disorganized manner, settling in areas far from existing networks and with more difficult topographical conditions. This situation has meant that low-income groups, in many cases, must purchase water from private vendors at prices that far exceed (up to 100 times in some cases) those of official companies. These groups also incur a high health risk, as there is no guarantee of the quality of the water provided (Jouralev, 2004).

BOX 2
PROVISION AND ACCESS TO BASIC INFRASTRUCTURE SERVICES IN PRECARIOUS SETTLEMENTS HABITAT PROGRAMS IN LATIN AMERICA AND THE CARIBBEAN

The Social Development Program in Border Areas in North Eastern and Western Argentina (PROSOFA) targets 80 percent of its financial support to basic sanitation investments (interventions in household and community drinking water systems, household sanitation solutions, sewage systems, household and community treatment systems for sewage, as well as treatment plants with biological filters). These investments are accompanied by investment in small-scale community, neighborhood and health infrastructure projects. Another interesting experience is the Rosario Habitat Program (in Rosario, Argentina), which invests in drinking water network extensions; in rainwater and sewage systems; and in local electricity, gas, and public lighting; together with local environmental protection infrastructure.

Part of the success of PROSOFA, is its associativity strategy among different actors in the development, implementation, operation and maintenance of financed projects. The Program subsidizes infrastructure investment for private service companies, cooperatives, or NGOs, working with these organizations and with regional ministerial entities and municipal governments, as well as regulatory bodies, to assure project completion. PROSOFA also strengthens social actors' capacities through training, in order to improve social control mechanisms towards service providers and system actors.

The non-governmental organization, FUNDASAL, seeks alternative technological solutions for basic sanitation service provision (sewage and sanitation networks using smaller pipes, laid in shallower network systems) in slums in El Salvador, as part of its integrated slum improvement projects. The advantage of these technologies lies in the fact that they are appropriate for the difficult topographical characteristics of the slum neighborhoods, as well as having low implementation, operating and maintenance costs.

An interesting example of shared responsibility and financing for urban infrastructure services, particularly for inhabitants of precarious settlements, is the Argentinean PROMEBA program. This federal program requires a decentralized project definition, formulation and implementation through provincial and municipal governments. In addition, individual projects must incorporate local level neighborhood and community organizations into the design and operation phases.

Source: Urban Poverty Project, Sustainable Development and Human Settlements Division, ECLAC. www.eclac.org.

In many countries of the region, drinking water supply services are intermittent, even in extensive areas of the main cities. It is estimated that over 219 million persons, constituting 60 percent of the population served through household drinking water supply connections, are served by systems that operate on an intermittent basis (PAHO, 2001a). In some countries, over 95 percent of the supply systems have problems of intermittency (PAHO, 2001b). The proportion of the population covered by adequate systems of monitoring and control of drinking water quality is very low in urban areas and insignificant in rural areas: only 24 percent of the urban population in the region is covered by effective systems for monitoring drinking water quality (PAHO, 2001b). It is estimated that 94 percent of drinking water in the large cities of the region is effectively disinfected, but almost 18 percent of the samples do not meet national standards for microbiological, chemical, physical and organoleptic properties (WHO/UNICEF, 2000). As a result of the cholera epidemic in 1991, the monitoring of drinking water quality and its disinfection has increased in most countries, and efforts are being made to achieve 100 percent disinfection in the region (PAHO, 2001a).

Argentina, Brazil, Chile, Colombia, Mexico and Venezuela have all made progress in expanding their wastewater treatment systems. In general, the countries of the region have not made significant advances in this area, mainly due to the high costs of wastewater treatment facilities and the chronic lack of financing in the sector. It is estimated that at present only 13.7 percent of wastewaters from the 241 million inhabitants whose homes are connected to sewage networks, receive some degree of treatment (see Table 2). Jouralev (2004) estimates current and potential untreated wastewater in the region: the urban areas of countries in the region generate approximately 510 cubic metres per second of wastewaters that are discharged into the environment without prior treatment.[15] The situation becomes even more alarming in view of the fact that a large number of treatment plants have been abandoned or function precariously (PAHO, 2001a). As a result of this, many bodies of water close to urban areas, are little more than open sewers, and watercourses crossing large cities are frequently anaerobic owing to the heavy load of sewage. If it were possible to offer universal access to drinking water supply and sewage services to the urban population (for example, by 2010 or 2015), the current levels of discharge of wastewaters would be doubled —both because of the increase in coverage and the increase in the urban population (Jouralev, 2004).

TABLE 2
SEWAGE EFFLUENTS WITH SOME DEGREE OF TREATMENT, AROUND 2000, IN LATIN AMERICA AND THE CARIBBEAN
(Percentage)

Less than 10%	From 10% to 20%	From 20% to 50%	More than 50%
Costa Rica (4)	Argentina (10)	Bolivia (30)	Antigua and Barbuda (100)
Dominica (0)	Brazil (10)	Guyana (50)	Bahamas (80)
Ecuador (5)	Chile (17)	Nicaragua (34)	Barbados (100)
El Salvador (2)	Colombia (11)	Dominican Republic (49)	Belize (57)
Grenada (0)	Cuba (19)	Santa Lucia (46)	Montserrat (100)
Guatemala (1)	Mexico (15)		Puerto Rico (100)
Haiti (0)	Panama (18)		Trinidad and Tobago (65)
Honduras (3)	Peru (14)		Uruguay (77)
British Virgin Islands (0)	Venezuela (10)		
Paraguay (8)			
Suriname (1)			

Source: PAHO (2001a), cited in Jouralev, 2004.

The LAC region, although basically humid, and generally with little shortage of water resources in the region (except in some Caribbean islands and other arid zones), continues to present difficulties in the provision of drinking water and sanitation services. In the region, drinking water supply accounts for 20 percent of total water extractions (WRI, 2003). As this is a relatively low rate of use and also considering the great abundance of water resources in the region, it is clear that the deficit in coverage of services is, with some isolated exceptions, mainly the result of lack of investment in infraestructure rather than a lack of water availability. Water pollution is a major problem because of municipal, industrial and mining related liquid waste dumping and the diffuse pollution caused by agrochemicals. The demand for these drinking water and sanitation

15 Assuming that each urban inhabitant with a household connection for drinking water and sewage generates on average 200 liters of wastewater per day, 229.6 million persons would produce about 530 cubic meters per second, of which only 70 would receive some degree of treatment. The urban inhabitants who have household connections for drinking water but not for sewage (87.0 million), at a rate of 50 liters of wastewaters per person per day, would produce another 40 cubic meters per second of wastewaters (Jouralev, 2004).

services, especially in the last two decades, has increased much faster than the response capacity of water management systems. As water consumption rises and wastewater collection increases only somewhat, the insufficient installed capacity for treatment is overwhelmed and the rivers, lakes, beaches, coastal areas and seas in which effluents are dumped become polluted. Deficiencies in waste-water treatment have increased the vulnerability of the Caribbean countries in particular, because of their impact on marine and coastal resources and on groundwater contamination.

BOX 3
WATER AQUIFERS IN THE VALLEY OF MEXICO AND URBAN DRINKING WATER DEMAND

Currently, the Valley of Mexico aquifer supplies close to 70 percent of the water consumed in the Valley of Mexico Metropolitan Zone (VMMZ), at a rate of 45.4 m per second. The growth of the metropolitan area of more than 18 million inhabitants has caused the progressive overexploitation of underground aquifers (almost double their recharge capacity). In earlier decades aquifers to a depth of 100 meters were exploited; at present aquifers of poorer quality are exploited up to depths of more than 450 meters.

Overexploitation of the aquifer has reduced the level of water where there is a concentration of wells, and has affected its quality. Since 1983 when systematic sampling was begun, a decrease in the groundwater levels has been observed that varies between 0.1 and 1.5 m annually in the different areas of the VMMZ. Between 1986 and 1992, the net drop in the areas of greatest extraction was 6 to 10 meters.

One of the most dramatic consequences of the drop in the water level has been ground subsidence, which has been a serious problem since the beginning of the 20th century. The city sinks at the rate of 5 to 40 centimeters annually, weakening the foundations of buildings and making them more vulnerable to earthquakes. The maximum accumulated subsidence in the central region at the end of the 20th century reached 10 meters, at a rate of 48 centimeters annually.

Subsidence has caused extensive damage to infrastructure, including the foundations of buildings and the drainage system, resulting in water leakage from the distribution network calculated to be about 37 percent supply. Losses from slanting land mean that some zones need constant pumping to drain sewage and rain water.

As groundwater is exhausted, the need to bring in water from neighboring basins increases; the resulting ecological and economic costs could make this unsustainable. The present rate of demographic growth in the VMMZ means that the demand for water will increase by 7.2m per second in the next 10 years. If remedial measures are not taken, by 2020 the water deficit will be 21 m per second (46 percent of present consumption); the only solution will be to bring in water from distant sources, or undertake a massive redistribution of population.

Source: Extract from UNEP (2003). GEO - Latin America and the Caribbean. Regional Office for Latin America and the Caribbean/UNEP. Costa Rica. November.

In the last three decades, over 500 wells providing drinking water to the population in the Federal Capital and the urban area of Buenos Aires had to be taken out of service because of quality problems caused by irrational use of the aquifer (high nitrate content, salinisation and industrial pollution). The Rimac River is the main source of water supply for the city of Lima, Peru, yet over half (51 percent) its microbiological pollution comes from the city itself; 83 percent of dumped organic matter originates in the capital's urban industry. In Colombia it is estimated that every year some 4.5 million cubic metres of sewage are dumped, 90 percent of which comes from household and industrial sources. Colombia and Mexico together generate two thirds of the total organic surface water load that empties into the north-east Pacific, for a total 92,767 tons of organic pollutants. In 1995, only 39 percent of 140 small Caribbean industries treated their sewage in any way. Approximately 64 percent of sewage water is discharged in marine and coastal zones, 25 percent into the soil, 6 percent into drains and 4 percent on to crops as irrigation (UNEP, 2003).

The new models of urban water management have been characterized by the privatization (partial or full) and decentralization of services, as well as the institutional restructuring of the sector (creation of regulatory entities). These modernized water management systems are experiencing serious difficulties in equitably meeting the needs of low-income sectors and in financing investments in modernization. Some countries, like Chile, have successfully implemented subsidies geared towards demand, focused on the poor, yet in many countries this would be difficult to implement due to the weaknesses in the State. The cases of the social conflict in Cochabamba, Bolivia, and the failure in Buenos Aires, Argentina to consider the issue of service for the poor, illustrate this issue.

Which administrative level is best suited for managing water services is a particularly complex and conflictive matter, given that it is subject to economies of scale and scope. Relationships between centralization and decentralization of activities appear to show that, rather than a problem of radical alternatives, it is more importantly a question of structuring balanced systems. A study in Colombia found that implementing decentralization without first conducting a thorough activity analysis led to the loss of economies of scale, and that assigning responsibilities to local organizations lacking technical training was not conducive to sound resource management. Chile, one of the most successful experiences in the region, has adopted its own model, capitalising on economies of scale and scope in order to extend services efficiently on the basis of regional companies, each of which serves an extensive area. Meanwhile, countries that have adopted models on a fragmented political base at the municipal level show serious difficulties, between rich and poor municipalities, and due to non-functional subsidy schemes.

The region has privatized a significant number of drinking water and sanitation services. The situation after privatization has, however, been cause for some concern. Regulatory and structural failures include: the vulnerability of regulators to institutional capture; ambiguity regarding their independence; the non-application of concepts such as reasonable income and returns; the monopolisation of essential infrastructure; the unilateral control of some resources that constitute key supplies; and others, such as price transfers and the lack of information or accounting practices that limit the monitoring of the supplying companies' service (Winchester, 2005).

Over the last 30 years, reforms relating to modification of the institutional and industrial structure of the sector, the formulation of new legal and regulatory frameworks, the setting up of the designated institutions and, in some cases, the transfer of services to the private sector, have made relatively rapid progress in the region. There are still significant lags, however, in reforms associated with tariff adjustments to permit the self-financing of services; the creation of effective subsidy systems for low-income sectors; the implementation of the regulatory frameworks; and the modification of public service provider performance. These gaps constitute effective policy constraints, which along with recent macroeconomic instability and the structural deficit of public finances, has limited the expected degree of success of the reforms (Jouralev, 2004).

BOX 4
OPTIONS FOR SMALL TOWNS WATER SUPPLY AND SANITATION IN PERU

The Small Town Pilot Project in Peru is an initiative implemented by the Vice Ministry of Construction and Sanitation of Peru, the Canadian international Development Agency (CIDA) and the Water and Sanitation Program administered by the World Bank. This project aims to improve water and sanitation services through new management models based on an innovative approach where the municipality associated with the community delegates the service administration to a local specialized operator. It is being implemented on a pilot basis in 10 small towns in Peru (3 on the coast, 3 in the highlands and 4 in the Amazon jungle).

According to the results of a recent assessment (2004), sanitation services managed by local government (who traditionally provides water and sanitation services) are characterized by insufficient coverage rates, fees that do not recover costs, municipal subsidies, inadequate system operation and maintenance, deficient management, political interference, high turnover of service personnel, delays in fee payments and the unwillingness of community members to pay fees due to poor service quality.

The project objective is to help small municipalities select a suitable model for the water and sanitation services; the project also provides technical assistance to municipalities. Key to the project is the active involvement of the community in order to assure long-term sustainability; the project promotes community involvement by encouraging the municipality to empower the community to (i) decide on the change of management model and the service quality users require and can pay for; (ii) lead the change process together with the municipality; (iii) give a local operator an opportunity to provide the service; and (iv) participate in the supervision of the local operator.

The new management models proposed by the project have the following characteristics:

- The municipality does not directly administer water and sanitation services.
- Based on a technical proposal, the community determines the service quality it requires and can pay for.
- A specialized private or mixed economy operator delivers the services under a contract with the municipality. The municipality continues to own the infrastructure.
- Users agree to pay service fees in a timely manner.
- The community, represented by a Neighborhood Community Board, monitors the quality of the service provided by the service operator.

The project uses micro metering to promote equity and establish affordable service rates; different models of fixed and variable rates for water and sanitation services, depending on the type and frequency of services the community chooses are offered. The service fee also includes a contribution to a fund to be administered by the operator or municipality, which is used exclusively for its stated purpose, including subsidies for the poorest citizens, environmental protection measures, and health and hygiene educational programs.

Source: Water and Sanitation Program, The World Bank, 2005. "The Small Town Pilot Project in Peru. A Private-public and Social Partnership to Change Water and Sanitation Management Models". World Bank Field Note. June.

Until recently, the main focus of efforts to improve urban water sanitation and supply have focused within the cities themselves, on better distribution systems, treatment plants and sewage disposal (which, without a doubt will continue to be important). In recent years, however, interest has been taken in the opportunities for maintaining urban water supplies (and perhaps even more importantly water quality) through management of natural resources: creating markets for watershed services, creating protected and/or forested conservation areas in watershed areas, and some combination of the two options.

In LAC, municipal authorities are now increasingly looking up into the hills towards the watersheds that supply their drinking water, and at ways in which improvements can be made at the source. The improved management of the upper watershed for the maintenance of water services is a strategy implemented in several countries in Latin America and the Caribbean, including Brazil, Colombia, Costa Rica, the Dominican Republic, Ecuador, Honduras and Panama. In most cases, the approach favored is the establishment of protected areas rather than the creation of market systems, to improve management practices among land users.

Additionally, watershed protection, by giving additional impetus to the creation of protected areas, can play a key role in assisting national and regional biodiversity conservation strategies. About 80 percent of Quito´s 1.5 million population have drinking water from two nature reserves: Anitsana

(120,000 ha) and Cayambe-Coca Ecological Reserve (403,103 ha). To control threats to the reserves, the local government is working with local NGOs to design management plans, which will highlight actions to protect the watersheds, including stricter enforcement of protection to the upper watersheds and measures to improve or protect hydrological functions, protect waterholes, prevent erosion and stabilize banks and slopes. A major incentive for the protection the cloud forests of La Tigra National Park (23,871 ha) in Honduras was that they provide more than 40 percent of the annual water supply to the 850,000 people of the capital city, Tegucigalpa.

São Paulo's 18 million inhabitants depend heavily on some key protected areas for their drinking water. One of the most important is the Cantareira State Park (7,900 ha). The Cantareira catchment, located in the last remnants of the highly endangered Atlantic forest, provides 50 percent of the water supply to the Greater São Paulo Metropolitan area, and the State Park is of central importance for its protection. The 58,280 ha area known as Billings includes São Paulo's single largest water reservoir. From 1989 to 1999, 6 percent of the area was deforested. Currently, 53 percent of the area is still covered by native vegetation. Guarapiranga Ecological Park, Morro Grande State Reserve, Itapeti Ecological Station, Juquery and Alberto Loefgren State Parks are also all important for maintaining the São Paulo water supply. Ensuring the management of the system is a daunting challenge. Urban encroachment on protected areas, degradation of soil and water catchment, water pollution, irrigation and water for energy are just a few examples of conflicting uses that need to be balanced.

BOX 5
WATERSHEDS, CITIES AND PROTECTED AREAS IN LATIN AMERICA AND THE CARIBBEAN

Bogotá, Colombia. Bogotá's water supply is derived from three main components. The main water source for the city (about 70 percent) is the Chingaza system, located 50 km east from Bogotá. It collects water from the Guatiquía, Blanco, and Teusacá Rivers into two large reservoirs: the Chuza and San Rafael dams. Both its integrity and functioning largely depend on the conservation of the watersheds involved within the Chingaza National Park (50,374 ha). The second component is the Bogotá River system. It collects water from the upper watershed of this river and stores it in three reservoirs: the Sisga, Tominé and Neusa dams. The third component, the Tunjuelo System stores water from the Tunjuelo, San Francisco and San Cristobal Rivers in two dams: Chisacá and La Regadera.

Rio de Janeiro, Brazil. Fourteen different protected areas and the Atlantic Rainforest Biosphere Reserve help to protect the sources of water for the main Guandu Water Treatment Facility, which provides over 80 percent of Rio de Janeiro's water. Within the Rio de Janeiro Metropolitan area there are a further four protected areas protect areas, which were once the city's main sources for water, but which now only provide just under 10 percent of the supply.

Santiago, Chile. Chile's national capital, Santiago, is dominated by a mountainous landscape estimated to cover some 85 percent of the metropolitan region. The most important sources of water for Santiago are the Maipo River and the Laguna Negra (76 percent), which extends from Laguna Negra volcano in the Andes. The river basin covers some 15,000 km2 and the main river runs for about 250 km. The water from this river comes from melted snow in the mountains. Surface water represents 80 percent of the water used in the city and underground water contributes 20 percent. There is considerable protection at the sources of the rivers, with a national park, national reserve and nature sanctuaries located in the mountain range where little agriculture activity occurs; the total area of scientific interest is 11,275 hectares, and protected areas reach a total of 820,947 hectares. Chile's matorral ecosystem is the only example of Mediterranean scrub ecoregion found in all of South America and is only one of five such ecosystems in the world. Within the Latin American and the Caribbean region, this ecosystem has been designated as a high-priority in terms of the need to conserve its biodiversity. The only representative sample of this important ecosystem is Chile's Rio Clarillo National Reserve, which represents only some 2 percent of the ecosystem's total area.

In 1997, the National Commission for the Environment (*Comisión Nacional de Medio Ambiente*) conducted a survey that identified the Santiago Foothills, a primary example of the Chilean *matorral* ecosystem, as of 'singular relevance in terms of its biodiversity'. In 1998, the Ministry of Housing and Urban Development (MINVU) commissioned a survey of potential natural sites in the Santiago metropolitan area to be considered for conservation status. The results of the survey indicated that 19 out of the 24 sites surveyed were located in the Foothills and confirmed the importance of this ecosystem in the metropolitan region. The Metropolitan Santiago Master Plan (PRMS) administered by MINVU thus classified the Santiago Foothill ecosystem as an 'Ecological Conservation Area', to be "preserved in natural condition, in order to ensure and contribute to environmental balance and quality". A proposed project area of 12,900 ha, bordered by hills to the west which limit the further expansion of Santiago's urban development, the Mapocho and Maipo rivers to the north and south respectively, and a mountain range to the east, is being supported by the World Bank. In the past, the Foothills were used for extensive grazing, topsoil extraction and extraction of firewood and coal from existing sclerophyllous vegetation. Over time, these historical uses have contributed to a reduction in vegetative cover and soil degradation, which in turn are thought to have contributed to a change in the area's hydrology and exacerbated downstream water quality conflicts. The major economic activities in the area are grazing, fruiticulture, and provision of potable water (*Empresa Metropolitana de Obras Sanitarias),* which supplies potable water for part of the municipal district of La Reina, which represents about 20 percent of potable water in Santiago.

Santo Domingo, Dominican Republic. It is estimated that 52 percent of the population of the Dominican Republic do not have access to potable water. The main sources of water for Santo Domingo are located in the Caribbean watershed, the source of the rivers Yuna and Nizao, Yaque del Sur, San Juan and Mijo. Many of the rivers are being polluted by sewage, agriculture and industry. The *Madre de las Aguas* (Mother of the Waters) Conservation Area, consists of five separate protected sections covering more than 323,760 hectares: Armando Bermúdez National Park (76,600 ha), Juan B. Pérez Rancier (Valle Nuevo) National Park (40,900 ha), José del Carmen Ramírez National Park (73,784 ha), Nalga de Maco National Park and Ebano Verde Scientific Reserve (2,310 ha). The Madre de las Aguas shelters the headwaters of 17 rivers that provide energy, irrigation and drinkable water for more than 50 percent of the country's population. The area ranges in elevation from 1,000 to 3,087 meters, making for a high degree of habitat diversity and endemic species. About 90 percent of the conservation area's amphibian and reptile species, 43 percent of the butterfly species, 10 percent of the bird species and 94 percent of the bat species are unique to the area. About 40 percent of plant species in the conservation area are endemic. Cloud forests are the origin of fresh water for much of the country's river systems while montane broadleaf forests provide protection to waterways at lower elevations. At the beginning of the 1900's, forest covered around 85 percent of total area of the country but by 1986 only just over 10 percent remained forested. Since the 1960's, the government has prohibited deforestation in an effort to protect forest resources, but even protected areas remain under threat. Unsustainable logging, uncontrolled fires, slash and burn agriculture, expansion of sun-grown coffee fields and hillside farming are causing soil erosion and significant species loss in the conservation area.

Source: Extract from WWF Alliance for Forest Conservation and Sustainable Use (2003). Running Pure: The importance of forest protected areas to drinking water. A research report for the World Bank / WWF Alliance for Forest Conservation and Sustainable Use. August.

Watershed-based services are usually funded through user fees to finance improved management of the protected area upstream (Pagiola, 2003). Demand for water services mostly originates from downstream water users, including farmers, hydroelectric producers, and domestic water users in urban areas (FAO, 2000). Markets for watershed services are usually local in scope, with most transactions occurring at the watershed level, financing land uses that are generating watershed benefits (Pagiola, 2002). Given the local nature of demand and the presence of a discrete number of well-organized beneficiaries (e.g., water or hydroelectric utilities, irrigation commissions), it is relatively easy to mobilize downstream beneficiaries and involve them in these payment for environmental services (PES)[16] schemes.

A survey of 61 watershed-based payment schemes conducted by Landell-Mills and Porras found that these markets are more institutionalized and rely on a cooperative relationship between demand and supply rather than on competition among service providers and beneficiaries. This survey also found an increased willingness on the part of beneficiaries to pay for services, as awareness is growing on the importance of conservation in upper watersheds for the maintenance of water services (Mayrand and Paquin, 2004). Watershed-based PES schemes are increasingly used and have been put in place in several countries, including the United States, Mexico, Colombia, Ecuador, Costa Rica, Honduras and Brazil.

A well-known example is the *Fondo Nacional del Agua* (Fonag) in Ecuador. Fonag collects contributions from water users, including the water utility of the city of Quito and a hydroelectric power utility, to fund conservation practices in the upper watershed that provides drinking water for the city of Quito (Echevarría, 2002). Also in Ecuador, the municipality of San Pedro de Pimampiro, in the province of Imbabura, is developing a pilot project aiming to protect drinking water sources by paying land users in the upper basin to improve forest management in the watershed (World Wildlife Fund and Danida, 2003). In Cuenca, also in Ecuador, the municipal water company (ETAPA), has begun an integrated environmental management program, and has bought and protected the upper watershed lands that provide drinking water for the city. Currently

[16] The central principles of the payment for environmental services (PES) approach are that those who provide environmental services should be compensated for doing so and that those who receive the services should pay for their provision.

ETAPA has broadened its activities to water treatment and has built the first sewage treatment facility in Ecuador.

Another interesting example of watershed PES is the Heredia, Costa Rica case. In 1998 a provincial state public company in Costa Rica became a public corporation in which municipalities were the shareholders.[17] Since 2000, this company has been charging a drinking water tariff that incorporates the cost of protecting the forests and water basins needed to guarantee users a sustainable water supply, as well as for post service water treatment (Cordero, 2003). The associated program PROCUENCAS, financed by the water tariff, formalizes conservation commitments through ten year voluntary contracts with micro watershed property owners: as of the year 2003, 800 hectares had been incorporated into the program.

2.2 Solid Waste Management

Between 1995 and 2001, per capita daily urban solid waste generation in LAC is estimated to have decreased by 15 percent (PAHO, 2005a). Absolute magnitudes of waste generated, however, have increased: from 275,000 tons per day in 1995 to 369,000 tons per day in 2001,[18] of which 56 percent was generated in large urban centers, 21 percent in medium urban centers and 23 percent in small urban centers.[19] Based on projected urban population growth and assuming current solid waste generation levels, the Pan American Health Organization (2006) projects that by the year 2015, more than 446,000 tons of municipal solid waste will be generated daily in the region.

How is this solid waste managed in urban areas in the region? Are there differences in the quality of waste management systems between larger and smaller urban centers? Or among countries or sub regions? Or within cities? What are the implications for different waste management approaches with respect to urban environmental impacts and sustainable development opportunities?

Municipal level government has been traditionally in charge of providing solid waste management services in Latin America.[20] In general the municipality is responsible for organizing and managing the public sanitation system, which would include infrastructure provision for collection, transport, treatment and final disposal of solid waste services, the administration of these services, as well as the provision for long term technical and financial planning of public santitation services.

Average municipal solid waste[21] generation per person in Latin America is below the waste production levels of developed countries. According to PAHO´s 2005 Solid Waste Evaluation in LAC, the average generation per capita for municipal waste in LAC is 0.91 kg/inhab/day,[22] as

[17] Part of the law which permitted the creation of the public services corporation assigns this company with the responsibility to promote the protection and sustainable management of the natural resources in Heredia.

[18] With regards to hazardous waste, the situation is still more critical in some LAC countries. It is estimated that only in Mexico the total generation of industrial hazardous waste amounts to an approximate volume of eight million tons annually, which does not include mining waste. Even countries with a smaller area and population are in a critical situation. Such is the case of Trinidad and Tobago and Jamaica, whose economies are strongly linked to industrial processes in the energy sector related to the oil industry and natural gas, that carry a large amount of hazardous and non biodegradable wastes. With regards to hospital hazardous waste, a study carried out by PAHO in 21 LAC countries in 1993 estimated that a total of 220,547 tons daily of this type of wastes was generated. Frequently, hazardous wastes are disposed of jointly with municipal solid wastes without any prior treatment.

[19] Large urban centers consist in cities with more than 200,000 inhabitants. Medium sized centers include cities with between 50,000 and 200,000 inhabitants. And small centers are urban settlements with less than 50,000 inhabitants.

[20] In the English speaking Caribbean countries, including Suriname, solid waste management services are directly provided by national level government, usually through Ministry of Health of some autonomous solid waste authority.

[21] Municipal solid wastes include solid waste from residential, commercial, institutional, industrial activities (small industry and crafts), and sanitation of public areas. Household wastes correspond to wastes generated within a house and constitute approximately between 50 to 75 percent of municipal waste.

[22] See Table 1.9, Appendix 1.

compared to that of countries such as the United States (2.02), Australia (1.89), Canada (1.80), Finland (1.70), France (1.29), Japan (1.12) and Spain (0.99) (PAHO, 2006). Table 1.9 in Appendix 1, shows the average per capita waste generation for domestic and municipal waste for different sized population centers in countries in the region. For large population centers (greater than 200,000 inhabitants) the regional weighted average for household waste is 0.88 kg/inhab/day. This average shows a marked increase for centers with a population of more than 1 million (1.04 kg/inhab/day). For medium size population centers, the regional average for household waste is 0.59 kg/inhab/day, without greater differences between 50,000 to 200,000 inhabitants. The regional average for small population centers is 0.54 kg/inhab/day. With regards to municipal waste, the average for large centers corresponds to 1.09 kg/inhab/day, for medium the average is 0.75 kg/inhab/day, and for small centers it is 0.62 kg/inhab/day. Approximately half of the waste generated in LAC is produced by medium and small centers, municipalities that tend to have more difficulty in assuming appropriate waste management strategies.

The Caribbean island states face an unusual growth and development situation due to their limited surface area and their strong dependency on tourism for economic survival. The lack of land resources in the Caribbean islands creates serious competition between housing, transport infrastructure, traditional agriculture and tourism. In recent years, some Caribbean islands have experienced explosive economic growth due to the tourism industry putting pressure on providing basic services and on the environment. In the Caribbean island states, tourism and its contribution to transient population on the islands can have a significant influence in municipal waste generation. Countries such as Barbados, with a stable population of 269,000 receives 800,000 tourists annually with lay days and some 500,000 from cruises, which puts stress on demand for renewable and non renewable natural resources. Barbados ranks within the 10 countries in the world with the most water scarcity, and places it within the six small countries in a risk situation (UNEP, 2003). Other smaller countries such as the British Virgin Islands, with a total permanent population of 20,647, has a temporary population that exceeds 38 percent of its stable population,[23] with the consequent increases in solid waste generation and serious difficulties for its disposal. These small island states are characterized for their fragile and vulnerable ecology, and are therefore easily affected by the dumping of solid waste and wastewater in the environment (PAHO, 2005a).

Regarding the composition of waste, the same PAHO evaluation estimates that the municipal solid waste composition in the region maintains a constant pattern across countries and size of cities: approximately 56 percent of waste is of organic origen, followed in importance by paper and plastics. Regarding the physical-chemical composition of solid waste, element that defines the region´s waste energy value, a high percentage of humidity (40 to 60 percent) and a low caloric power (less than 1.381 kcall/kg) are detected as generalized characteristics. In general, the average energy value and waste humidity in the region make it very difficult to obtain recoverable energy from incineration (PAHO, 2005a).

Regarding greenhouse gas emissions, it is estimated that carbon dioxide (CO_2) and methane (CH_4), the main components of the biogas generated at waste final disposal sites, contribute 55 percent and 15 percent, respectively, to total biogas generated. The National Center for the Prevention of Catastrophes in Mexico, estimates that daily waste in final disposal sites (about 90,000 tons per day), generates 39.77 million m^3 of these gases (op. cit.). The recovery and energy use of methane produced in landfills is carried out in very few countries in the region (Mexico, Chile and Brazil).

Although a direct relationship between inadequate solid waste management and population health has not been established due to lack of adequate epidemiological studies, the unhealthy conditions that undisposed of, or inappropriately disposed of waste constitute a real and potential threat to human health and the environment. Waste not collected that is deposited without any or

[23] Trinidad and Tobago´s temporary population reaches 24 percent, and The Grenadine´s reaches 42 percent.

with inadequate control in the environment originates a broad range of sanitary problems that translate into an increase in the prevalence of diseases such as dengue, leptospirosis and gastrointestinal diseases. The direct and indirect environmental and social costs that represent the production, handling and inadequate disposal of waste to the community are growing in the region and are significant. The environmental impacts are mainly revealed in the contamination of surface and underground waters for public supply and the obstruction of drainage canals due to the uncontrolled dumping of solid wastes in bodies of water. Other important impacts that affect human health are the emission of air contaminants due to open air burning; the incineration of waste without adequate control equipment; the transmission of pathogen microorganisms through water; as well as vectors that transmit diseases. These are in addition to aesthetic and nuisance impacts due to noise and bad odors.

Surface and underground water contamination is very serious in the region especially in areas with water table levels. It is estimated that 50 percent of the population in LAC use underground water as the primary source of water supply, including large cities like Buenos Aires, Mexico City, Lima, Santiago and Sao Paulo. The contamination of urban aquifers is produced mainly by the indiscriminate discharges of agrochemicals, untreated industrial waste, and municipal wastes deposited into the sewage systems. Environmental contamination from leachates is critical in the majority of LAC countries, especially in those areas where storm water and surface and underground hydric resources are abundant. In a few countries in the Region leachate treatment is carried out (Buenos Aires, Caxias do Sul, Curitiba, Rio de Janeiro, Sao Paulo, Porto Alegre, Salvador, Belo Horizonte, Mexico, D.F., Santiago).

Economic and urban development in the region leads to a greater demand of urban sanitation services, which pose an enormous challenge for countries to provide the conditions conducive to the adequate management of waste, and therefore minimizing related environmental and sanitation problems. In LAC, final disposal is one of the most critical aspects of solid waste management.[24] At an urban regional scale, 45 percent of all waste is disposed of in open-air dumps or waterways; 68 percent of all waste is disposed of in an inadequate way (including controlled landfills). This regional average hides variations according to city size and across countries. In large cities, almost 60 percent of solid waste is disposed of inadequate sanitary landfills. In small cities, only 14 percent of waste is disposed of adequately. In these cities, almost 60 percent of all solid waste is disposed of in open-air dumps or waterways. In medium sized cities, only 19 percent of all waste is disposed of adequately. With regards to the final disposal of hazardous materials, the situation is critical in the majority of LAC countries, since it is a common practice in the region to dispose of hospital and hazardous waste together with municipal waste. In LAC, there are secured landfills for hazardous wastes in the following countries: Argentina (8); Barbados (1); Brazil (+50, of which 10 or 12 units are collective use landfills, the remainder are industry landfills for their own use); Chile (8); Colombia (1); Cuba (4); Ecuador (Quito, 1); Guyana (Linden, 1); Nicaragua (1); Mexico (1) and Uruguay (Montevideo, 1).

In the majority of the region´s countries, waste disposal has been traditionally carried out under insufficient technical and environmental control conditions. In Paraguay, close to 50 percent of the solid waste final disposal sites are open-air dumps. In Ecuador, the cities of Guayaquil, Cuenca and Loja have one landfill, but with no environmental monitoring; only the Cuenca landfill is water resistant with geomembrane technology. In Chile, around 45 percent of the total urban population is covered by disposal in landfills; however, 70 percent of the final disposal facilities do not have the corresponding sanitary authorization and only 11 facilities have been approved by the environmental impact system. In Mexico, according to recent research on municipal performance regarding solid waste management carried out by the Mexican Commission for Environmental

[24] See Table 1.10, Appendix 1.

Infrastructure, in more than 100 cities with a population of more than 100,000, no final disposal sites complied with 100 percent of existing environmental regulations, and only 15 sites were ranked above 75 points of a total of 100 (PAHO, 2005a).

National averages mask the situations prevalent in the region´s slums and urban marginal neighborhoods. In many cities of the region, the poor and indigent live in outlying impoverished areas that lack basic public service infrastructure, including waste collection. Environmental and health conditions can be dramatically poor in these areas. In addition, the economic and social impoverishment in these settlements force many families to use waste as a survival strategy, via street recollection or scavenging in dumps, with the associated health risks.

BOX 6
INFORMAL WORKERS IN THE SEGREGATION AND RECYCLING OF WASTE MATERIALS

The large number of open-air dumps that exist in the Region easily allows for segregation and recovery of materials, especially in large cities, with all the sanitation risks it implies. In almost all the large and medium size cities in the region, in practically all LAC countries, segregators work at waste generation sites and sources, in public streets, in collection trucks and in final disposal sites. Segregators sell mainly cardboard, paper, glass, plastic and metals to intermediaries that transport these materials to recycling companies. When waste recovery occurs at waste generation sites and sources, especially when institutional or from markets, worker sanitary conditions are usually acceptable; this is in contrast to the severely unsanitary conditions for waste recovery from containers or bags deposited in streets, as well as in final disposal sites.

Brazil. In Brazilian cities such as Recife, Porto Alegre, Rio Grande do Sul and Belo Horizonte, waste segregators (for both street and final disposal site) are organized into associations and cooperatives which work with the municipality in selective collection programs. The PAHO Waste Evaluation reports that in some regions in Brazil, there are nearly 25,000 people working as segregators at final disposal sites, of which at least 22 percent are less than 14 years of age.

Mexico. In this country, there are between 25,000 to 30,000 segregators working at the final disposal sites, whose average age is almost 40 years old; there are proportionately more women working as segregators (1.12 women to each man working). The life expectancy for segregators in Mexico is less than 50 years as compared to the national average of 76 years.

In **Paraguay,** there are approximately 3,600 segregators, of which half operate in the main dump in the city of Asuncion. About 1,200 of these are organized in cooperatives.

In **Colombia**, the Bogota Recyclers Association estimates that around 41,500 families made up of 249,000 people informally work in the collection and transportation of waste for recovery purposes. Accordingly, there are 107 cooperatives and association groups that make up a total of 51,000 persons that carry out organized work at waste generation sources (industry, home, commerce). These organized groups also provide sanitation services to urban centers, private companies, transportation terminals and some shopping malls, especially in the cities of Bogota, Cali, Medellin, Manizales, Armenia and Rionegro, and they have participated in the discussion and preparation of solid waste management plans for the cities of Bogota, Cali and Manizales.

In Argentina, as a result of the 2001 crisis, it is estimated that only in the city of Buenos Aires, more than 20,000 "cardboard recollectors" (cartoneros) arrived in the city every night to segregate recyclables from plastic bags placed in sidewalks.

In **Chile**, 3,500 to 6,000 people work in the segregation activity at final disposal sites. The prohibition of access to the landfills in the Metropolitan Region of Santiago has influenced in the decrease in the amount of segregators at these sites; however, segregation at dumps occurs all over the country. Informal recycling is also being done by independent collectors (*cartoneros or cachureros*) that collect waste at the place of origin in order to later classify it and sell it to intermediaries or to recycling industries. Each collector can collect around 100 kg of waste daily, mainly paper, cardboard and glass.

Ecuador data shows about 3,500 segregators working in the big cities.

In **Honduras,** in the three cities with the largest population, there are 500 people working in dumps, of which 30 percent are women and the number of children, easily constitute about the same ratio.

In January 2003, the First Latin American Segregators Congress took place in Caxias do Sul, in which more than 800 persons from Brazil, Argentina and Uruguay participated. One Congress objective sought the strengthening of workers´ organization in associations and cooperatives. The Congress outcome was the Caxias do Sul Charter, proposing a series of measures to improve waste management opportunities for informal workers. These included training and professional education, the review of the legislation related to cooperatives, proposals for the eradication of open air dumps, the definition of waste generators´ responsibility in the appropriate disposal of waste, credit facilities, among others. Integration of segregators into municipal collection programs has been limited however. To date, only 451 municipalities (8.2 percent) of a total of 5,507 Brazilian municipalities have integrated segregators to selective collection activities.

Source: Pan American Health Organization (PAHO) (2005a). Report on the regional evaluation of municipal solid waste management services in Latin America and the Caribbean. PAHO, Washington, D.C.

Formal segregation and recovery of recyclable materials is not carried out at a large scale in LAC. For the majority of the wastes produced in LAC, recycling is not economically attractive and less than 3 percent of household and commercial solid wastes from the region are recycled. PAHO´s Solid Waste Evaluation estimates that nearly 2.2 percent of total waste materials are recovered from garbage: 1.9 percent corresponds to inorganic recycling and 0.3 percent to organic waste recycling. Informal recycling (recovery before collection or in different phases of waste collection and disposal) is, however, widely promoted in Latin America. This activity has increased in countries that have experienced rapid and deep economic crisis, such is the case of Argentina and Uruguay.

Mexico City has, since 1994, solid waste selection and recovery plants with a total capacity of 5,500 tons per day and with an average recovery potential of 5.3 percent (291.5 tons per day). The plants are built as part of a system oriented towards by-product recycling; the systems seeks to extend the life cycle of final disposal sites, create employment sources, improve the quality of life of informal segregators and help in environmental conservation. Plants receive subsidies for investment expenses, and for operating and maintenance costs. Additionally, the National Recyclers Institute exists, which has a membership of more than 500 recyclers in the country, which recover different by-products with a commercial value. Colombia stands out as the Latin American country that has traditionally had the highest recycling rate in paper and cardboard in Latin America, eighteenth at a world level, with 57 tons recycled for each 100 produced, surpassing the United States that recycles 31 tons, Germany with 50 tons and Japan with 53 tons. It is estimated that in Ecuador approximately 40 percent of the paper and cardboard available is recovered through recycling. In Chile, in the Metropolitan Region of Santiago approximately 50 percent of paper and cardboard generated is recycled, around 10,000 tons per month (close to 50 percent of these materials are recycled in the country); approximately 2,000 tons per month glass, with which 33 percent of the glass containers are produced; close to 1,000 tons per month of thermoplastics and close to 50 percent of industrial waste (43,000 tons per month) is recycled within and outside of the industry (CONAMA, 1999).

Due to the fact that space is limited in the Caribbean islands, the few alternatives for disposal in landfills have intensified other waste treatment alternatives oriented towards minimization and recycling. Thus, recycling programs have increased in recent years (Antigua and Barbuda, the Cayman Islands, Dominica, Grenada, the Grenadines, Saint Lucia and Saint Vincent, and Trinidad and Tobago).

BOX 7
SMALL AND MICRO ENTERPRISES, AND COOPERATIVES IN SOLID WASTE MANAGEMENT

In several countries in LAC, the participation of private small and micro enterprises in solid waste collection has been increasing. The advantages of these companies reside in the intensive use of labor, the use of very low cost technologies and the promotion of greater community participation to facilitate the materials collection and separation at the waste generation source.

In Bolivia, the participation of micro enterprises in providing sanitation services dates back to the 1980s and is concentrated in the cities of Cochabamba, Santa Cruz de la Sierra, Trinidad, La Paz and Sucre. In both La Paz and Sucre, these services have shown greater business development and stability. Solid waste management cooperatives, even though not widely promoted in the region, provide services to an important number of the population, mainly the poor. In Salvador, Bahia, Brazil, the Recycling Cooperative (COOPCICLA), recycles at the waste source, through selective collection, and is sponsored by the Metropolitan Project for the Metropolitan Region of Salvador. The project considers a deposit construction for selection and storage, equipment acquisition and training for recyclers. Furthermore, in various cities, cooperatives work with local authorities to provide sanitation y recycling services: Porto Alegre (Rio Grande do Sul), Santo Andre (São Paulo) and Curitiba (Parana). Colombia´s experience in solid waste management cooperatives has been organized through the National Recyclers Association, a national organization that clusters 78 local cooperatives and pre-cooperatives: “Rescue” in Bogota dedicated to the selective collection at the source of recyclable materials from offices, industry, hotel and other commercial entities; “Prosper” in Manizales that in addition to recycling has public sanitation activities; and “Recovery” in Medellin in waste management at a municipal level as well as in the private sector. The Recovery cooperative is ISO 9001/2000 certified to provide services.

In the early 1990s, Porto Alegre and Belo Horizonte were the pioneer Brazilian capitals in the implementation of participatory solid waste management models, that together with other initiatives in this area, served as the basis for the

Waste and Citizens Program. This program advocates for the social mobilization and organization of the community for their broad participation in waste management, especially for selective waste collection. In 1998 the National Waste and Citizens Forum was created as an integral part of the program, with the participation of 19 public and private institutions that are directly or indirectly linked to solid waste management. The Forum seeks to stop waste segregation by children and adolescents and improve technologies for the final disposal of solid waste in Brazil. Waste and Citizens state forums have been progressively created in Bahia, Pernambuco, Ceara, Sergipe and Maranhao, and in Sao Paulo.

Source: Pan American Health Organization (PAHO) (2005a). Report on the regional evaluation of municipal solid waste management services in Latin America and the Caribbean. PAHO, Washington, D.C.

The LAC countries are in different stages of development in the solid waste sector. At national levels, health and environmental ministries have begun to define regulatory frameworks for the sector and its services. At local levels, municipalities continue to provide waste management services, whose operation adopts different modalities. Among them, the private sector has been acquiring greater importance, not only in providing urban sanitation services, but also in investments to develop the solid waste sector; although frequently with a municipal counterpart with limited supervisory capability. In small municipalities, this limitation is even more severe and is exacerbated by limited financial resources. The most critical limitation to improve solid waste management in the Region is the lack of a national governing institution with sufficient authority to provide effective orientation to the sector. When this governing function exists, it is partial and scattered among public institutions in the majority of the Latin American countries, with the ensuing gaps in political management and coordination of the sector to formulate and implement policies, plans and programs in the matter of solid waste at a national level, with the corresponding harmonization required for delegation to subnational levels.

2.3 Urban Air Quality and Urban Transport

2.3.1 Air quality

Urban inhabitants in Latin American mega cities and large metropolitan areas, as well as increasingly in medium sized and smaller cities, are exposed to air pollutants that surpass recommended limits. In Mexico alone, approximately 25 million people are affected by air pollution. Cifuentes (2005) surveys available air quality data for 46 cities in LAC.[25] At the time of this study, twenty six of these cities, containing 85 million people (of which 28 million were children less than 18 years of age) out of the almost 100 million population of the cities considered in the study´s universe, were exposed to particulate concentrations above internationally accepted levels.[26] For many of them (18 million, 6 of them children), the excess was notably large (more than twice the US standard at that time).

Current WHO standards are considerably stricter than those used in the Cifuentes study.[27] The evidence on airborne particulate matter and public health is consistent in showing adverse health effects at exposures experienced by urban populations in cities throughout the world, in both developed and developing countries. The range of effects is broad, affecting the respiratory and cardiovascular systems and extending to children and adults and to a number of large, susceptible groups within the general population. The risk for various outcomes has been shown to increase

[25] See Table 3.

[26] According to Cifuentes, the 2005 US standard for PM10 is 50 μg/m3 (annual average), which is consistent with the standard adopted in many LAC countries.

[27] In 2006, the World Health Organization released new guidelines for average annual level of PM10: these aim for less than 20 micrograms per cubic meter (annual average) to prevent ill health.

with exposure and there is little evidence to suggest a threshold below which no adverse health effects would be anticipated. The epidemiological evidence shows adverse effects of particles after both short-term and long-term exposures (WHO, 2005). Considering current WHO standards, the entire population universe surveyed in Cifuentes study would be exposed to air pollutants that surpass recommended limits (almost 100 million persons living in cities in LAC).

Main ambient pollutants are carbon monoxide (CO), nitrogen oxides (NOx), sulfur dioxide (SO2), tropospheric ozone (O3), and particulate matter (PM). Transport activity is a key source of direct and indirect pollution, especially in larger cities, but also increasingly in medium sized cities. The transportation sector is estimated to account for over 40 percent of PM10[28] emissions in Mexico City, 86 percent of PM10 emissions in Santiago (the latter including direct emissions from combustion and indirect emissions from paved and unpaved roads), and over 75 percent of NOx emissions for both cities (O´Ryan and Larraguibel, 2000). Emissions from fixed sources only account for 7 percent and 14 percent in Santiago (for PM10 and NOx) and around 15 percent and 12 percent in Mexico City.

Fuel quality -particularly sulfur content in gasoline and diesel fuel- is a key factor that determines the amount of SO2 emissions, which contribute to PM10 when converted in the air to sulfates. As a comparison, sulfur contents in diesel fuel in Brazilian cities reach up to 1000 ppm, while in Mexico City these are currently 50ppm and in Santiago, Chile these have been reduced from 500 to 300 ppm in 2001 and to 50ppm in mid 2004 (Walsh, 2005). Prior to 2006, US and Canadian standards limited sulfur contents in diesel fuel to 500 ppm. Since then, stricter reduction targets have been implemented for both countries. By around 2015, all diesel fuel will be limited to a sulfur content of 15ppm. In Europe, since 2005, the maximum limit for sulfur content in diesel fuel is 50ppm. Moreover, the European Union es expected to confirm a final reduction target of 10ppm (EURO V fuel standard) for 2009.

As to ozone pollution, Sao Paulo, Santiago, and the Valley of Mexico showed decreasing trends of between 20 and 30 percent at the end of the 1995-2000 period for which systematic measurements were made. However, in 1999-2000 concentrations of ozone in the three metropolitan areas remained above the norm for between 18 and 88 percent of the time, and Mexico City experienced the most serious problems (UNEP, 2003).

Pollution from expanding transportation networks is exacerbated by older transportation fleets (often diesel-fuel buses), low vehicle turnover (10-20 years), inadequate vehicle maintenance, and traffic congestion. Excess circulation of buses in off-peak hours due to the need to finance the fixed costs of small bus owners adds significantly to emissions in some cities. Insufficient or inadequate public transport and the horizontal expansion of cities, with people living far away from where they work, also influence emission levels.

As stated, other key emission sources include industry and dust from roads. The second main source of pollution in Latin America comes from industrial activities. In several cities, industrial activity is still an important source of air pollution emissions. However several larger cities have attacked the problem by imposing and enforcing emission standards for industrial sources. Such is the case for example, for Santiago and Mexico City as well as in Quito and Bogota. However there are still some cities with heavy industrial air pollution such as Cubatao in Brazil.

In certain specific areas the air pollution problem is not related to vehicles or industrial activity, but rather to residential use of fuel wood for cooking and/or heating as in Temuco and other mid sized cities in the south of Chile and some Central American countries; forest fires such as in Central America; or even volcano eruptions as in Quito, Ecuador in 1999 (UNEP, 2003).

[28] PM with an aerodynamic diameter less than 10 μm.

Many cities in this region also have topographical and meteorological conditions that can prevent emitted pollution from dispersing, allowing the buildup of pollutants.[29]

Since growth in income for developing countries in LAC is expected, it is very likely that vehicle-related emissions will increase significantly as more people have access to cars. According to the World Business Council for Sustainable Development, the vehicle fleet in LAC is projected to triple in the next 25 years, from around 60 million cars to almost 150 million in 2030 (2004).

TABLE 3
PM10 MONTHLY AVERAGE CONCENTRATIONS IN LAC CITIES [a], AROUND 1995-2003

Country	City		Period	Population (2000)	PM10 Period Average (µg/m^3)	Monthly Maximum (µg/m^3)	TSP [b] Annual Average (µg/m^3)
Argentina	Buenos Aires	B	1997-1998	8 680 000	-	-	188.5
	Cordoba	B	1987-1992	1 368 000	-	-	154.0
	Mendoza	B	1997-1998	846 900	-	-	31.2
Brazil	Campinas	A	1997-2003	969 400	42.9	69.0	-
	Canoas	A	1997-2003	306 100	25.4	41.9	-
	Cubatao	A	1997-2003	775 500	65.3	90.0	-
	Curitiba	B	2000-2001	108 300	-	-	51.0
	D. Caxias	B	1986-1993	1 587 000	-	-	115.6
	Itaguai	B	1989-1996	82 000	-	-	35.6
	Porto Alegre	A	1997-2003	1 361 000	44.8	53.8	-
	Rio de Janeiro	B	1986-1996	5 858 000	-	-	128.1
	Sao Paulo	A	1997-2003	1 0430 000	49.0	72.2	-
	S.J. Meriti	B	1986-1996	449 500	-	-	182.4
	Sorocaba	A	1997-2003	493 500	30.5	47.3	-
	Vitorio	A	1997-2003	292 300	27.8	31.9	-
Chile	Calama	A	1997-2003	138 400	61.4	71.8	-
	Santiago	A	1997-2003	5 408 000	82.0	117.7	-
	Temuco	A	1997-2003	245 300	43.8	68.1	-
Colombia	Bogota	A	1997-2003	6 866 000	59.3	77.4	-
	Cali	A	1997-2003	4 318 000	43.4	45.9	
Costa Rica	Heredia	B	1996	98 500	76.5	-	228.3
	San Jose	B	1996-1999	309 700	53.0	-	200.0
Ecuador	Guayaquil	B	1994-1995	1 985 000	-	-	120.7
	Quito	B	1994-1998	1 399 000	59.5	-	200.1
El Salvador	San Salvador	B	1996-1999	479600	62.7	-	189.4
Honduras	Tegucigalpha	B	1994-1999	850200	79.4	-	452.7
Jamaica	Kingston	A	1997	655 000	69.0	-	-
Mexico	Guadalajara	A	1997-2003	3 772 000	58.0	79.2	-
	Juarez	A	1997-2003	1 219 000	65.9	103.3	-
	Mexico City	A	1997-2003	19 220 000	60.2	94.6	-

29 Such as the thermal inversions typically observed in Mexico City and Santiago.

(Table 3 Concluded)

	Monterrey	A	1997-2003	3 280 000	67.0	112.0	-
	Puebla	A	1997-2003	1 272 000	56.7	74.8	-
	Valle de Toluca	A	1997-2003	1 253 000	48.6	80.0	-
Nicaragua	Managua	B	1996-1999	864 200	60.9	-	313.8
Panama	Panama City	A	1997-2003	825 300	77.1	93.2	
Peru	Lima	B	1999	7 501 000	146.4	-	165.8
Uruguay	Montevideo	B	1998-1999	1 381 000	-	-	253.3
Venezuela	Caracas	B	1986-1995	1 836 000	-	-	67.8
Total Urban Population City Universe			98 783 700				

Source: Cifuentes, Luis A., Alan J. Krupnick, Raúl O'Ryan and Michael A. Toman (2005). Urban Air Quality and Human Health in Latin America and the Caribbean, Working Paper. Inter-American Development Bank. Washington, DC, October. http://www.iadb.org/sds/env

[a] Per Cifuentes, based on expert judgment the air quality situation is presented for 21 cities with reliable information (type A cities), and for 18 cities with data that are more uncertain but that are expected to reflect typical annual averages (type B cities), for a total of 39 cities. The data are the result of a combination of readily available data from internet, communications with local experts in Latin American cities and expert opinion on the quality of the data from the research team. An effort was made to include all major cities for which experts concur there are or could be air pollution problems and to ensure that the information for the key cities considered is of reasonable quality.

[b] TSP : Total Suspended Particulates. Medition of total suspended particulates occured prior to improved medition technolody in LAC. Current meditions are for PM10 and fine particulate matter.

Much of the population in LAC faces a double environmental burden. Malnutrition, lack of access to health services and other ills related to poverty may render the population more susceptible to developing adverse health effects from air pollution. How far socioeconomic status modifies the effects of air pollution on health still warrants attention. Temporal variations in ambient PM10 concentrations have been associated with increased daily mortality. In Sao Paulo, a 1995 study shows how the death rate of adults living in more polluted zones was 13 percent higher when suspended particulate concentrations were relatively high. In Lima, in 1998, more than 90 percent of medical admissions of children under 5 was due to respiratory infections, many of which can be attributed to air pollution and specifically to transport sector emissions. According to a study by the Peruvian Institute of Pneumology, one out of two transit police suffer from respiratory problems. And in Santiago, 4,000 people die prematurely every year from causes related to air pollution: approximately 1,700 of which are due to prolonged exposure to suspended particulates (UNEP, 2003).

The Cifuentes (2005) study estimating potential health benefits to emissions reductions for 46 cities in LAC, finds that the effects on health of these excess pollution levels are quite significant. Limiting the analysis only to cities with PM concentrations above the US standard, the reduction of concentrations to the level of the standard would avoid on the order of 10,500 to 13,500 premature deaths as well a host of illness incidents, reduced activity days, and lost productivity. The premature deaths avoided from this air quality improvement would occur across the age distribution but would be especially important for more sensitive elder and child populations (by some of their estimates, 10,000 and 2,500 excess deaths avoided in these groups, respectively). The total premature deaths avoided would be on the order of 2 to 2.6 percent of total deaths per annum in the cities considered.

Several countries including Brazil, Mexico, Colombia and Chile have regular monitoring programs that have followed United States Enviornmental Protection Agency guidelines. Cities with air quality measuring systems have introduced new technologies to expand their capacity to prevent episodes exceeding the permitted thresholds. Mexico City, Santiago and all large Brazilian cities have established standards similar to those of the World Health Organization, although they are more tolerant to burning coal and sulphur dioxide (Cifuentes, et al, 2005).

An increase in emissions may be offset by taking old vehicles out of circulation, raising the price of petrol and switching to alternative fuels (such as hydrated ethylic alcohol or liquid or natural gas instead of petrol). Several of these measures have been promoted in Brazil since the 1980s and in Mexico since the mid- 1990s. In addition, most countries in the region are phasing out the use of leaded gasoline. By the end of 2001, there were 23 countries in Latin America and the Caribbean with lead-free petrol and, compared to 1990, the region as a whole had achieved a reduction of 90 percent in atmospheric emissions of lead from petrol (UNEP, 2003).

The regional Clean Air Initiative (as part of the global World Bank project) is the principal regional program on air quality improvement in Latin America, providing both city specific planning and program development, as well as training in issues in the area (valuation of alternative air quality improvement measures; monitoring and measurement; sustainable transport; case studies, among others). Three regional success stories are generally accepted reference cases in the Region: Sao Paulo, Brazil; Santiago, Chile; and Mexico City. The later two of these cases are reviewed in Box 8.

BOX 8
SANTIAGO, CHILE AND METROPOLITAN MEXICO´S AIR POLLUTION CONTROL PROGRAMS

In Chile, the Plan to Decrease Air Pollution in the Metropolitan Region was initiated in 1990 and revised in 1997, and in 2004. The plan's strategies included regulating household and industrial emissions, introducing taxes, removing highly polluting buses, controlling bus circulation and emissions, introducing automobiles with catalytic converters, improving fuel quality, and paving streets (O'Ryan and Larraguibel, 2000). In addition, the government introduced a system of transferable pollution permits, which industries could buy or sell to reduce their total emissions. An assessment of the plan's implementation revealed that almost 60 percent of proposed actions were successful. As a result, both the emission of particulates and the number of days when alerts were sounded or emergencies declared have been reduced significantly. Between 1989 and 1999 concentrations of suspended particulates, for example, fell by 24.1 percent for those smaller than 10 micrometers and by 47.4 percent for those smaller than 2.5 micrometers.

In 1995-99 the entire population of the Mexico City metropolitan area was exposed to annual average concentrations of PM10 exceeding 50 micrograms per cubic meter, the annual average standard in both Mexico and the United States. The daily maximum one hour ozone standard was exceeded at least 300 days a year. Assessments for the period 1991-1999 reveal that the concentrations of carbon monoxide, sulfur dioxide and lead tended to remain below the limits established during that period. In the case of ozone, although there is a trend to reduce concentrations, levels above the standard were registered on many days throughout the year; the concentration of suspended particulates, increased in the period 1995-2000. In early 2004, more than 3.5 million vehicles plied city streets, 30 percent of them more than 20 years old, and 79 percent of them, private automobiles. In 1990, 1.7 million vehicles were registered in the metropolitan area.

In Mexico, the Comprehensive Program Against Air Pollution (PICCA) in the Valley of Mexico (1990 to 1995) and the 1995-2000 Program to Improve Air Quality in Mexico City (PROAIRE) permitted the implementation of substantive air pollution control measures in the areas of transportation (electric transportation system support), industry (emissions levels restrictions by industry type and monitoring systems), and fuels (quality improvement including elimination of lead, use of a catalytic converter, improvement of combustion through increased oxygen levels, stricter restrictions of sulfur volumes in diesel fuels, among others). The enforcement of compulsory engine maintenance standards was also a goal of the air quality improvement measures. Measures were complemented by institutional modernization of environmental governance structures at the city level, including the creation in 1996, of the Metropolitan Environmental Commission.

Improving air quality in Mexico City -in spite of persistent difficulties- required institutional capacity building; improvements in regulatory, communications and citizen participation mechanisms; and strengthened integration of metropolitan policies. Citizen participation has proved to be of fundamental importance. Other initiatives include: the establishment of the Valley of Mexico Environmental Trust Fund, to finance air quality improvement programs through a tax on petrol; the Automatic Environmental Monitoring Network; environmental emergency programs; a Day Without a Car vehicle restriction program; an epidemiological surveillance system; a reforestation program; and·environmental education in the Mexico City metropolitan area.

With the implementation of PROAIRE III (2002-2010), the third major air pollution control program for Mexico City, ozone and PM10 concentrations have been reduced. Measures which influenced positively in these reductions include: improved enforcement of vehicular maintenance,[30] increased number of vehicles with catalytic converters; improved monitoring and enforcement of the 300 most polluting industries; improved public transportation systems; and the renovation of the taxi fleet to more modern vehicles. In 2005-6, environmental regulations relating to improved fossil fuel quality – cleaner fuels -- and emissions controls for new vehicles – cleaner vehicles – were implemented. Additionally, alternative fuel use is being promoted for vehicles in the public transport system; and intra urban freight regulations are being implemented.

Sources: United Nations Environmental Program (UNEP) (2003). GEO - Latin America and the Caribbean. Regional Office for Latin American and the Caribbean/UNEP. Costa Rica. November; Mexico City in Movement. EMBARQ. The WRI Center for Transport and the Environment; and Vergara, Walter. "Reducing GHG in Transport: The Mexico City Transport Corridor Project" World Bank Environmental Department, www.embarq.wri.org.

2.3.2 Urban Transportation

In the metropolitan area of the Valley of Mexico alone, transportation accounted for 57 percent of CO_2 emissions in 2002, followed in magnitude by industry (33 percent) and residential/commercial sources (7 percent) (Vergara, no date). Inefficiencies in the urban transport sector generate serious environmental impacts in urban air quality.

The relation of urban transport and the sustainable development agenda is clear: this urban sector has both macro and micro links to the agenda. With high levels of urbanization in LAC, and a growing share of GDP being generated in cities, local public services increasingly affect business costs, thus influencing potential gains from agglomeration. Urban transport, in this context, is a crucial service. On a micro level, urban transport represents a high percentage of household expenditure, and is often higher than all other utilities combined (World Bank, 2005). The poorest group, however, may not use transportation at all: in Santiago 45 percent of the poor walk as compared to other transportion alternatives (bus: 29 percent; car: 13 percent; metro: 3 percent; other: 10 percent). Similar statistics are valid for Sao Paulo, Brazil (World Bank, 2005).

Current main sector issues are related to economic and population growth, the expansion of city limits, increasing motorization and car ownership and use, and a lack of coordination of urban planning and transport. In a context of rapid urbanization, traffic congestion is growing, as is air and noise pollution. In metropolitan regions, in general, there is a lack of coordination between levels of government. Public transport organization is often chaotic, with poor performance levels, leading to decreases in demand, revenues and higher costs per passengers. Transport operators show poor financial performance, and pressure for public subsidies. A rise in the informal sector in urban transportation (vans) is seen in the region, as are increased fares and reduced frequencies. Cars are becoming more attractive for higher income sectors. In Brazil, the increase in the motor vehicle fleet between 1990 and 2005 was 130 percent, in Chile, 120 percent, and in Mexico, 110 percent (ECLAC, 2006). For low-income users, accessibility, affordability, availabililty and acceptability have become key issues. From a sector perspective, targeted versus general subsidies for low income users become an issue as does overall urban transport financing.

Public policy for sustainable transportation systems must integrate urban transport and land use planning strategies creating a denser, high quality urban fabric, combined with activity nodes that are dense and that blend multiple uses – housing, employment, services, public space, etc.– and good public transportation between nodes. This implies the reorganization and improvement of the public transportation system (network layout, incorporation of high capacity modes on trunk corridors, modal service and fare integration); the development of financing mechanisms to ensure

[30] CO_2 emissions have been markedly reduced since the beginning of the 1990s, according to the remote monitoring of vehicle emissions.

long term financial sustainability (regulatory mechanisms, fare adjustments); as well as private sector participation in operations and investment.

World Bank Global Environmental Facility (GEF) projects are promoting integrated transport sector and pollution control strategies. Planning for urban transport, with an emphasis on public transport systems in a context of high urban densities with key site developments, and strategies to integrate transport modes, as well as road pricing and fuel taxes to create incentives for sustainable transportation use behavior are being promoted to control and reduce city vehicle use. These policy options are combined with measures to control and reduce emissions per vehicle per kilometer traveled, including: inspection and maintenance programs for vehicles; standards for new vehicles; fuel quality standards; high-use fleet upgrading programs; bus route licensing schemes; and tax incentives for clean vehicles and fuels. Examples of current GEF projects are the promotion of bicycle use in Santiago, Lima, Bogota and Sao Paulo; the modernization of bus systems in Santiago, Lima, Mexico and Colombia; the integration of land use policies in Santiago and Sao Paulo; and congestion pricing, freight management; and decontamination bonds in various regional cities.

Congestion means increased exposure to pollutants. The measures taken to reduce congestion in the region have been aimed at both transport supply (separate lanes, higher-quality buses, organization of intersections, coordination of stoplights) and demand (limitation of parking spaces, education, use restrictions) (Bull, 2003). An interesting example of the latter are some of the initiatives implemented by the Sao Paulo (population 17 million) municipal transit company, which has shown notable progress in maintaining traffic flow: transit security education to children, youth and adults; varied starting times of different city activities; and vehicle use restrictions. Use restrictions have been applied during peak hours in the central part of the city. These measures have been shown to significantly reduce congestion and increase traffic speed. Benefits have been estimated at US$ 2 million 570 thousand per operating day (78 percent corresponds to saving time and 10 percent to reduction in fuel consumption).

BOX 9
SUSTAINABLE TRANSPORT STRATEGIES IN MEXICO CITY.

Almost 20 million people live in the MCMA (Mexico City Metropolitan Area). This city ranks among the top five cities with the worst congestion/pollution combination in the world. Each day, 29.1 million daily passenger trips occur within this metropolitan area. In 2004, close to 4 million registered private vehicles (including 100,000 taxis) make 17.6 percent of the total daily trips, and contribute to 90 percent of total street congestion and 50 percent of all transport-related emissions. Around 2.5 million days are lost from work annually due to transport related issues. A total of USD$10 billion is lost annually from time lost in traffic; the average commute in 2004 was 2.5 hours. Four thousand premature annual annual deaths have been attributed to air pollution and 2,500 deaths per year from traffic accidents. Traffic accidents are the primary cause of child mortality for 5-14 year olds. And riders in public or private transit vehicles are exposed anywhere from 2 to 6 times higher concentration levels of air pollutants than in the open air. Eighty four percent (84 percent) of air pollution in MCMA is transport related.

The *Centro de Transporte Sustentable*, in conjunction with the World Resources Institute Center for Transport and the Environment, and city government, developed a four prong approach to develop sustainable transport systems in Mexico City.

1. Bus Rapid Transit (BRT) on the city's primary avenues. The strategy´s objectives included:

• The reduction of transportation's impact on the environment

• The integration of public transportation systems within the State of Mexico

• The promotion of a modal change through the creation of metropolitan corridors

• The reinforcement of the public transportation system through design and implementation of bus priorities

• The support of technical improvements in the transport sector by introduction of cleaner and more efficient technologies and organizational systems

• The transformation of the industry/market structure by providing adequate incentives to service providers

BRT Sustainable Development Impacts		
Economic	Environmental	Social
Increased productivity from time not spent in traffic (approx. 50 percent average reduction in net commute time along corridor)	Improved air quality	Reduced respiratory illnesses (specifically for lower income, public transport users)
Approximately 90 percent cost savings per kilometer compared to metro construction	Estimated from 35,000 to 70,000 annual tons of CO_2 reduction	Increased public safety and quality of life
Decreased public healthcare costs from reduced respiratory illnesses	Reduced consumption of non-renewable resources	Strengthen city pride, image and guide Mexico City towards urban sustainability
Reduced fuel consumption costs for city	Reduction of noise pollution	Increased access to reliable transport
Increased tax revenue for city from formalized transport system		Reduced congestion
Increased real estate value in corridor accessible areas		

2. Diesel Retrofit: of the city's heavy-diesel bus fleet with catalytic converters and ultra low sulfur diesel after proving significant emissions reductions.

3. Test Clean Fuels and Buses: Testing of best engine/fuel combinations for new high-capacity, low emission transit buses for future city purchases.

4. Non-Motorized Transport: Promotion of walking and cycling as sustainable transportation alternatives through integration to other modes of transport, public awareness efforts and continuous proposals to city authorities. This project included technical consulting to city authorities for the improvement of more than 90 Km. of bicycle lanes, among other aspects.

Source: Extract from Mexico City in Movement. EMBARQ. The WRI Center for Transport and the Environment.

The Curitiba and Bogota experiences are two well-known regional success stories in city wide urban planning and transport system improvement. One of the key success factors in the city wide massive transport systems interventions via buses in Bogota (Transmilenio) and in Curitiba was the integration of land use planning and transport issues, as key components of sustainable urban development plans and processes that actively incorporated public actors, the private sector and the citizenry (Boletín FAL, 2002). Strong, longer term, and well informed local leadership (mayors) was also important to successful implementation.

BOX 10
TRANSPORT INITIATIVES IN BOGOTÁ, COLOMBIA. TRANSMILENIO

In 2003, the total urban population of Bogota reached around 7 million persons. At that time, nearly 32,000 public transport vehicles served 72 percent of the population; while 1 million cars transported 19 percent. In the late 1990s, the city developed a four-part transport strategy, incorporating transport network planning, a public space system, integrating parking areas, and a public transport system.

The first phase of the reorganized transport system, Transmilenio, was inaugurated in late 2000, and was structured in high speed, schedule based, principal axes services, operating in segregated lanes, and fed by buses that connect nearby neighborhoods to terminals. These principal axes services are integrated into other public transport lines, at terminals and various intermediate stations. Articulated buses are used that operate both in ordinary and express modes. Payment is via intelligent cards, administered by a specialized company. A Global Positioning System centrally controls and manages bus locations. Costs are far less than those of metro systems, although Transmilenio operational characteristics are quite similar to these types of systems; a year and a half after its inauguration, the systems transports some 700,000 passengers per working day. Transmilenio has successfully positioned itself among Bogotá's citizenry as a city development project. The Urban Development Institute, the Secretary for Public Works, the Secretary for Transportation and a small, high tech company called Transmilenio S.A manage Transmilenio. The private sector is a key player within the system; as concessionary of bus operations, tariff collection and fiduciary agent.

Since 1998, the program "Pico y placa", (automobile use restrictions during peak congestion hours and socialization of transport alternatives), has been operating in Bogotá. With restrictions of four license plate digits during morning and afternoon peak circulation periods, average traffic speed has increased by 43 percent, fuel consumption has reduced by 8 percent, and air pollution has been reduced by 11 percent. Complementary measures to create incentives to walk (sidewalk recuperation) and to use bicycles (a system of bike paths), as well as the Transmilenio effort have been implemented as well. On Sundays, 150 kilometers of streets are closed to automobile use, and opened as bikeways. Finally, the first Thursday in February has been named the day without cars, and the citizenry is invited not to use their automobile, proposal that has received much approval in the city.

Source: Hernández A., "Bogotá, una ciudad vivible, (http://www.cepal.org/Transporte/noticias /8/9178/ Bogot_viv.doc), March 2002; Sandoval, E, "Concepto integral del espacio público y la movilidad urbana. Enfoque de la ciudad de Bogotá. Caso específico: Transmilenio", document presented at international seminar in Caracas, 2001 and electronic edition of El Tiempo, "15 buses más para TM", (http://eltiempo.terra.com.co/bog/2002-07-25/index.html), July 25, 2002.

2.4 Energy Issues in Cities

Energy concerns within human settlements are highly conditioned by LAC regional energy sector issues. Urban specific initiatives regarding energy consumption and policy are incipient in the region, and are in general, driven by national energy security concerns and climate change mitigation strategies.

According to projections by the International Energy Agency, energy demand is expected to double in Latin America and the Caribbean in the next 25 years: by 2025, total energy demand is expected to reach 43 percent of the global total, nearly equaling levels of the industrialized countries (Leal and Samaniego, 2006). Much of this growth will be driven by the transport sector. According to the Energy Intensity Index[31] that compares energy consumption in terms of GDP units, Latin America has increased its consumption of energy by 2 percent since 1980, while the countries belonging to the Organization for Economic Cooperation and Development have decreased it by 24 percent. Fossil fuels will continue to dominate the energy matrix in the region. Projected market trends raise serious concerns related to increased vulnerability to supply disruptions, rising carbon dioxide emmsions,[32] and huge energy investment needs.[33] No structural modification in the countries' energy mix is expected, particularly concerning energy for electricity generation. Therefore, emphasis must be placed on energy efficiency, financial instruments and incentives to foster a larger share of renewable energy sources in the total mix. Given the significant cost gap between fossil fuels and hydroelectricity versus renewable energies, the share of renewable energies used in the LAC region is projected to increase only slightly. The Latin American region, led by Brazil and Central America, has taken some interesting initiatives in favour of incorporating a bigger share of biofuels in its energy strategy. Energy efficiency has been embraced as a priority by many LAC countries, and a number of initiatives are now underway.

OLADE (Latin American Office for Energy Development) reports disagregated figures for energy demand in Latin America. As of 2004, the transportation[34] and industrial[35] sectors show the highest proportions of aggregate demand in the region, followed by the residential sector[36] and commerce and services.[37]

---

31 Developed by the Economic Commission for Latin America and the Caribbean, ECLAC.

32 After a period of increased pollution control measures, and decreasing greenhouse gas emissions, in the past few years, there has been an erratic increase in the regional contribution to global emissions.

33 There are various dimensions to the situation in Latin America. Among the most important are the price of energy in the short and medium run, the availability of fossil energy sources in the medium term and especially the long term, and market competition for access to energy resources. No country in the region has a secure supply of fossil energy sources, not even resource endowed countries, given that commercialization channels are key elements of sector organization. According to Leal and Samaniego (2006), with respect to fossil energy resources, particularly natural gas–the preferred fuel in terms of low pollution and cost—a possibility exists that its use could lead to increased tension and confrontation in the region.

34 The percent growth between 1995 and 2004 was 2.05.

35 For this sector, percent growth between 1995 and 2004 reached 2.70.

36 With a 1.19 percent growth between 1995 and 2004.

37 With a 3.01 percent growth during the same period.

As urban consumption energy statistics are not available in the region, Table 4 shows national energy consumption by region, and by sector. Considering the high levels of urbanization in the region, residential percentages may serve as a proxy for urban household consumption of energy, as would commercial and public services energy consumption. Both Central America and the Caribbean, as well as South American average residential energy consumption show lower levels than European and World averages in 2001, and similar levels to North America (although Central America and the Caribbean show somewhat higher levels). Individual country level data, for both 1990 and 2001, show a significant contribution of these two sectors to total energy consumption in the Central American countries and in the Caribbean: in many cases close to 40 percent or more of total energy consumed (Dominican Republic, El Salvador, Guatemala, Haiti, Honduras, Jamaica, Nicaragua). On a regional scale, Brazil consumes almost a third of the total energy consumption in the region, followed in magnitude by Mexico (around 25 percent). Data indicates that consumption of energy in residential, public and commercial buildings contribute, in urban contexts, significantly to overall energy consumption.

BOX 11
NATIONAL LEVEL ENERGY EFFICIENCY PROGRAMS IN LAC

Chile. The National Program for the Efficient Use of Energy, is a joint program between the Ministry of Economy and the Ministry of Energy. As part of this program, a public-private joint commission has been established in order to seek agreements regarding energy efficiency with the private sector. The National Production Promotion Agency (CORFO) is currently designing instruments oriented toward the private sector and energy efficiency.

Argentina. The Small and Medium Enterprise Project for Increases in Energy Efficiency and Productivity is a co-initiative between the German Cooperative Technical Agency (GTZ) and the Argentinean Energy Agency, focused on the small and medium enterprise sector. A Biofuels Law has also recently been approved. Another example of energy efficiency programs at the national scale is a Global Environmental Fund (GEF) project with the Secretary of Energy: Energy Efficiency Project in Argentina.

Mexico. Among many other programs, this country has advanced most in the region, in the promotion of Energy Services Enterprises, through a special program developed by the National Commission for Energy Saving (specific program support for energy efficiency, and federal prizes).

Central America and the Caribbean. The Central American Commission for the Environment and Development (CCAD) has been developing a Strategy for Energy Efficiency for these regions, oriented toward the electric sector and electricity consumption. This commission has also begun a strategic alliance with the Biomass Users Network (organization which promotes energy efficiency markets and renewable energy sources) to develop a policy framework for the region.

Brazil. Since 1975, Brazil has promoted energy substitution through programs, such as the National Alcohol Program (PRO-ALCOHOL). Biomass fuels in 2000 (ethanol for automobiles and sugar cane bagasse for electricity generation) reduced carbon dioxide emissions by 7 percent in Brazil. Regarding demand side efforts is the National Program for Energy Conservation (since 1985), as well as fiscal incentives to promote low powered motor vehicles. Alternative energy sources are also promoted through national programs.

Source: ECLAC (2007). “Energía, Desarrollo Industrial, Contaminación del aire/atmósfera u Cambio Climático en la Región de América Latina y el Caribe: Nuevas Políticas, Lecciones, Mejores Prácticas y Oportunidades de Cooperación Horizontal”, CEPA Document for Sustainable Development Comission (CDS) 15, Regional Session. Sustainable Development and Human Settlements Division, ECLAC and UNEP/ROLAC and SEMARNET (Secretaría de Medio Ambiente y Recursos Naturales) (2006). El Cambio Climático en América Latina y el Caribe, UNEP/ROLAC and SEMARNET.

With regard to city specific initiatives, in Brazil, various city experiences related to renewable energy technology are particularly interesting. Both Belo Horizonte and Porto Alegre are actively promoting solar energy as alternative energy technologies within their cities. The City Council of Belo Horizonte has unanimously approved two laws that encourage the use of solar energy. The laws, which will go into effect in January 2008, provide tax subsidies to owners of properties that use solar energy. Although Porto Alegre was the first Brazilian city to pass legislation encouraging the use of solar energy, the law has not yet been regulated. In November 2006, the city council approved a law that created the Program to Encourage the Use of Solar Energy in Buildings, with the purpose of promoting the use and development of solar energy technologies. Sao Paulo is currently requiring solar panels in residences with four or more bathrooms and that all new constructions recieve the necessary infrastructure to make the use of solar energy possible. There are specific regulations for water heating systems in private and public buildings as well. Laws that promote the use of solar energy are currently being discussed in Curitiba, Sao Paulo, Belo Horizonte, Rio de Janeiro, and Minas Gerais.[38] Mexico approved a national law in 2005 to promote the use of solar water heating systems.

Household energy consumption accounts for 25 percent of Mexico´s national energy use. An annual energy increase of 5.6 percent is expected in the future. As part of Mexico´s Sustainable Housing Program, energy use criteria have been established in the definition of sustainable homes. There are currently almost 5000 housing units in 7 cities, being built under this program; more than 70 percent is very low income housing. Energy efficiency technology incorporated includes solar water heating and solar energy generation, efficient lamps, special air conditioning and insulation technologies, and bioclimatic designs.[39] As of January of this year, regulations for thermal specifications for building construction have been implemented in Chile. Currently an energy certification law is being debated.[40]

In April 2007, two collaborative green building groups were launched in Brazil, as part of the World Green Building Council.[41] The Conselho Brasileiro de Construcao Sustentável, will focus on research, ethical questions and issues specific to Brazil and green building. GBCBrazil, the second organization, is a significant group of businesses and other organizations that will administer the Brazilian rating system. The group is negotiating with the United States Green Building Council to license and adapt LEED[42] for Brazil. In addition to these efforts, substantial organizing efforts are underway in Argentina, Chile, Costa Rica and Mexico.

---

38 See www.cidadessolares.org.br for more information.

39 See www.conavi.gog.mx for more information.

40 Mexico's national housing policy has incorporated into its traditional objectives, both the promotion of housing construction according to regional climates, with efficient energy use, disaster prevention criteria, and the use of standardized products and services; and the use of eco-technologies in housing that guarantees local environmental protection and rational use of nonrenewable resources.
The general objectives of the Sustainable Housing Program are:

- To develop housing programs that promotes better quality of living, and that protects the natural resource sand the environment
- To establish minimum criteria to define a sustainable house in terms of efficient use of water, energy saving, bioclimatic design, green areas, and waste treatment.
- To provide indicators to measure the benefits and impacts of green home building
- To promote the establishment of fiscal incentives and financing advantages for green home builders.
- To promote the use of different materials and technologies to offer a wide choice of home types to impact the housing market.

Currently there are projects in 7 cities in Mexico, consisting in almost 5000 units, the majority very low income. New technologies for energy and waste efficiency are being implemented.

41 See www.uli.org (Urban Land Institute).

42 Leadership in Energy and Environmental Design Green Building Rating System is the US nationally accepted benchmark of the design, construction, and operation of high performance green buildings. See www.usgbc.org

BOX 12
WASTE-TO-ENERGY IN BRAZIL

In January 2004, the private Brazilian bank Unibanco, the power company Eletropaulo and the pension fund Biogas, started operating the first waste-to-energy plant in Brazil in the city of Sao Paulo. The gas generated by the decomposition of 7,000 metric tons of waste disposed daily in the Bandeirantes sanitary landfill, will produce enough energy to supply 200,000 people or 50,000 families. The gas utilization will prevent emission of 10 million liters of methane (CH4). The gas-to-energy plant, which according to the Director of Biogas is the largest in the world, has electricity potential of 22.6 MW (megawatts) and production capacity of 170,000 MWH. It is expected to operate for the next fifteen years, using not only the waste disposed in the landfill until the closure date of 2006, but also the 30 million metric tons of waste in the site.

According to a 2001 study by the Sao Paulo State Environmental Agency (CETESB), Brazil loses 325 MW of power, 0.4 percent of the 73,000 MW installed as a result of not producing energy from waste. The methane generated in the two sanitary landfills still in operation and the two that are no longer active in the city of Sao Paulo, could generate 32 MW of power, enough to supply 22.5 percent of the public lighting. The high cost of the project is the main reason why there have been only a few initiatives in the sector.

The Bandeirantes waste-to-energy plant costs about US$ 20 million (R$ 60 million). Unibanco is the major investor in the project. The bank's return is the savings in the energy bill in its 1,000 offices in the city. Eletropaulo invested about US$ 834,000 (R$ 2.5 million) in the construction of a sub-plant to supply the energy to the distribution net. Eletropaulo will improve the energy supply to 2,200 families that live in seven communities near the landfill and have poor or clandestine energy links. The Bandeirantes project investors expect to sell carbon credits with the entry into force of the Kyoto protocol.

The Brazilian government's decision to exempt such projects from transmission tariffs is an important stimulus that could bring the development of additional projects. Qualix Serviços Ambientais, which manages the Sao Joao landfill in Sao Paulo (the largest sanitary landfill in Latin America), announced an investment of US$ 20 million to generate 20 MW. This amount of energy is sufficient to supply a city of 150,000 inhabitants.

Source: US and Foreign Commercial Service and US Department of State (2005). Waste to Energy Plants in Sao Paulo and Brasilia. International Market Insight, International market Research Reports. www.strategis.ic.gc.ca

TABLE 4

ENERGY CONSUMPTION BY REGION, BY SECTOR, 1990 -2001

				Energy Consumption (as a percent of total final consumption) by Sector													
	Total Final Consumption (1 000 metric toe)[a]		% change	Residential		Industry		Road Transport		Other Transport		Agriculture		Commercial & Public Services		Other	
	1990	2001		1990	2001	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001	1990	2001
World	5 566 234	7 585 443	36	19.3	27.5	36.8	31.9	19.8	19.7	5.7	5.5	3.9	2.5	8.5	7.8	5.9	5.1
Europe	1 198 340	1 858 697	55	23.8	27.5	34.9	32.2	20.7	18.9	4.2	6.1	2.7	2.7	8.8	8.7	4.8	3.9
North America	1 468 100	1 725 599	18	16.3	16.5	27.2	27.2	29.0	31.1	8.2	7.2	1.2	1.1	12.3	12.5	5.8	4.3
Central America and the Caribbean	125 054	138 513	11	20.4	22.1	39.7	34.7	27.5	31.3	3.3	3.6	3.1	2.7	2.6	3.6	3.3	1.9
South America	222 271	304 536	37	19.5	16.5	37.8	38.9	27.6	28.1	3.4	3.8	4.4	4.3	4.5	5.1	2.8	3.4

Source: International Energy Agency, reported in World Resources Institute, Earth trends, www.earthtrends.wri.org.

Technical Notes:

[a] toe: tons of oil equivalent.

Residential includes all energy used for activities by households except for transportation.

Industry includes a combination of all industrial sub-sectors, such as mining and quarrying, iron and steel, and construction. Energy used for transport by industry is not included here, but is reported under transportation.

Road Transport includes all fuels used in road vehicles, including military, as well as agricultural and industrial highway use. The sector excludes motor gasoline used in stationary engines and diesel oil used in tractors.

All Other Transport refers to all fuel used for non-road transport except fuel used for international marine bunkers and ocean, coastal, and inland fishing. It includes transport in the industry sector and covers railway, air, internal navigation (including small craft and coastal shipping not included under marine bunkers), fuels used for transport of materials by pipeline and non-specified transport.

Agriculture includes all activities defined as agriculture, hunting, and forestry. The sector therefore includes energy consumed by ocean, coastal and inland fishing in addition to the energy consumed by traction, power, and heating.

Commercial & Public Services include, for example, wholesale and retail trade; the operation of hotels and restaurants; post and telecommunications; real estate, renting and business activities; the collection, purification and distribution of water; maintenance and repair of motor vehicles and motorcycles; financial intermediation, except insurance and pension funding; computer and related activities; sewage and refuse disposal; public administration and defense; education; and other community, health, social and personal service activities.

Non-energy Uses and ''Other'' includes the use of petroleum products such as white spirit, paraffin waxes, lubricants, bitumen and other products. It is assumed that these products are used exclusively for non-energy purposes. This category also includes the non-energy use of coal (excluding peat) and fuel inputs for the production of ammonia and methanol. All fuel use not elsewhere specified is included here.

3. Climate Change and Cities in Latin America and the Caribbean

Latin America and the Caribbean face many environmental and sustainable development challenges, with significant impacts on human health, resource productivity/incomes and poverty, and ecological "public goods". The driving forces in the region, with respect to climate change include:

- Rapid growth of energy consumption during the 1990s, especially for transportation;
- Substitution of other fuels for clean natural gas in both the non-electricity sector and for electricity generation (along with hydro resources);
- Low comparative advantages for alternative energy sources;
- With rapid urbanization and associated energy use, serious air pollution levels in many urban centers;
- Continued deforestation (with associated soil degradation and loss of biodiversity) in the region; and
- Serious problems associated with the management of urban solid waste (with associated methane venting).

Cities are key drivers of change in the carbon cycle. Urbanization has become a global process, with profound impacts on the way in which energy and land are used. At the same time, cities are centers of diverse kinds of innovation that may contribute to de-carbonizing our societies, and making them more sustainable.

3.1 Latin American and the Caribbean GHG Emissions Diagnostic

TABLE 5
GHG EMISSIONS ON A REGIONAL SCALE

	REGION POPULATION *(million)*	GDP *(2000 $b)*	CO_2 EMISSIONS *(mt CO_2)*	ELECTRICITY CONSUMPTION *(kwh per capita)*	CO_2 EMISSIONS PER CAPITA *(t CO_2 per capita)*
OECD	1 154	26 792	12 794	8 044	11.08
LATIN AMERICA	432	1 443	850	1 601	1.97
WORLD	6 268	33 391	24 983	2 429	3.99

Source: IEA 2005 cited in Simms and Reid (2006). "Up in smoke? Latin America and the Caribbean. The threat from climate change to the environment and human development The third report from the Working Group on Climate Change and Development", based on contributions from the Working Group on Climate Change and Development. New Economics Foundation, August.

Latin America and the Caribbean show below average GHG emissions, but high vulnerability to global warming (Table 5).

Carbon dioxide (CO_2) comprises the majority of the GHG emissions, at about 77 percent of the worldwide total. The remainder comes mostly from methane (CH_4) and nitrous oxide (N_2O). The contributions of methane and nitrous oxide are significantly larger in developing countries.

The 25 countries with the largest GHG emissions account for approximately 83 percent of global emissions; collectively they represent 70 percent of the global population and 87 percent of global GDP (Baumert, et.al., 2005).[43] The United States, China, the European Union, Russia, and India contribute approximately 61 percent of global emissions. Three of these 25 countries belong to the LAC region: Brazil (ranked 8th with 2.5 percent of world GHGs), Mexico (ranked 14th, with 1.5 percent of world GHGs), and Argentina (ranked 24th, with 0.9 percent of world GHGs).[44] On a global scale, there is a strong correlation between emissions, population and GDP rankings, reflecting the importance of population and economic growth as emissions drivers. World Resources Institute (Baumert, et.al., 2005) presents the results of a decomposition analysis in order to derive the relative contribution of different factors in country level emissions. The results for the three top emitting countries in LAC show that both GDP and population growth have a strong influence on emissions. The fuel mix, however, also has influenced CO_2 changes between 1990 and 2002, especially in Brazil (+13 percent) and Argentina (-11 percent). Energy intensity in Mexico, accounted for a decrease in 12 percent of emissions. This was counterbalanced by economic growth (17 percent) and population growth (22 percent).

Emissions predictions at the national level are highly uncertain. Uncertainties are especially acute in developing countries economies, which tend to be more volatile and vulnerable to external shocks. Furthermore, past projections have a dubious record of accuracy. For Mexico, for example, one scenario envisions a 68 percent emissions growth by 2025, while another suggests a 215 percent increase (Baumert, et.al., 2005).

---

43 Data is for 2000. GHG gases included are CO_2, CH_4, N_2O, HFCs, PFCs, SF6.

44 Data for per capita GHG emissions show, in addition to these three countries, Trinidad and Tobago ranking 10th on a global scale, and Antigua & Barbuda ranking 12th on a global scale. Due to the relatively small population in the Caribbean, this *per capita* contribution is not a significant percentage of the total volume.

In 2000, estimates indicate that the Latin America and Caribbean region was responsible for approximately 12 percent of global carbon dioxide emissions, with 4.3 percent of emissions coming from industry and 48.3 percent from land use changes. Regional methane emissions from anthropogenic sources (mainly livestock farming and the production and consumption of fossil fuels) represented 9.3 percent of the world total. Eighty-three percent of GHG emissions in LAC are from six countries (Brazil, Mexico, Venezuela, Argentina, Colombia, and Peru) (UNEP/ROLAC and SEMARNAT, 2006).

UNEP[45] Latin America analyzes the sources of GHG emissions in the region based on tendencies in existing emissions inventories (2006). According to these analyses, more than 50 percent of current emissions are derived from industrial production and the generation of electricity.[46] Deforestation is considered to be the main source of atmospheric emissions in Latin America and the Caribbean, particularly due to the impact in the Amazon basin. In Mexico and Argentina, the principal source of GHG emissions is fossil fuel combustion. Large cities in the region, as well as many medium-sized cities, also emit greenhouse gases, mainly generated by motor transport and industrial production. Although carbon dioxide is generally the main greenhouse gas, if total greenhouse gases are estimated in carbon dioxide equivalent units, methane is more important in countries such as Argentina, Chile and Uruguay. More than 71 percent of methane emissions in South America and 48 percent in Mexico come from livestock.

While it is impossible to calculate the exact proportion of greenhouse gases generated in urban areas, worldwide they are likely to account for most human-driven emissions. This takes into account the concentration of industry and wealthier social groups with high-consumption lifestyles. It also factors in the greenhouse gas emissions from activities that serve urban areas, such as agriculture, forestry, oil and natural gas exploitation, air and road transport, and electricity generation. In Latin American cities, the combined impacts of population growth, urbanization, motorization and increased energy use act as drivers for emissions.

The Ecological Footprint analysis highlights the problem of urban systems and their environmental impacts based on resource consumption. The methodology is based on an ecological understanding of how a city extracts food, water, energy and land from a bioregion (and beyond) and requires ecosystem services to absorb its wastes. The total resource use of a city is determined relative to its population, and the resulting calculation allows a per capita footprint of land to be compared to that of other cities. These comparisons are useful for obtaining a sense of how much a city should be trying to reduce its full ecological impact, both globally and locally. Box 13 describes the Ecological Footprint for Santiago, Chile.

[45] United Nations Environmental Program.
[46] In the Caribbean, emissions are caused principally by petroleum refineries, and mining activities.

BOX 13

ECOLOGICAL FOOTPRINT OF THE METROPOLITAN REGION OF SANTIAGO (CHILE) (2002)

To estimate a population's ecological footprint, it is necessary to calculate the quantity of water and land continuously required to produce all of the goods consumed and to assimilate all of the waste generated by that population. The concept of the ecological footprint is based on the notion that each unit of consumption or waste, whether material or energetic, requires a certain amount of land. As it is not possible to assess each of the thousands of individual consumer goods and waste involved, calculations are limited to key categories, and even further by the availability of data.

The ecological footprint of the Metropolitan Region of Santiago (RMS) was calculated as 1.28 ha/per capita for 2002, an area 5 times as large as the region itself. The food category is the largest (0.73 ha/per capita), followed by transportation (0.35 ha/per capita) and direct energy (0.10 ha/per capita). The table below provides a general summary of the results of different variables used to calculate the ecological footprint of Santiago and illustrates the difference in area required to sustain each individual component.

Ecological Footprint Summary, RMS (2002)

Component	Total Area Required(hectares)	Ecological Footprint(ha/per capita)
Direct Energy	633 316	0.1044871
Food	4 460 608	0.7359300
Materials	1 053	0.0001737
Water	98 340	0.0162246
Waste	95	0.0000156
Transport	2 118 129	0.3500902
Constructed (and degraded, w/o productivity)	457 868	0.0755409
TOTAL	7 769 408	1.2824621

Energy. The ecological footprint for the energy variable was 0.10 ha/per capita in the RMS for 2002, meaning that a total of 633,316 Ha were required to absorb the region's CO_2 emissions. The largest amount of land, 263,083 Ha, was required to absorb natural gas emissions, while the second largest was that required to absorb fuel emissions, with 232,933 Ha.

Food. The food variable's ecological footprint was measured at 0.74 ha/per capita in the RMS during 2002, meaning that approximately 4,460,608 hectares were required to produce all of the food consumed. The largest amount of land was required for beef production from bovine cattle (469,796 ha). In second place, vegetable produce (fruit, vegetables, and cereals) required 417,750 ha, while dairy products ranked third, requiring 142,238 ha.

Materials. Material goods of the RMS required 1,053 ha to produce, equal to 0.0001737 ha/per capita in the RMS during 2002. The greatest amount of land was required by 'Other material goods,' mainly wood (941 ha), followed by construction materials (65 ha).

Water. In 2002 the RMS required 98,340 ha, equal to 0.0162246 ha/per capita, for its water supply. The area of land was required mainly for storage of the water in Laguna Negra, Laguna Lo Encañado and El Yeso reservoir. The aquifer located in the region's west-southwest sector was also incorporated, even though it represents hectares underground.

Waste. Waste generated in the RMS required 95 ha, equal to 0.0000156 ha/per capita during 2002. The largest amount of land was required for the disposal of Residential Solid Waste (RSW) and hospital waste (54 ha), followed by mining waste deposits, which required 39 ha.

Transportation. The transportation variable required 2,118,129 ha, or 0.35 ha/per capita to absorb principally CO_2 emissions that were produced in the RMS in 2002 by motorized transport. The largest segment was taken up by private vehicles (1,501,013 ha), which produced 5.5 million tons of CO_2, and the second largest by air transport (passenger and cargo planes), with 250,863 ha required to absorb 928,195 tons of CO_2.

In 2002 the RMS had an ecological footprint of 1.28 ha/per capita, leading to the conclusion that the region requires 7,758,317 hectares—five times its current size—to provide the energy and material resources it consumes and to absorb the waste generated by its resident population. In effect, the RMS depends on other regions to uphold its urban dynamic and receive its negative externalities.

Of the three pillars of sustainability—social equity, economic growth and environmental balance—the ecological footprint focuses mainly on the third and only slightly on the first two. It is therefore difficult to interpret whether the overall sustainability of the RMS is strong or weak, as the consumption of natural capital does not weigh heavily or explicitly in the procedure used to calculate the footprint.

The city-region of the RMS is a focal point for national development. The concentration in the RMS of Chile's population and the economic activities serving the export-oriented natural resource sector makes the region's sustainability an important indicator of the national situation. The region has a large ecological footprint due to its use of the natural resource base and, similar to most metropolitan regions, its status as a net importer of resources. This method of analysis is indicative of the negative and positive trends affecting the region; in addition to highlighting aspects of the regional (and inter-regional) social economy and the condition of the environment that are negatively affected by modern production and consumption processes, it also can contribute to the design of better public policies and encourage environmentally sensitive decision making at all levels of government, from ministerial and regional authorities to neighborhood committees. In many regards, it highlights the need to take into account externalities when evaluating the performance of different actors, in order to promote well being in a broad sense. This is a complex process, mainly because of the wide range of potential externalities, the difficult task of identifying those responsible for them in dense urban spaces, the challenge of determining the ability or resilience of the natural environment and society to react to these externalities, and the variation of these phenomena over space and time.

Today, the application of the ecological footprint is complicated by the poor quality of information available to calculate some complex figures, such as the scaling of food provision and associated local conversion factors. A number of authors have pointed out that the current model is especially sensitive to variations in certain variables such as energy and the ecological capacity of a determined territorial unit. Other significant variations may also arise and distort the footprint. Another obstacle to its application is that the footprint does not address wealth, poverty and equity, and as the figures calculated in this case are regional, little can be inferred in regard to who benefits from the present system and who is negatively affected. In this regard, the pillar of social equity is left out of the equation. Only in the area of production and consumption trends are social and economic criteria incorporated.

Evidently, the ecological footprint is more valuable as an educational tool than as an instrument for decision making in public policies. This is reflected in its emphasis on international comparability and its promotion within civil society and among individuals, for example, who are encouraged to measure their own footprints.

Source: Barton, J, Ricardo Jordán, Silvia M. León, and Oriana Solis M. (2007). *¿Cuán sustentable es la Región Metropolitana de Santiago? Metodologías de Evaluación de la Sustentabilidad.* Sustainable Development and Human Settlements Division, ECLAC. Serie Medio Ambiente. August.

3.2 LAC Vulnerability to Climate Change

Regional climate change impacts are expected to be wide ranging and include coastal sea level increases, increased sea surface temperatures in the Caribbean Basin, increased intensity of weather disturbances, tropical glaciers and snowcap melting, significant warming of moorlands and other high altitude ecosystems in the Andes, higher frequency and extension of forest fires, the appearance of tropical disease vectors in the Andes piedmont, changes in agricultural productivity, and impacts on coastal and watershed ecosystems (Vergara, 2005).

In most Caribbean island states, 50 percent of the population resides within 2 km of the coast (Vergara, 2005): these populations will be directly affected by sea level rise and other climate impacts on coastal zones. Increased sea temperatures in the Basin, is already contributing to the pace of coral destruction. Climate change will affect the physical and biological characteristics of coastal areas, modifying their ecosystem structure and functioning (loss of biodiversity, fisheries, and shorelines; increased vulnerability of coastal mangroves and wetlands to storm surges; increased salinity and ecosystem change). With respect to mountainous areas, among other expected changes, are a loss of many of the environmental goods and services provided by these mountains, especially water supply to urban areas, basin regulation, and associated hydropower potential.

A warmer climate will generally increase exposure to tropical diseases, health impacts from weather disturbances in the Caribbean Basin, and respiratory irritants. In Latin America, a large portion of the population lives in mountain ranges, including large urban areas situated above 2,000m, normally not exposed to tropical diseases (dengue and malaria). Increased temperatures will most probably affect the prevalence of these vector borne diseases in higher altitudes. Diarrhoeal diseases also may increase as a result of more frequent and severe floods and drought. An increase in the frequency and severity of extreme weather events will result in more frequent humanitarian emergencies, particularly affecting populations in high-risk areas such as coastal zones, river valleys and cities. Climate change is also expected to lead to an increase of rodent-borne diseases: due to a warmer climate and changing habitats, allowing rodents to move into new areas.

Many countries in the LAC region are at increased risk from natural disasters as a consequence of climate change. The region is subject to extreme climatic events and natural phenomena that take place in frequently recurring cycles –earthquakes, tropical storms, hurricanes, floods, droughts, volcanic eruptions – and the region is highly vulnerable to these increasingly frequent natural phenomena, which affect its ever more fragile ecological and social systems. Within the region the Caribbean is the sub region most affected by natural disasters. The entire region's cities are extremely vulnerable to disasters of both natural and technological origin (the risks inherent in hazardous activities), with negative microeconomic and macroeconomic consequences at the local, regional and national levels. Moreover, urbanization patterns, especially among poor sectors further heighten urban vulnerability. ECLAC estimates that in the 2004 hurricane season, total economic impact of natural disasters in the region amounted to 7,559 million USD: and in 2005 season, to 5,409 million USD.

What is done within urban areas has a very large influence on whether the risks arising from the direct and indirect effects of climate change can be reduced. Well-planned and well-governed urban areas can greatly reduce these risks – while unplanned and poorly governed cities can greatly increase them – especially risks of flooding and extreme weather events. Most of the region's largest cities are coastal cities and so are vulnerable to sea level rise; many are very vulnerable to extreme weather events; and many Pacific Coast cities relay on glacial melt for their water supplies during dry summers – a source that will be severely depleted within 20 years at current rates of glacial melt.

BOX 14
CLIMATE CHANGE AND URBANIZATION IN BRAZIL

Brazil entered the twenty-first century with over eight out of ten of its 182 million inhabitants living in urban areas. In 2001 there were over 55 million people living in poverty in Brazil, with 76 percent of these living in shantytowns. In the last 10 years, the central areas of major cities have grown by 5 percent while the outskirts have grown by 30 percent.

This urbanization process, characterized by forest loss and the hardening of ground surfaces (soil compaction), contributes to increases in temperatures. Insufficient public transport and growing numbers of private cars are adding to greenhouse gas emissions. Cities like São Paulo, Rio de Janeiro and Recife are suffering from floods and mud slides. The consequences are felt by all city inhabitants but the worst affected are those who live in poverty, especially women and children, whose vulnerability is increased.

In spite of the links between cause and effect that climate change issues make visible within society, social and environmental movements in Brazil continue to resist working together. In one Brazilian debate on a new national law about the occupation of urban land, legalizing shantytowns was seen as a crucial conquest for campaigners working for the homeless and slum dwellers. Yet Brazilian ecologists vehemently opposed the law, as many precarious settlements are built on highly vulnerable urban areas or on lands essential for ecosystems services (for example, preservation of water supply and quality). Should these city inhabitants be moved to remote areas, increasing the need for transport, or should urban expansion be controlled to preserve the forests? Urgent dialogues are needed to build bridges between both views and face the real threat: the underlying pattern of land use and the appropriation of natural resources.

Source: Simms, Andrew and Hannah Reid (2006). "Up in smoke? Latin America and the Caribbean. The threat from climate change to the environment and human development The third report from the Working Group on Climate Change and Development", based on contributions from the Working Group on Climate Change and Development. New Economics Foundation, August.

3.3 Urban Responses to Climate Change in Latin America and the Caribbean

3.3.1 Mitigation Issues and Experiences

The possibilities for mitigation initiatives are multidimensional, and may include: (i) relating emissions reductions to increases in emissions capture; (ii) both energy supply and consumption; (iii) issues related to both fuel combustion and to fugitive emissions (e.g., methane from solid waste); and (iv) all recognized "emitting" sectors (energy, industry, land use change and forestry, agriculture, sanitary landfills, urban transport, etc.) (UNEP/ROLAC and SEMARNAT, 2006).

City dwellers use vast quantities of energy, which is mostly derived from fossil fuels. This same energy, that provides heat and electricity and powers vehicles, is also responsible for GHG emissions. Cities also contribute to GHG emissions from waste management practices and urban expansion (land use substitution). Climate change is closely linked to the increasing demand for energy and transport that flows from growing urban populations. Although cities continue to be in the background of the international debate on climate change, city governments can have significant influence. The facilities that cities operate, and the land use and other decisions they make have substantial impact on present and future energy consumption levels, fuel used, and waste generated in the communities they serve.

In the region, ICLEI's[47] Cities for Climate Protection (CCP) campaign supports cities in the reduction of CO_2 emissions, other GHGs and air pollutants. At a global level, the CCP Global Cities Network reduced 60 million tones of CO_2 equivalent in 2005. In Latin America, for the 2005-2006 period, ICLEI reports energy savings of 8.5 million KWh, and 5,700 tons of CO_2 equivalent/year mitigated, for a total of 18 cities participating at a regional level. The campaign offers a framework for local governments to develop a broad agenda on climate change, and provides analytical methods to help set reduction targets and develop a climate change action plan. Two examples of city specific implementation of improved technology are Sao Paulo (Methane to energy) and Querétaro, Mexico (Street Light Retrofit) (Wyman, 2006).[48] The Clinton Climate Initiative is supporting the fifteen biggest cities in the world to improve energy efficiency in existing constructions and reduce GHG emissions: Curitiba, Lima, Mexico City, Rio de Janeiro, and Sao Pablo are part of the associated network of cities (Large Cities Climate Leadership).

In urban metropolitan areas the transport sector is estimated to account for a third or more of total emissions of the greenhouse gases with the greatest significance for climate change: carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O). For example, in Lima transport accounts for about 37 percent of CO_2 emissions, and in 2000 the sector was estimated to contribute 4.68 million tons of the city's CO_2 emissions (World Bank, 2005). In Santiago emissions of CO_2 from the transport system in 1994 were estimated at 4.2 million tons, about 68 percent of which was attributed to cars, taxis, and light trucks. In Mexico GHG emissions from transport accounted for an estimated 19.6 million tons of CO_2 in 1998 (World Bank, 2005).

The growing energy needs that countries face in the transport sector, especially in urban transport in developing countries, present major challenges in terms of energy security and the environmental externalities associated with GHG emissions, which are growing at a faster rate than

[47] The International Council for Local Environmental Initiatives.

[48] 10,000 high wattage street lights were replaced with more efficient lamps, cutting carbon dioxide (CO2) emissions by nearly 4,000 tonnes per year.

is population. The growth of secondary cities and urban sprawl contribute to the pressure on existing urban transport networks. A moderate increase in per capita vehicle ownership could lead to a long commute time, changes in land use, and more transport-related air pollution. The trend toward increased motorization, in all its forms, leads to longer travel times for surface public transport (buses)—which in turn induces more auto and taxi use—and to poor traffic safety, the economic inefficiency of increased fuel use, and degradation of the urban quality of life.

Studies show that large GHG benefits could be achieved through a shift from small and private vehicles to large-capacity vehicles for personal transportation. This modal shift is expected to avoid the GHG emissions that would have resulted from the small vehicles. To illustrate, a shift to public transportation is expected to reduce CO_2 emissions in the Greater Santiago region by 9.6 percent, while emissions of particulate matter (PM10 and PM2.5) would drop by 8 percent, assuming the implementation of urban land use policies regarding housing and commercial real e state development, along with transportation planning to avoid congestion (World Bank, 2005).

BOX 15
REDUCING EMISSIONS IN MEXICO CITY[49]

Famous for its air pollution problems, Mexico City also contributes significantly to greenhouse gas emissions, accounting for 20 percent of the country's total emissions and 2.1 percent from Latin America as a whole. The carbon footprint in 2004 was estimated at 33.5 million tons of carbon dioxide (or its equivalent). This figure is expected to reach 66 million tons by 2012. Due to rapid growth it is difficult for Mexico City to establish an emissions reduction target, so the city aims to limit the growth of emissions, rather than reduce emissions absolutely.

The Transport Corridors Project seeks to contribute to the reduction of global carbon emissions from the passenger transport sector in the Metropolitan Area, to be achieved through a modal shift toward low polluting, space efficient transport corridors with exclusive bus-ways. At the time of project development, a total of 275,000 certified carbon reductions (CERs) were estimated for the space efficient corridors: carbon financing has been integrated into the project. These emissions reductions would be achieved through technology replacement, modal shifts and improved traffic flows. The introduction of climate friendly measures in transport policy required the development of baseline methods and monitoring and verification protocols, as well as the modernization of the institutional and regulatory framework. City authorities see access to carbon financing as part of a win-win situation: mitigation of GHG emissions together with access to new financing mechanisms for urban transportation development.

PROAIRE 2002–2010 is one of the overall strategies that integrate air quality and climate protection in Mexico City. It aims to cut emissions of air pollutants and greenhouse gases over an eight-year period. Activities include energy-efficiency improvements, protection of forests and green spaces, and public transportation enhancements. Many of the PROAIRE measures focus on transportation, which constitutes 37 percent of emissions within the federal district of Mexico City. The municipal government plans to replace 80,000 of Mexico City's oldest 109,400 functioning taxis between 2001 and 2006. By paying US$1,300 towards each old vehicle with the owner paying the price difference for a new, lower-emissions vehicle, daily emissions from taxis will be reduced by about 31 percent. Dedicated traffic lanes to run fuel-efficient, high-capacity buses to cut emissions and congestion are being developed. The first Bus Rapid Transit Corridor on Avenida Insurgentes, the city's major north-south thoroughfare, opened in June 2005. It carries about 250,000 passengers per day.

Emissions reduction strategies also target improving the efficiency of low-income housing. Water and energy efficiency systems will be installed into 30,000 new social housing units and retrofitted into 45,000 existing units over a three-year period. Systems include compact fluorescent bulbs, low-flow showerheads, and tap aerators. The estimated annual emissions reduction from these changes is 31,000 tons of carbon dioxide. Over a five-year period, solar-powered heating systems will be installed in 50,000 new social housing units.

Internationally, Mexico City also participated in the design phase of the Chicago Climate Exchange, a reduction and trading pilot program for emission sources and offset projects in the United States, Canada, and Mexico.

Source: Extract from Low Carbon Leader: Cities (2005). The Climate Group, London and Vergara, Walter. "Reducing GHG in Transport: The Mexico City Transport Corridor Project" World Bank Environmental Department, www.embarq.wri.org

The Kyoto Protocol allows countries to use instruments such as the Clean Development Mechanism (CDM) to market global environmental services, with co-benefits for sustainability, and access to project financing. Most countries are developing CDM initiatives: the Mexican case described in Box 15 is an example.

[49] See Box 8 and 9.

3.3.2 Adaptation Issues and Experiences

Much of the urban population and most urban governments have a very low adaptive capacity to all environmental hazards, including low adaptive capacity for climate variability and climate change. This is a developmental issue, and makes large sections of the urban population very vulnerable to any increase in the frequency or intensity of storms or to increased risks of disease or constraints on water supplies or food price rises, which in wealthier, better governed cities are usually easily adapted to. A shift from disaster response to disaster preparedness and disaster risk reduction, which would have significant relevance for urban resilience to climate change, has not yet occurred in most city and national level policies.

Sherbinin, Schiller and Pulsipher (2007) analyze the vulnerability of global cities to climate hazards, taking Mumbai, Rio de Janeiro and Shanghai as case studies. Based on their assessment, the following discussion regarding Rio de Janeiro is presented, as an example of the complex situation that cities may face as climate change impacts their realities.

Currently, Rio suffers from a significant ongoing vulnerability to climate hazards, particularly flooding and landslides. Although civil defense institutions have been created to cope with natural disasters, underlying structural problems, including political clientelism and acute spatial segregation based on income, render the city vulnerable to climate hazards. Little in the way of concrete flood protection infrastructure has been set up in the wake of serious 1988 floods. It is possible to speak of highly vulnerable sub-populations living in slums (favelas) and near waterways, and relatively less vulnerable upper classes living in high-rise apartments in locations less susceptible to inundation. At the same time, climatic changes are predicted that will likely increase the severity of intense rainfall events and raise sea level. Although the economy of Rio de Janeiro is relatively robust, significant portions of GDP will be required for relief and reconstruction if floods of the magnitude of 1967 and 1988 are repeated. Unless more concerted efforts are made to prepare for climate hazards, the city will remain vulnerable.

BOX 16
CUBA: LESSONS IN DISASTER REDUCTION

Cuba is a small and poor country whose geographical location gives it a high and recurrent risk of hurricanes. Yet when Hurricane Wilma struck in October 2005, this small island evacuated 640,000 people from its path, with just one fatality. The sea went one kilometer inland and flooded the capital, Havana, yet there were no deaths or even injuries. This was not a one-time response, but built upon a depth of experience in dealing with hurricanes. In the seven years between 1996 and 2002, for example, six major hurricanes hit Cuba, yet a total of just sixteen people died. In each case, hundreds of thousands of people – sometimes 700–800,000 at a time – were successfully evacuated, often within 48 hours.

The Cuban population has developed a culture of safety. Many ordinary people see themselves as actors with important roles to play in disaster preparation and response. Education and training, a culture of mobilization and social organization, and government priorities of human life in emergencies promote this vision. At the heart of the system is a clear political commitment, at every level of government, to safeguard human life. This creates both a centralized decision-making process alongside a decentralized implementation process equally necessary for effective emergency preparedness and response. The system has been tried and tested so many times that high level of mutual trust and confidence exists between communities and politicians at every level of the system.

Tangible assets supporting disaster preparedness include: a strong, well-organized civil defense, an efficient early warning system, well-equipped rescue teams, and emergency stockpiles and other resources. Intangible assets are effective local leadership, community mobilization, solidarity and a population that is ‘disaster aware’ and educated in what actions to take, and local participation in evacuation planning.

Source: Simms, Andrew and Hannah Reid (2006). “Up in smoke? Latin America and the Caribbean. The threat from climate change to the environment and human development The third report from the Working Group on Climate Change and Development”, based on contributions from the Working Group on Climate Change and Development. New Economics Foundation, August.

Adaptation activities in the region tend to be focused on water management experiences, disaster preparedness (both local and national scales), regional and national adaptation planning, and capacity building in these areas, as in measurement and research. It is difficult to detect explicit urban scale forward looking adaptation experiences for climate change impacts. Projects and initiatives related to a series of issues discussed (water and sanitation; solid waste infrastructure) as well as others (public health preparedness; urban land use planning) could be considered adaptation related, if designed and implemented in a forward looking way, incorporating potential climate change impacts as conditioning elements. Table 6 presents a number of adaptation options and policies for urban areas, and illustrates this idea of win-win solutions to current urban challenges.

TABLE 6
URBAN RESPONSE AND ADAPTATION OPTIONS FOR LAC

SECTOR	ADAPTATION OPTION/STRATEGY	POLICY
Water supply/ water hazards	Water storage and conservation techniques; incentives for water conservation; water re-use; water recycling; desalination; increase water use efficiency; public education; flood risk map; public participation flood adaptation and mitigation programs; greater investment in water supply systems; controlled use of urban and rural groundwater.	Urban water policies and integrated water resources management; water-related hazards management; integrating climate change into public policy; policy to control groundwater abstraction
Infrastructure/ settlement (including cities in the coastal zones)	Cleaning drainage system and replacement of primary sewer system; encourage infiltration and increasing depression and street detention storage; re-designing structures; relocation; seawalls and storm surge barriers; dune reinforcement; land acquisition and creation of wetlands as buffer zone against sea level rise and flooding; protection or existing natural barriers; maintaining defensible space around each building/neighborhood.	Design standards and codes; regulations; integrate climate change considerations into design; land use policies; insurance; financial incentives; public education regarding risk of living in hazard prone areas.
Human Health	Heat related public health action plans; emergency medical services; access to public 'cooling centers'; improved climate sensitive disease surveillance and control; access to safe water and improved sanitation; greater in governmental coordination and cross-boundary coordination.	Public health policies that recognize climate risk; strengthen health services; intergovernmental, regional and international cooperation; greater investment in health services.
Urban Transport	Environment friendly transportation system; energy efficient cars; car pooling; efficient public transportation system; new design standards and planning for urban roads, rail, etc., to cope with warming and drainage: fuel substitution.	Integrating climate change considerations into urban transport policy; investment in research and development; incentives for energy efficient car industry.
Energy	Strengthening of overhead transmission and distribution lines; underground cabling for utilities; increasing energy efficiency; emphasis on renewable resources.	Sustainable urban energy policies; regulations; fiscal and financial incentives to encourage use of green energy and building; incorporate climate change in design standards and codes.

Source: Extract from Mirza (2007). Urban Issues, Concerns and Responses to Climate Change in the Cities of the Americas: What are in the IPCC AR4?, Paper presented to "The Response of Urban Areas to Climate Change" Seminar. Hunter College, New York, USA. September 26-27, 2007.

4. Harmony and Dissonance between Human Settlements and the Environment: Cases in Latin America and the Caribbean

Three areas of interest for urban sustainability are presented in this chapter. The first is regarding urban biodiversity issues, and uses Sao Paulo as a case study in order to show the complexity of the competing interests within Sao Paulo for land use, and how this is affecting biodiversity and other sustainable development goals (water source conservation, habitability for poor urban sectors, for example). The second case describes Curitiba, perhaps the most well know sustainable city in Latin America, and model for forward looking sustainable land use planning on a global scale. The last area is two cases of local environmental management as illustrations of the Agenda 21 paradigm in the region. The application of this perspective as a city wide strategy is not particularly common in LAC, although partial applications are found within city environmental management across the region.

4.1 Urban Biodiversity in Sao Paulo: Urban sprawl and public policy

Land use regulations and public policies in transportation and housing strongly influence the dynamics of urban sprawl and its environmental impacts. Such is the case of Sao Paulo, Brazil.

Between 1970 and 1990, the rate of population growth declined in the Sao Paulo Metropolitan Area, from 4.5 to 1.5 percent a year. Intra-urban dynamics show interesting patterns of migration. The center of the city, with its concentration of high- and medium- income areas, is currently losing inhabitants. Peri-urban areas, however, are growing fast: from 19 percent in 1991 to 30 percent in 2000. This demographic growth of the Brazilian peri-urban regions results from the continued expansion of poor areas, almost all of which are located in the suburbs of the Metropolitan Area. This persistent horizontal growth of the city requires a continuous extension of public services networks to these areas, even when central area facilities are not fully used. Peri-urban areas show the worst socio-economic indicators, with high levels of poverty, illiteracy and unemployment. The entire Metropolitan Region covers about an area of about 60 by 70 kilometers.

Between 1995 and 2003, Sao Paulo received significant residential real estate investment: almost US$ billion in private investment, the bulk of which was realized in central areas. In the fast growing (demographically speaking) peri-urban areas, almost no private development investment is registered, and insignificant levels of public housing have been built. The majority of the housing has been self built and illegal occupation accounts for 43 percent of the population living in these areas.

One of the most significant environmental impacts of the urban sprawl of Sao Paulo, has been its contribution to the massive destruction of the green belt of the Atlantic Rainforest surrounding the city. The Atlantic rainforest is one of the most endangered ecosystems in the world. Different studies on deforestation estimate that less than 10 percent of the original forest remains in Brazil and the rate of destruction continues to be high. Urban sprawl was followed by a significant destruction of the remaining forest within Sao Paulo's Metropolitan Area, with little respect for the restrictive environmental legislation that forbids deforestation of the Rainforest (bylaw 750/93). These "city" green areas are officially part of the Biosphere Reserve (a United Nations iniciative) and are key for different ecological dynamics, since they serve as ecological corridors for migratory species. They also play a fundamental role in the conservation of water resources (see Box 5).

Sao Paulo's Atlantic Rainforest city green belt has been partially preserved (especially in its northern and southern parts) mainly because the topography of the remaining areas does not allow for agricultural exploitation. The southern region is part of the water resources protection area for the Metropolitan Area. This green area is seeing an intensification of its already high population growth rates. Green areas and water sources are protected in Sao Paulo by national, state, and local legislation that define different types of, and multiple uses for, protected areas. In the case of Sao Paulo, these are:

- Environmental Protection Areas (with possible private land use according to specific regulation);
- Water Source Protection Areas (private use of land is permitted; currently there are 1.8 million people in such areas in Sao Paulo, although 17 of the 39 municipalities of the Metropolitan Area have more than 50 percent of their land protected by this regulation);
- Parks, Forest Reserves, and Urban Green Areas under local or state jurisdiction (these are government property, and their occupation by private dwellers is prohibited).

Data presented in Torres (et al, 2007) show deforestation rates in unprotected areas between 1991 and 2000 (1.3 percent); parks and reserves showing some regeneration (1.6 percent); and preservation areas showing significant forest loss, up to 3 percent of their total territory. The data implies that environmental legislation for protected areas is not necessarily working to conserve and preserve ecosystems.

The Sao Paulo Municipality urban biodiversity policy reports 21 percent of its territory designated with some conservation status: 2 preservation areas, 33 municipal parks, and 7 natural parks (6 more in progress). The 2003 strategic master plan defines land use in terms of special zones for environmental protection, for sustainable development, and for agricultural services. An integrated program for the protection of Sao Paulo's Environmental Areas was created in 2005, and was strongly reinforced in 2007, integrating policies and programs between the local government and the State of Sao Paulo. The project aims to protect biodiversity and guarantee the preservation of the water source which represents around 30 percent of Sao Paulo's consumption of potable water. A new Municipal Environmental Police Division was created in 2007 for the preservation areas in the southern part of the city.

Sao Paulo is also developing a larger program to recover degraded riparian areas including the recovery of water courses, re-vegetation, leisure and bicycle routes. The Tree Planting Project, operating since 2005, plants 180,000 trees each year (100 species native to the Atlantic Forest). This program aims to increase the green vegetation covering of the city and to create corridors for the circulation of the fauna that still inhabits the city. Sao Paulo’s Green Belt was incorporated, along with that of 72 other municipalities, in 1993 as an integral part of the Atlantic Forest Biosphere Reserve (Neves, 2007).

4.2 Forward looking sustainable land use planning in Curitiba, Brazil

Curitiba is perhaps the best planned city in Brazil, and an international model for sustainable development. With a population of 1,800,000 persons (annual growth 2.3 percent), the Curitiba experience is often cited both for its success in local implementation and management of a visionary urban development plan, as well as for the results that this process has had over the city’s environmental, economic, cultural and social evolution.

Curitiba’s process originated in a visionary land use and urban development plan (1965 Master Plan) – definition of criteria for urban structural axes and associated land use, and roads and transport systems; central area valuation and preservation of patrimony; definition of desired urban population densities; economic and employment development; adequate provision of public infrastructure and services; and protection of the environment,– as well as the creation of a specific institution that would be responsible for coordinating and monitoring urban development processes (Instituto de Pesquisa e Panejamento Urbano de Curitiba/IPPUC) (Vallicelli, 2002). The combination of the core values expressed in the city plan and IPPUC’s creation allowed a people-centered planning for efficiency and sustainability even under difficult circumstances (during the military dictatorship, times of economic crisis in Brazil and despite high numbers of poor migrants to the city). After three decades of innovative practices, in the year 2000, the Zoning and Land Use law was approved and is currently used as a planning instrument, which defines use parameters that orient both public and private investment.[50] Another key to Curitiba’s success is a strong, continuing political leadership.

The city’s achievements are the result of strategic, integrated urban planning, including social, economic and environmental programs. Transportation, land-use planning and housing development are integrated to support one another in order to improve the quality of life in the city. This allowed the city to meet strategic objectives in the 1970s which sought to minimize downtown traffic, encourage social interaction by providing more leisure areas and pedestrian zones in the center of the city, and encourage the use of public transport and cycling in order to achieve an environmentally healthy city.

Despite major challenges that came from rapid growth, significant improvements have been made to the city’s quality of life in areas including public transportation, preservation of the city’s cultural heritage, expansion of parks and green areas, and social and environmental programs.

The city pioneered the idea of an all-bus transit network with special bus-only avenues created along well-defined structural axes that were also used to channel the city's growth. The

[50] www.ippuc.org.br, www.curitiba.pr.gov.br.

transit system is rapid and cheap, and is currently being integrated with the metropolitan region. Its efficiency encourages people to leave their cars at home. Curitiba has one of highest rates of car ownership in Brazil, and high population growth. Yet auto traffic has dropped substantially. Curitiba has the highest public ridership of any Brazilian city (about 2.14 million passengers a day), and it registers the country's lowest rates of ambient pollution and per capita gas consumption. In addition, an inexpensive “social fare” promotes equality, benefiting poorer residents settled on the city's periphery. A standard fare is charged for all trips, meaning shorter rides subsidize longer ones. One fare can take a passenger 70 kilometers.

Downtown areas have been transformed into pedestrian venues, including a 24-hour mall with shops, restaurants, and a street of flowers tended by street children. This vibrant pedestrian zone encourages tourism, which generated US$280 million in 1994, 4 percent of the city’s net income. The city’s 30-year economic growth rate is 7.1 percent, significantly higher than the national average of 4.2 percent. Per capita income is 66 percent higher than the Brazilian average.

Curitiba is referred to as the ecological capital of Brazil, with a network of 28 parks and wooded areas. In 1970, there was less than 1 square meter of green space per person; in 2002 there were 52 square meters for each person. Residents planted 1.5 million trees along city streets. Builders get tax breaks if their projects include green space. Flood waters diverted into new lakes in parks solved the problem of dangerous flooding, while also protecting valley floors and riverbanks, acting as a barrier to illegal occupation, and providing aesthetic and recreational value to the thousands of people who use city parks.

The “green exchange” employment program focuses on social inclusion, benefiting both those in need and the environment. Low-income families living in shantytowns unreachable by truck bring their trash bags to neighborhood centers, where they exchange them for bus tickets and food. Under the “garbage that's not garbage” program, 70% of the city's trash is recycled by its residents. The city's paper recycling alone saves the equivalent of 1,200 trees a day. As well as the environmental benefits, money raised from selling materials goes into social programs (MacLeod, 2002).

Curitiba’s biggest current challenge is to coordinate planning efforts with cities in its metropolitan area (26 municipalities: estimated 3.2 million people in all). The outlying areas are growing faster than Curitiba itself, increasing pressure on the city’s public services as well as on the environment. Curitiba also has its share of favelas, where 300,000 people live without access to basic public services and legal dwellings.

4.3 Local Agenda 21s in Latin America and the Caribbean: Manizales, Colombia and Ilo, Peru

UNEP/ROLAC supports the Sustainable Cities Network in LAC, where models for Local Agenda 21 have been supported and piloted. This network supports training and education for local environmental mangement of cities in the region, and serves as a clearinghouse, along with ICLEI, for these issues in LAC.

Under the Agenda 21 methodology, in Manizales, Colombia, a local environmental action plan (Bioplan-Manizales) was developed with widespread public consultation. The plan was integrated into the municipal development plan and the municipal budget. It includes measures to protect and revitalize the city’s rich architectural heritage, improve public transport (partly funded by a tax on petrol), reduce the risk of landslides (the city is in a mountainous region) and relocate the population living on steep slopes at high risk of landslides.

The relocation program was linked to the development of eco-parks throughout the city, some on land that had slopes that were too dangerous for permanent settlements and others with important ecological functions – for instance, one integrated into the city's watershed, and another focused on protecting biodiversity. Many of these eco-parks were managed by community associations.

Community based environmental initiatives helped to generate jobs – for instance managing eco-parks, running tree nurseries and increasing recycling. More localized environmental action plans have also been developed –the Olivares commune (one of 11 communes in Manizales and also the one with the lowest average income) process identified the commune's main environmental problems and also the areas's environmental resources on which the agenda was built. The city also developed an innovative indicators program – the 'environmental traffic lights' through which progress in each of its 11 communes are tracked in regard to social conditions, community involvement, natural resource use, energy efficiency and waste management. Data on current conditions and trends in each commune are displayed in public places. They are called environmental traffic lights because, for each indicator, public boards show whether conditions are improving (green), getting worse (red), or are stable (amber). The monitoring of progress is helped by environmental observatories in different parts of the city.

In the port city, Ilo, in southern Peru, the environment has been transformed over an 18 year period with major improvements in the quality of housing and liquid and solid waste management and in provision for water, sanitation, garbage collection, electricity, paved streets and green areas. Some 300 projects have been financed and implemented through partnerships between municipal government and community-level management committees. The local authorities have a land development program which ensures land for housing is available to low income households, and so Ilo has avoided the problem of rapidly expanding illegal settlements, even though the city's population has expanded more than sixfold since 1961. A large coastal area within the city has been reclaimed for public use (with the municipal authorities helping to move the industries, settlements and institutions that were located there) and this now includes a pier, tree-lined walkways, play spaces and an amphitheatre. There has been a long fight with a copper factory that was set up in Ilo some 40 years ago that generates high levels of solid waste and air pollution. Citizen pressure forced the company to stop polluting the local bay and dumping wastes on local beaches although reducing the very high output of sulphur dioxide has been more difficult. Development plans for the city occur within a coherent environmental plan, which is developed through consultation with different groups and is supported by a Commission with representatives drawn from many agencies and sectors.

5. Conclusions and Policy Implications

Within urban areas, the primary concern from the perspective of human well-being is whether urban settlements provide a healthy and satisfying living environment for residents. Urban development can easily threaten the quality of the air, the quality and availability of water, the waste processing and recycling systems, and many other qualities of the ambient environment that contribute to human well-being. Certain groups (for example low-income residents) are particularly vulnerable, and certain services (such as those not easily traded, for example recreational services from urban parks), are of concern to all urban dwellers. From a sustainable development perspective, future generations well being must be considered as well, and the implications for quality of life in urban settlements in the future. It is also useful to distinguish among the linkages between urban systems and the ecosystem services that exist within urban areas, between urban centers adjoining non-urban ecosystems, and between urban centers and distant ecosystems. Moreover, to appreciate the importance of relations between urban systems and ecosystem services, it is important to consider the negative as well as the positive effects that urban systems can have on ecosystem services. This paper has highlighted many of these concerns, from an overall regional perspective, as well as through the analysis of city specific, and sector or issue specific urban case studies.

The region shows opportunities for the integration of environmental concerns into urban decision making: in the areas of transport planning, land use planning, new and improved models for water and sanitation provision, urban biodiversity issues and resource conservation, among others. The constraints on effective urban sustainable development are, however, great in the region, and encompass issues related to financing, institutional capacities, competing development agendas within fragmented decision making structures, significant structural problems (poverty, inequity), as well as limited economic growth. Perhaps the most promising strategies are those that combine two or more pressing issues on the local agenda with more “distant” or more “green” goals (for example, curbing global emission or resource conservation issues). Clearly, there is a great need for environmental managers and technical professionals to be integrated into urban development decision making; and vice versa, that urban managers be integrated into more “environmental” sectors (conservation, water, energy, climate change, etc.). The experiences regarding conservation of urban water sources through payment for environmental services is a case in point. These experiences show environmental tools being effectively applied to urban problems, and show potential for multiple goal achievements and positive rural-urban linkages.

Although extremely complex, and with partial achievements, the Sao Paulo urban biodiversity case illustrates how urban land use planning can integrate environmental conservation goals (local, regional and global) and tools. The sustainable transport cases also show multiple goal achievement through the integration of land use planning, social development concerns, technical air quality and transport planning, as well as global climate concerns (Mexico City, Curitiba, and others).

Another important distinction is the type or heterogeneity of approaches and solutions required for different city sizes and within cities, for different place specific problems. The participatory models for small city water provision in Peru requiere certain preconditions and implementation support systems apparently specific to small and medium sized cities. Solutions for mega cities or large metropolitan areas tend to be different, involving large private water enterprises. Lessons learned from the small city participatory models, however, may have applications to poorer unserviced areas of metropolitan cities, through collective negotiation of water fees and service levels.

The measurement of sustainability through appropriate indicators is imperative at a city level, as well as at regional levels. Urban sustainable development information tends to be fragmented and incomplete, and not necessarily updated on a periodic basis; and therefore limited in its use in overall urban planning. This reality limits the strategic environmental evaluation of policy options and development projects within urban contexts or across urban contexts, in order to effectively inform decision making.

Critical cross-cutting issues for the LAC region include:

- Encouraging public authorities to have the political will to ensure that sustainable development is seen as relevant and receives institutional backing, particularly concerning energy, housing, water and sanitation issues, which are normally governed by sectoral policies;
- Bringing about explicit public-private commitments for national, regional, provincial/state, local/municipal governments and the business sector (large firms, SMEs, micro enterprises) to work jointly on the most critical environmental problems and overcome regulatory barriers;
- Establishing participation mechanisms that allow the public to be more informed and that guarantee that its opinions will be taken in account;
- Reinforcing territorial-planning instruments, which have not attained the prominence they deserve in Latin America and the Caribbean, since market-based criteria tend to prevail over social interests and the needs of the ecosystem, especially regarding soil degradation and biodiversity loss;
- Setting up national instruments along the lines of the Strategic Environmental Impact Assessment (vis-à-vis policies, plans and programs), to allow for a broader vision than that of the project assessments currently applied in almost every country of the region;
- Allowing for horizontal cooperation among the LAC countries, as a basis for integrating environmental and similar or related matters with other local, city wide and global urban development concerns;
- Estimating future increases in pollution from transportation, industry, urban growth and the energy demand needed for these activities;
- Identifying regional/sub regional agreements that allow for stricter environmental requirements while protecting competitiveness;
- Requiring transnational banks and trade agreements to support cleaner technologies;
- Deepening and invigorating air-quality programs in LAC cities;
- Improving public transportation and making it a priority of public investment;
- Incorporating environmental conservation goals (local, city wide, national and global) to city development goals.

Bibliography

Barton, J, Ricardo Jordán, Silvia M. León, and Oriana Solis M. (2007). ¿Cuán sustentable es la Región Metropolitana de Santiago? Metodologías de Evaluación de la Sustentabilidad. Sustainable Development and Human Settlements Division, ECLAC. Serie Medio Ambiente y Desarrollo. August.

Baumert, Kevin, Timothy Herzog, and Jonathan Pershing (2005). Navigating the Numbers. Greenhouse Gas Data and International Climate Policy. World Resources Institute.

Boletín FAL (Facilitación del Comercio y el Transporte en América Latina y el Caribe), December 2002, No. 196.

Bull, Alberto (2003), Congestión de Tránsito, El problema y cómo enfrentarlo, Cuadernos de la CEPAL 87, Economic Commission on Latin America and the Caribbean, United Nations, and German Technical Cooperation (GTZ), Santiago, Chile.

Cifuentes, Luis A., Alan J. Krupnick, Raúl O´Ryan and Michael A. Toman (2005). Urban Air Quality and Human Health in Latin America and the Caribbean, Working Paper. Inter-American Development Bank. Washington, DC, October. http://www.iadb.org/sds/env

The Climate Group (2005). Low Carbon Leader: Cities (2005). The Climate Group, London.

Cordero Camacho, Doris (2003). “PROCUENCAS, protección y recuperación de microcuencas para el abastecimiento de agua potable en la provincia de Heredia, Costa Rica”. Foro Electrónico Latinoamericano Sistemas de Pago por Servicios Ambientales en Cuencas Hidrográficas Foro Electrónico Latinoamericano Payment Schemes for Environmental Services in Watersheds. 12 april - 21 may 2004 www.rlc.fao.org/foro/psa/

Echevarría, M. (2002). “Financing Watershed Conservation: The Fonag Water Fund in Quito, Ecuador” in eds., S. Pagiola, J. Bishop and N. Landell-Mills, Making Market-based Mechanisms Work for Forests and People. Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development. London, Earthscan. pp. 91–101.

ECLAC (2007). “Energía, Desarrollo Industrial, Contaminación del aire/atmósfera u Cambio Climático en la Región de América Latina y el Caribe: Nuevas Políticas, Lecciones, Mejores Prácticas y Oportunidades de Cooperación Horizontal”, CEPA Document for Sustainable Development Comission (CDS) 15, Regional Session. Sustainable Development and Human Settlements Division, ECLAC.

_____ (2006a), Statistical Yearbook for Latin America and the Caribbean, 2006.

_____ (2006b). Social Panorama of Latin America, 2006.

_____ (2005). The Millenium Development Goals: a Latin American and Caribbean perspective, LC/G.2331-P, Santiago, Chile, March.

ECLAC/UNEP (2002). The sustainability of development in Latin America and the Caribbean: challenges and opportunities, United Nations, Libros de la CEPAL 68, Santiago, Chile.

El Tiempo, “15 buses más para TM”, (http://eltiempo.terra.com.co/bog/2002-07-25/index.html), July 25, 2002.

Food and Agriculture Organization/FAO (2000). Land-Water Linkages in Rural Watersheds Electronic Workshop- Synthesis Report. http://www.fao.org/ag/agl/watershed/watershed/papers/paperewk/pewrken/synthesis.pdf

Hernández A., “Bogotá, una ciudad vivible, (http://www.cepal.org/Transporte/noticias /8/9178/ Bogot_viv.doc), March 2002.

Jouravlev, Andrei (2004). Drinking water supply and sanitation services on the threshold of the XXI century, Serie Recursos Naturales e Infraestructura, 74, Natural Resources and Infrastructure Division, Economic Commission for Latin American and the Caribbean, December.

Leal, José and Joseluis Samaniego (2007). “Environmental Issues in Latin America and the Caribbean” in Energy cooperation in the Western Hemisphere : benefits and impediments, ed. by Sidney Weintraub with Annette Hester and Veronica R. Prado, Center for Strategic and International Studies. Washington, DC:CSIS Press.

Mac Donald, Joan (2004). “Informe sobre pobreza y precariedad del hábitat en ciudades de América Latina y el Caribe”, United Nations, Serie Manuales, Santiago, Chile.

MacLeod, Kirsten (2002). “Orienting Urban Planning to Sustainability in Curitiba, Brazil”, Local Strategies for Accelerating Sustainability: Case Studies of Local Government Success, ICELI-Canada.

Mayrand, Karel and Marc Paquin (2004). “Payments for Environmental Services: A Survey and Assessment of Current Schemes,” Unisféra International Centre for the Commission for Environmental Cooperation of North America. Montreal. September.

Mirza (2007). Urban Issues, Concerns and Responses to Climate Change in the Cities of the Americas: What are in the IPCC AR4?, Paper presented to “The Response of Urban Areas to Climate Change”Seminar. Hunter College, New York, USA. September 26-27, 2007.

Neves, Helio (2007). “Preserving Biodiversity in Sao Paulo”, presentation to City Mayors Meeting, Biodiversity Objectives 2010, Curitiba, Brazil, 2007.

O'Ryan, R. and L. Larraguibel (2000). Contaminación del aire en Santiago: estado actual y soluciones. Documento de Trabajo CEA N°75. Universidad de Chile.

Pan American Health Organization (PAHO) (2005a). Report on the regional evaluation of municipal solid waste management services in Latin America and the Caribbean. PAHO, Washington, D.C.

PAHO (2005). An assessment of health effects of ambient air pollution in Latin America and the Caribbean. Washington, D.C: PAHO.

______ (2001a). Informe regional sobre la evaluación 2000 en la región de las Américas: agua potable y saneamiento, estado actual y perspectivas, Washington, DC.

_____ (2001b). “Salud, agua potable y saneamiento en el desarrollo humano sostenible”, 35ª Sesión del Subcomité del Comité Ejecutivo de Planificación y Programación (Washington, DC, 14 to 16 March 2001). www,paho.org

Pagiola, S. et al. (2003). Paying for the Environmental Services of Protected Areas: Involving the Private Sector. Durban, South Africa, 8–17 September 2003: Fifth World Parks Congress: Sustainable Finance Stream. p. 2.

Pagiola, S. et al. (2002). “Making Market-based Mechanisms Work for Forests and People,” in eds., S. Pagiola, J. Bishop and N. Landell-Mills. Making Market-based Mechanisms Work for Forests and People. Selling Forest Environmental Services: Market-based Mechanisms for Conservation and Development. London, Earthscan. p. 264.

PNUMA/ORPLAC and SEMARNAT (2006). El Cambio Climático en América Latina y el Caribe. PNUMA/ORPLAC and SEMARNAT (Secretaría de Medio Ambiente y Recursos Naturales).

Prüss-Üstün, Annette and C. Corvalán (2006). Preventing disease through healthy environments. Towards an estimate of the environmental burden of disease, World Health Organization.

Sandoval, E. (2001) “Concepto integral del espacio público y la movilidad urbana. Enfoque de la ciudad de Bogotá. Caso específico: Transmilenio”, document presented at international seminar in Caracas.

Simms, Andrew and Hannah Reid (2006). “Up in smoke? Latin America and the Caribbean. The threat from climate change to the environment and human development The third report from the Working Group on Climate Change and Development”, based on contributions from the Working Group on Climate Change and Development. New Economics Foundation, August.

Sherbinin, Alex de, Andrew Schiller and Alex Pulsipher (2007). “The vulnerability of global cities to climate hazards”, in Environment and Urbanizations, Vol 19(1):39-64.

Solanes, Miguel and Andrei Jouralev (2006). “Water Governance for Development and Sustainability”, Serie recursos naturales e infraestructura No. 111, Division of Natural Resources, ECLAC. June.

Torres, Haroldo, Humberto Alves and Maria Aparecida de Oliveira (2007). “Sao Paulo peri-urban dynamics: some social causes and environmental consequences”in Environment and Urbanization, International Institute for Environment and Development. Vol 19(1):207-223.

United Nations (2003). Demographic Yearbook, United Nations Population Division, United Nations. New York.

UN-Habitat (2003). “Agua y saneamiento en las ciudades del mundo: acciones locales para alcanzar objetivos mundiales”, Earthscan Publications Ltd., Londres.

UNEP/ROLAC and SEMARNET (Secretaría de Medio Ambiente y Recursos Naturales) (2006). El Cambio Climático en América Latina y el Caribe, UNEP/ROLAC and SEMARNET.

United Nations Environmental Program (UNEP) (2003). GEO - Latin America and the Caribbean. Regional Office for Latin American and the Caribbean(ROLAC)/UNEP. Costa Rica. November.

US and Foreign Commercial Service and US Department of State (2005). Waste to Energy Plants in Sao Paulo and Brasilia. International Market Insight, International market Research Reports. www.strategis.ic.gc.ca

Vergara, Walter (2005). Adapting to Climate Change: Lessons Learned, Work in Progress, and Proposed Next Steps for the World Bank in Latin America, Sustainable Development Working Paper No. 25, The World Bank, Latin America and the Caribbean Region, Environmentally and Socially Sustainable Development Department. October.

Vergara, Walter (without date). “Reducing GHG in Transport: The Mexico City Transport Corridor Project” World Bank Environmental Department, www.embarq.wri.org

Walsh, M. P. (2005). Status Report: Low Sulfur Diesel Fuel Trends Worldwide. Memo June 13, 2005.

Water and Sanitation Program, The World Bank, (2005). “The Small Town Pilot Project in Peru. A Private-public and Social Partnership to Change Water and Sanitation Mangement Models”. World Bank Field Note. June.

WHO-UNICEF (2006). World Report on Monitoring of Goal 10 of the MDGs by the Joint Program for Monitoring Water and Sanitation Services, PAHO/WHO-UNICEF. September.

Winchestesr, Lucy (2005). “Sustainable human settlements development in Latin America and the Caribbean”, Serie Medio Ambiente, Sustainable Development and Human Settlements Division, ECLAC. Santiago, Chile. February.

World Bank (2005). Sustainable tansport and air quality, regional program on sustainble transport and air quality. Ppt presentation april 8. ver web address.

_______(2004). The Little Green Data Book. Washington, DC.

World Business Council for Sustainable Develooment (2004). “Mobility 2030. Meeting the challenges to sustainability”. P. 33.

World Health Organization (2005). WHO Air Quality Guidelines Global Update 2005. Report on a Working Group Meeting, Bonn, Germany, 18-20 October 2005.

World Resources Institute (WRI) (2003). World resources 2002-2004. Decisions for the Earth: balance, voice, and power, Washington, DC.

_______(without date). “Mexico City in Movement. EMBARQ”. The WRI Center for Transport and the Environment. www.embarq.wri.org.

_______UNEP, UNDP (United Nations Development Program), World Bank, (1998). World Resources 1998-1999, WRI, Washington, D.C., US.

World Wildlife Fund Alliance for Forest Conservation (2003). Running Pure: The importance of forest protected areas to drinking water. A research report for the World Bank / WWF Alliance for Forest Conservation and Sustainable Use. Washington, D.C.: World Bank / World Wildlife Fund. August.

World Wildlife Fund and Danida (2003). “From Good-will to Payment for Environmental Services. A Survey of Financing Alternatives for Sustainable Natural Resource Management in Developing Countries”.

Wyman, Michelle (2006). “ICLEI, Local Governments for Sustainability”. Presentation to IADB Sustainable Energy and Climate Change in LAC Seminar, November.

Web pages consulted:

www.cidadessolares.org.br

www.conavi.gog.mx

www.curitiba.pr.gov.br

www.earthtrends.wri.org

www.embarq.wri.org

www.ippuc.org.br

www.olade.org.ec

www.uli.org

www.usgbc.org

Appendix 1

TABLE 1.1
TOTAL POPULATION AND PROJECTED TOTAL POPULATION, LATIN AMERICA AND THE CARIBBEAN, BY FIVE YEAR PERIODS [a]
(Thousands of persons, at mid-year)

Country	1990	1995	2000	2005	2010	2015
Anguilla	-	10	11	12	13	14
Antigua and Barbuda	-	70	76	81	87	92
Netherlands Antilles	191	186	175	181	189	195
Argentina	32 581	34 779	36 784	38 592	40 519	42 403
Aruba	-	84	92	99	103	106
Bahamas	255	280	301	323	345	366
Barbados	257	261	267	268	274	276
Belize	186	215	240	268	296	322
Bolivia	6 669	7 482	8 428	9 427	10 426	11 411
Brazil	149 690	162 019	174 719	187 597	200 019	211 450
Chile	13 179	14 395	15 398	16 267	17 094	17 865
Colombia	34 875	38 542	42 321	46 039	49 665	53 183
Costa Rica	3 076	3 475	3 925	4 322	4 695	5 022
Cuba	10 605	10 964	11 199	11 369	11 514	11 645
Dominica	72	75	78	79	83	87
Ecuador	10 272	11 397	12 299	13 215	14 205	15 200
El Salvador	5 110	5 669	6 276	6 875	7 441	7 977
Grenada	96	99	102	103	110	119
Guatemala	8 908	10 004	11 225	12 700	14 362	16 176
Guyana	729	734	744	751	752	741
Haiti	7 108	7 622	8 357	9 151	9 994	10 848
Honduras	4 901	5 654	6 485	7 347	8 203	9 044
Turks and Caicos Islands	-	15	19	26	28	30
British Virgin Islands	-	18	21	22	23	24
United States Virgin Islands	-	108	112	112	110	109
Jamaica	2 369	2 485	2 584	2 651	2 702	2 747
Mexico	84 002	91 145	98 881	106 147	112 891	119 178
Montserrat	-	10	4	4	5	5
Nicaragua	4 141	4 477	4 957	5 483	6 050	6 635
Panama	2 411	2 670	2 948	3 228	3 504	3 764
Paraguay	4 248	4 828	5 496	6 216	6 980	7 773
Peru	21 762	23 837	25 939	27 947	29 958	31 972
Puerto Rico	3 528	3 695	3 834	3 954	4 060	4 157
Dominican Republic	7 296	7 705	8 396	9 100	9 791	10 436

Table 1.1 (concluded)

Saint Kitts and Nevis	-	40	40	43	45	47
Saint Vincent and the Grenadines	-	114	116	118	122	124
Saint Lucia	138	149	153	161	167	174
Suriname	402	417	433	447	462	474
Trinidad and Tobago	1 215	1 260	1 285	1 306	1 322	1 340
Uruguay	3 106	3 218	3 337	3 455	3 566	3 681
Venezuela (Bolivarian Republic of)	19 731	22 043	24 311	26 577	28 834	31 017
Latin America and the Caribbean [b]	443 975	483 617	522 929	561 345	598 773	634 104
Latin America [c]	-	471 924	511 683	551 056	589 711	626 680
Caribbean [d]	-	35 709	37 458	39 131	40 750	42 250

Source: ECLAC, Statistical Yearbook for Latin America and the Caribbean, 2006 and ECLAC, Social Panorama of Latin America and the Caribbean, 2006

[a] Ratio of the total mean annual growth of a population during a given period of time, to the mean population for this same period.

[b] Includes 46 economies: Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, British Virgin Islands, Bolivarian Republic of Venezuela, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falklands Islands (Malvinas), French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands, United States Virgin Islands and Uruguay.

[c] Includes 20 economies: Argentina, Bolivarian Republic of Venezuela, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru and Uruguay.

[d] Includes 24 economies: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Cuba, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Jamaica, Martinique, Montserrat, Netherlands Antilles, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands, and United States Virgin Islands.

TABLE 1.2
PERCENT OF URBAN POPULATION IN LATIN AMERICA AND THE CARIBBEAN[a]
(percentage of total population)

Country	1995	2000	2005	2010	2015	2020
Anguilla	100.0	100.0	100.0	100.0	100.0	100.0
Antigua and Barbuda		35.8	36.8	38.4	40.6	43.4
Netherlands Antilles	68.6	69.2	70.1	71.4	73.1	75.0
Argentina	87.4	89.6	91.8	93.1	94.0	94.7
Aruba	48.8	46.7	44.7	43.7	43.7	44.8
Bahamas	86.5	88.5	90.0	91.0	91.6	92.2
Barbados	47.3	50.0	52.9	55.9	59.1	62.2
Belize	48.0	48.0	48.6	49.9	51.8	54.3
Bolivia	59.2	61.8	64.2	66.4	68.3	70.0
Brazil	77.9	81.2	83.4	85.0	86.2	87.0
Chile	83.8	85.3	86.6	87.5	88.3	89.0
Colombia	72.1	74.5	76.6	78.4	80.0	81.4
Costa Rica	54.2	58.7	62.6	66.0	68.8	71.0
Cuba	73.2	74.7	76.1	77.4	78.5	79.6
Dominica	69.3	71.0	72.7	74.4	76.2	77.9
Ecuador	57.8	60.4	62.8	65.0	67.0	68.7
El Salvador	52.5	55.2	57.8	60.3	62.6	64.7
Grenada	35.0	38.5	42.2	45.8	49.4	53.0
Guatemala	36.5	43.0	50.0	57.2	63.6	68.7
Guyana	34.5	36.3	38.5	41.1	44.2	47.8
Haiti	34.3	38.1	41.8	45.3	48.4	51.3
Honduras	42.9	45.3	47.9	50.6	53.2	55.8
Turks and Caicos Islands	43.6	45.2	47.4	50.1	53.4	56.7
British Virgin Islands	56.0	61.1	65.4	69.0	71.8	74.1
United States Virgin Islands	90.4	92.6	94.1	95.1	95.8	96.2
Jamaica	51.9	52.1	52.2	52.9	54.2	56.0
Mexico	72.7	74.8	76.5	78.1	79.5	80.8
Montserrat	12.5	12.9	13.8	15.1	16.9	19.5
Nicaragua	54.0	55.4	56.9	58.2	59.5	60.8
Panama	58.1	62.3	65.8	68.7	71.1	73.1
Paraguay	52.1	55.3	58.4	61.3	64.0	66.3
Peru	71.0	71.9	72.6	73.3	73.8	74.4
Puerto Rico	87.1	94.6	97.5	98.6	99.1	99.3
Dominican Republic	57.6	61.7	65.6	68.7	71.2	73.2
Saint Kitts and Nevis	33.7	32.8	31.9	31.8	32.5	34.1
St Vincent & the Grenadines	48.1	54.8	60.5	65.1	68.6	71.3
Saint Lucia	27.8	29.3	31.3	33.8	36.8	40.4
Suriname	70.2	74.1	77.2	79.7	81.6	83.0

(Table 1.2. concluded)

Trinidad and Tobago	71.7	74.1	76.2	78.1	79.7	81.2
Uruguay	90.5	91.3	91.9	92.4	92.8	93.1
Venezuela (Bolivarian Republic of)	87.4	90.8	92.8	93.6	94.0	94.2
Latin America and the Caribbean [b]	73.3	75.5	77.6	79.4	80.9	82.3
Latin America [c]	73.2	75.8	77.8	79.5	80.8	81.9
Caribbean [d]	61.4	63.3	64.7	66.2	67.8	69.6

Source: ECLAC, Statistical Yearbook for Latin America and the Caribbean, 2006.

[a] Ratio of the total mean annual growth of a population during a given period of time, to the mean population for this same period.

[b] Includes 46 economies: Anguilla, Antigua and Barbuda, Argentina, Aruba, Bahamas, Barbados, Belize, British Virgin Islands, Bolivarian Republic of Venezuela, Bolivia, Brazil, Cayman Islands, Chile, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, Ecuador, El Salvador, Falklands Islands (Malvinas), French Guiana, Grenada, Guadeloupe, Guatemala, Guyana, Haiti, Honduras, Jamaica, Martinique, Mexico, Montserrat, Netherlands Antilles, Nicaragua, Panama, Paraguay, Peru, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Suriname, Trinidad and Tobago, Turks and Caicos Islands, United States Virgin Islands and Uruguay.

[c] Includes 20 economies: Argentina, Bolivarian Republic of Venezuela, Bolivia, Brazil, Chile, Colombia, Costa Rica, Cuba, Dominican Republic, Ecuador, El Salvador, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru and Uruguay.

[d] Includes 24 economies: Anguilla, Antigua and Barbuda, Aruba, Bahamas, Barbados, British Virgin Islands, Cayman Islands, Cuba, Dominica, Dominican Republic, Grenada, Guadeloupe, Haiti, Jamaica, Martinique, Montserrat, Netherlands Antilles, Puerto Rico, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and the Grenadines, Trinidad and Tobago, Turks and Caicos Islands, and United States Virgin Islands.

TABLE 1.3

TRENDS IN SELECTED ECONOMIC INDICATOR (PER CAPITA GDP, URBAN UNEMPLOYMENT), LATIN AMERICA AND THE CARIBBEAN, 1990 TO 2005

Country	Year	Per Capita GDP (in 2000 dollars) [a]	Urban unemployment (percentage)
Argentina	1990	5 833	7.4
	2000	7 730	15.1
	2005	8 132	11.6
Bolivia	1990	870	7.3
	2000	996	7.5
	2004	1 015	6.2
	2005	1 033	…
Brazil	1990	3 096	4.3
	2000	3 444	7.1
	2005	3 574	9.8
Chile	1990	3 069	9.2[c]
	2000	4 884	9.2[c]
	2005	5 729	8.0[c]
Colombia	1990	1 832	10.5
	2000	1 979	17.2
	2005	2 153	14
Costa Rica	1990	3 123	5.4
	2000	4 063	5.3
	2005	4 505	6.9
Cuba [b]	1990	3 057	…
	2000	2 519	5.5[c]
	2004	2 798	1.9[c]
	2005	…	1.9[c]
Ecuador	1990	1 252	6.1
	2000	1 296	14.1
	2005	1 535	10.7
El Salvador	1990	1 639	10
	2000	2 093	6.5
	2005	2 129	7.3
Guatemala	1990	1 447	6.3[c]
	2000	1 718	…
	2005	1 720	…
Haití	1990	528	…
	2000	438	…
	2005	390	…
Honduras	1990	894	7.8
	2000	929	…
	2005	977	6.5

(Table 1.3 Concluded)

Mexico	1990	4 960	2.7
	2000	5 874	3.4
	2005	5 993	4.7
Nicaragua	1990	713	7.6[c]
	2000	794	7.8
	2005	835	7
Panama	1990	2 942	20
	2000	3 942	15.2
	2005	4 413	12
Paraguay	1990	1 410	6.6
	2000	1 291	10
	2005	1 296	7.6
Peru	1990	1 650	8.3
	2000	2 056	8.5
	2005	2 340	9.6
Dominican Republic	1990	1 773	…
	2000	2 789	13.9[c]
	2005	3 089	18.0[c]
Uruguay	1990	4 802	8.5
	2000	6 019	13.6
	2005	6 084	12.2
Venezuela (Bolivarian Republic of)	1990	4 827	10.4[c]
	2000	4 819	13.9[c]
	2005	4 939	12.4[c]
Latin America [d]	1990	3 330	7.3
	2000	3 890	10.4
	2005	4 055	9.1

Source: Social Panorama of Latin America, 2006. Prepared by the Social Development Division and the Statistics and Economic Projections Division of Economic Commission for Latin America and the Caribbean (ECLAC) on the basis of official information from the relevant countries.

[a] Real per capita gross national income.

[b] The figures for per capita GDP and per capita disposable income are unofficial estimates prepared by ECLAC. According to information from the Government of Cuba, that country's economy (expressed in terms of GDP) grew by 11.8% in 2005. This growth rate was calculated using a new methodology being studied by ECLAC and the Government of Cuba.

[c] Nationwide total.

[d] The aggregate figures for Latin America are obtained from weighted averages for all countries for which data are available in each indicator.

TABLE 1.4
URBAN POVERTY AND INDIGENCE, BY METROPOLITAN AND OTHER URBAN AREAS, IN LATIN AMERICA, 1990 TO 2005
(In percentage)

Country	Year	Population below the poverty line [a]				Population below the indigence line			
		Country total	Urban Areas			Country total	Urban Areas		
			Total	Metropolitan area	Other urban areas		Total	Metropolitan Area	Other urban areas
Argentina	1990	…	…	21.2	…	…	…	5.2	…
	1994	…	16.1	13.2	21.2	…	3.4	2.6	4.9
	1999	…	23.7	19.7	28.5	…	6.7	4.8	8.8
	2002	…	45.4	41.5	49.6	…	20.9	18.6	23.3
	2005	…	26.0	22.6	30.0	…	9.1	7.6	10.8
Bolivia	1989	…	52.6	…	…	…	23.0	…	…
	1999	60.6	48.7	45.0	63.9	36.4	19.8	17.5	29.0
	2004	63.9	53.8	50.5	60.4	34.7	20.2	17.3	26.0
Brazil	1990	48.0	41.2	…	…	23.4	16.7	…	…
	1999	37.5	32.9	…	…	12.9	9.3	…	…
	2005	36.3	32.8	…	…	10.6	8.2	…	…
Chile	1990	38.6	38.5	32.1	43.5	13.0	12.5	9.3	14.9
	1998	21.7	20.7	14.6	25.0	5.6	5.1	3.3	6.4
	2003	18.7	18.5	12.4	22.7	4.7	4.4	2.8	5.6
Colombia [b]	1991	56.1	52.7	…	…	26.1	20.0	…	…
	1994	52.5	45.4	37.6	48.2	28.5	18.6	13.6	20.4
	1999	54.9	50.6	43.1	53.1	26.8	21.9	19.6	22.7
	2005	46.8	45.4	33.8	48.6	20.2	18.2	12.0	19.9
Costa Rica	1990	26.3	24.9	22.8	27.7	9.9	6.4	4.9	8.4
	1999	20.3	18.1	17.5	18.7	7.8	5.4	4.3	6.5
	2005	21.1	20.0	18.7	24.9	7.0	5.6	5.1	7.3
Ecuador	1990	…	62.1	…	…	…	26.2	…	…
	1999	…	63.5	…	…	…	31.3	…	…
	2005	48.3	45.2	…	…	21.2	17.1	…	…
El Salvador	1995	54.2	45.8	34.7	55.1	21.7	14.9	8.8	20.1
	2001	48.9	39.4	32.1	47.7	22.1	14.3	9.9	19.2
	2004	47.5	41.2	33.2	48.6	19.0	13.8	8.4	18.8
Guatemala	1989	69.4	53.6	…	…	42.0	26.4	…	…
	1998	61.1	49.1	…	…	31.6	16.0	…	…
	2002	60.2	45.3	…	…	30.9	18.1	…	…
Honduras	1990	80.8	70.4	59.9	79.5	60.9	43.6	31.0	54.5
	1999	79.7	71.7	64.4	78.8	56.8	42.9	33.7	51.9
	2003	74.8	62.7	50.3	72.5	53.9	35.1	23.3	44.5
Mexico	1989	47.7	42.1	…	…	18.7	13.1	…	…
	2000	41.1	32.3	…	…	15.2	6.6	…	…
	2005	35.5	28.5	…	…	11.7	5.8	…	…

(Table 1.4 Concluded)

Nicaragua	1993	73.6	66.3	58.3	73.0	48.4	36.8	29.5	43.0
	1998	69.9	64.0	57.0	68.9	44.6	33.9	25.8	39.5
	2001	69.3	63.8	50.8	72.1	42.4	33.4	24.5	39.1
Panama	1991	…	39.9	38.2	46.3	…	16.2	15.6	18.3
	1999	…	25.8	24.2	32.5	…	8.1	7.5	10.6
	2005	33.0	24.4	…	…	15.7	7.7	…	…
Paraguay	1990	…	…	43.2	…	…	…	13.1	…
	1994	…	49.9	42.2	59.3	…	18.8	12.8	26.1
	1999	60.6	49.0	39.5	61.3	33.9	17.4	9.2	28.0
	2005	60.5	55.0	48.5	64.3	32.1	23.2	15.5	34.5
Peru	1997	47.6	33.7	…	…	25.1	9.9	…	…
	2001[d]	54.8	42.0	…	…	24.4	9.9	…	…
	2004[d]	51.1	…	…	…	18.6	…	…	…
Dominican Republic	2000	46.9	42.3	…	…	22.1	18.5	…	…
	2005	47.5	45.4	…	…	24.6	22.3	…	…
Uruguay	1990	…	17.9	11.3	24.3	…	3.4	1.8	5.0
	1999	…	9.4	9.8	9.0	…	1.8	1.9	1.6
	2005	…	18.8	19.7	17.9	…	4.1	5.8	2.4
Venezuela (Bolivarian Republic of)[c]	1990	39.8	38.6	29.2	41.2	14.4	13.1	8.0	14.5
	1999	49.4	…	…	…	21.7	…	…	…
	2005	37.1	…	…	…	15.9	…	…	…
Latin America [e]	1990	48.3	41.4	…	…	22.5	15.3	…	…
	2000	42.5	35.9	…	…	18.1	11.7	…	…
	2005	39.8	34.1	…	…	15.4	10.3	…	…

Source: Social Panorama of Latin America, 2006. Prepared by the Social Development Division and the Statistics and Economic Projections Division of Economic Commission for Latin America and the Caribbean (ECLAC) on the basis of special tabulations of data from household surveys conducted in the relevant countries.

[a] Includes the population below the indigence line or living in extreme poverty.

[b] The sample design used in the surveys conducted since 2001 is such that the figures for urban and rural areas are not strictly comparable with those of previous years.

[c] The sample design used in the surveys conducted since 1997 does not distinguish between urban and rural areas, and the figures therefore refer to the nationwide total.

[d] Figures from the Peruvian National Institute of Statistics and Informatics (INEI). Figures are not comparable with previous years owing to the change in the sample framework of the household survey. According to INEI, the new figures constitute a relative overestimation of 25% for poverty and 10% for indigence in relation to the previous methodology.

[e] Estimate for 19 countries of the region.

TABLE 1.5

URBAN POPULATION EMPLOYED IN LOW PRODUCTIVITY SECTOR OF THE LABOUR MARKET, IN LATIN AMERICA AND THE CARIBBEAN, 1990 TO 2005

(Percentage of the total employed urban population)

Country	Year	Total	Microenterprises [a]				Domestic employment	Unskilled self-employed workers [b]		
			Employers	Wage or salary earners				Total	Manufacturing & Construction	Comerse & Services [c]
				Total	Prof. & Technical	Non-prof. Non-technical				
Argentina (Greater Buenos Aires)	1990	44.4	3.8	12.0	0.4	11.6	5.7	22.9	6.9	16.0
	2000	42.2	3.4	16.0	1.4	14.6	5.3	17.5	5.1	12.4
	2005	39.8	2.5	14.5	1.4	13.1	7.1	15.7	5.5	10.1
(Urban)	2000	43.5	3.3	15.4	1.3	14.1	5.9	18.9	5.6	13.2
	2005	41.2	2.8	14.5	1.3	13.2	7.2	16.7	5.6	10.9
Bolivia	1989	58.5	1.1	10.5	0.9	9.6	5.8	41.1	9.8	30.0
	1999	64.3	2.5	12.8	1.0	11.8	3.1	45.9	12.1	31.1
	2004	70.9	4.1	18.1	1.4	16.7	4.6	44.1	10.8	28.9
Brazil [d]	1990	49.2	…	21.6	4.3	17.3	6.2	21.4	3.5	15.8
	1999	47.3	2.2	10.1	1.7	8.4	8.5	26.5	5.2	16.4
	2005	43.6	2.2	10.3	0.9	9.4	8.5	22.6	6.3	12.0
Chile [e]	1990	38.8	0.8	10.3	0.9	9.4	7.0	20.7	5.7	14.0
	1998	34.4	2.6	10.7	1.0	9.7	5.9	15.2	4.1	10.2
	2003	31.8	2.4	7.9	0.8	7.1	6.5	15.0	4.9	9.2
Colombia [f]	1991	…	…	….	…	…	5.6	27.3	6.4	20.0
	1999	…	…	…	…	…	5.2	35.7	7.5	26.7
	2005	…	…	…	…	…	5.3	37.6	7.6	27.2
Costa Rica	1990	36.9	4.4	10.5	0.8	9.7	4.4	17.6	6.4	10.1
	2000	39.1	4.1	13.0	1.2	11.8	4.5	17.5	4.5	11.9
	2005	39.9	5.9	13.0	1.6	11.4	4.9	16.1	3.8	11.5
Ecuador	1990	54.5	3.6	11.9	0.6	11.3	4.5	34.5	7.8	24.4
	2000	56.5	3.0	15.0	1.2	13.8	4.7	33.8	7.1	24.1
	2005	57.9	4.8	16.3	1.2	15.1	5.2	31.6	5.8	23.3

(Table 1.5 Continued)

El Salvador	1990	55.6	2.7	13.6	0.3	13.3	6.1	33.2	8.7	21.8
	2000	53.8	5.0	13.5	1.0	12.5	4.1	31.2	7.0	21.7
	2004	54.6	4.4	13.9	0.7	13.2	3.9	32.4	6.5	23.9
Guatemala	1989	54.6	2.1	14.6	0.8	13.8	7.0	30.9	7.4	14.9
	1998	64.4	3.6	22.4	2.3	20.1	3.9	34.5	8.2	20.7
	2002	57.6	5.2	13.9	0.8	13.1	4.0	34.5	8.9	19.8
Honduras	1990	53.3	1.0	13.9	0.7	13.2	6.7	31.7	8.9	18.7
	1999	55.2	5.1	12.2	1.0	11.2	4.8	33.1	7.4	22.0
	2003	59.4	4.3	14.3	0.9	13.4	4.1	36.7	10.0	22.0
Mexico [g]	1989	…	2.8	…	…	…	2.7	18.9	3.0	12.5
	2000	42.5	3.9	16.0	1.1	14.9	3.0	19.6	3.6	15.1
	2005	42.9	2.4	17.1	1.6	15.5	4.5	18.9	3.2	15.1
Nicaragua	1993	49.2	0.5	13.3	1.6	11.7	6.2	29.2	7.7	17.5
	1998	60.6	3.0	16.2	1.7	14.5	6.4	35.0	4.3	26.4
	2001	59.9	3.6	16.5	0.7	15.8	4.4	35.4	5.5	25.7
Panama	1991	37.9	2.6	5.8	0.6	5.2	7.0	22.5	4.3	11.2
	1999	37.3	2.1	7.2	0.7	6.5	6.1	21.9	4.6	13.5
	2005	40.5	2.8	9.4	0.7	8.7	6.8	21.5	4.0	16.4
Paraguay (Asunción)	1990	55.5	6.8	17.0	1.1	15.9	10.5	21.2	5.2	15.5
	1999	51.9	4.7	14.9	1.3	13.6	9.1	23.2	5.2	17.1
	2005	56.0	5.2	14.2	0.9	13.3	10.7	25.9	5.4	18.1
(Urban)	1994	61.2	7.2	16.0	1.0	15.0	10.5	27.5	5.4	20.2
	1999	59.1	5.0	15.8	0.9	14.9	9.2	29.1	5.2	21.3
	2005	61.3	4.6	16.1	0.9	15.2	11.1	29.5	5.7	19.3
Peru	1997	60.6	4.9	13.1	1.2	11.9	4.4	38.2	5.4	28.6
	1999	63.3	4.5	14.9	1.9	13.0	5.8	38.1	4.9	29.4
	2003	64.6	3.7	13.3	0.9	12.4	5.6	42.0	5.3	29.7
Dominican Republic	1992	…	…	…	…	…	3.2	32.8	5.6	23.0
	2000	45.1	1.8	8.5	0.7	7.8	4.1	30.7	7.3	20.6
	2005	49.3	3.5	6.9	0.5	6.4	4.8	34.1	7.9	22.3

(Table 1.5 Continued)

Uruguay	1990	39.2	2.7	10.6	0.3	10.3	6.9	19.0	5.6	12.0
	2000	42.6	2.4	11.8	0.7	11.1	9.1	19.3	7.3	10.9
	2005	44.3	2.5	14.3	0.6	13.7	7.2	20.3	6.9	12.3
Venezuela (Bolivarian Rep. of) [h]	1990	39.2	4.9	6.7	0.2	6.5	6.3	21.3	4.1	15.3
	2000	54.6	3.8	11.6	0.4	11.2	2.1	37.1	7.4	24.7
	2005	52.0	3.7	11.2	1.0	10.2	1.9	35.2	6.0	24.4

Source: Social Panorama of Latin America, 2006. It is prepared by the Social Development Division and the Statistics and Economic Projections Division of Economic Commission for Latin America and the Caribbean (ECLAC), on the basis of special tabulations of data from household surveys conducted in the relevant countries.

[a] Refers to establishments employing up to five persons. In the cases of Bolivarian Republic of Venezuela, Bolivia (1999 and 2002), Chile (1996), Dominican Republic, El Salvador, Panama (up to 2002) and Uruguay (1990), includes establishments employing up to four persons.

[b] Refers to own–account workers and unpaid family workers without professional or technical skills.

[c] Includes persons employed in agriculture, forestry, hunting and fishing.

[d] Until 1990 the "microenterprises" category included wage earners lacking an employment contract. In 1993 and from 1996 to 1999, this category included wage earners in establishments employing up to five persons, so that the figures for these years are not comparable with those for previous years.

[e] Information from national socio–economic surveys (CASEN).

[f] In 1993, the survey's geographical coverage was extended to include nearly the entire urban population of the country. Up to 1992, the survey covered approximately half the urban population, except in 1991, when a nationwide survey was conducted. The sample design used in the surveys conducted since 2001 is such that the figures for urban areas are not strictly comparable with those of previous years.

[g] Information from national household income and expenditure surveys (ENIGH). In the 1994 survey no information was given on the size of establishments employing wage or salary earners.

[h] The sample design used in the surveys conducted since 1997 does not distinguish between urban and rural areas, and the figures therefore refer to the nationwide total.

TABLE 1.6

PERCENT OF URBAN POPULATION LIVING IN SLUMS AND SLUM POPULATION TOTAL, 2001 LATIN AMERICA AND THE CARIBBEAN

Country	2001		Country	2001	
	Percent	Thousands of people		Percent	Thousands of people
Antigua & Barbuda	6.9	2	Guyana	4.9	14
Argentina	33.1	10 964	Haiti	85.7	2 574
Aruba	2.0	1	Honduras	18.1	638
Bahamas	2.0	5	Jamaica	35.7	525
Barbados	1.0	1	Martinique	2.0	7
Belize	62.0	69	Mexico	19.6	14 692
Bermuda	1.0	1	Netherlands Antilles	1.0	2
Bolivia	61.3	3 284	Nicaragua	80.9	2 382
Brazil	36.6	51 676	Panama	30.8	505
British Virgin Islands	3.0	0	Paraguay	25.0	797
Canada	5.8	1 419	Peru	68.1	12 993
Cayman Islands	2.0	1	Puerto Rico	2.0	59
Chile	8.6	1 143	Saint Kitts and Nevis	5.0	1
Colombia	21.8	7 057	Saint Pierre and Miquelon	8.7	1
Costa Rica	12.8	313	St. Lucia	11.9	7
Cuba	2.0	169	St. Vincent & Grenadines	5.0	3
Dominica	14.0	7	Suriname	6.9	22
Dominican Rep.	37.6	2 111	Trinidad and Tobago	32.0	310
Ecuador	25.6	2 095	Turks and Caicos Islands	2.0	0
El Salvador	35.2	1 386	United States	5.8	12 842
French Guiana	12.9	16	Uruguay	6.9	4
Greenland	18.5	9	Venezuela	40.7	8 738
Grenada	6.9	2	Virgen Islands	2.0	62
Guadeloupe	6.9	30	Central America & Caribbean	23.7	28 748
Guatemala	61.8	2 884	South America	35.5	98 803

Source: United Nations Human Settlements Program (UN-HABITAT). 2003. Slums of the World: The face of urban poverty in the new millennium?. Available on-line at: http://www.unhabitat.org/publication/slumreport.pdf. Nairobi: UN-HABITAT.

TABLE 1.7
ACCESS TO DRINKING WATER IN LATIN AMERICA AND THE CARIBBEAN, 1995 TO 2004
(Percentage of total population)

Country	Year	Total inhabitants (000)	Urban (%)			Rural (%)			Total (%)		
			Domiciliary connection	Other type	Without connection	Domiciliary connection	Other type	Without connections	Domiciliary connection	Other type	Without connections
Antigua and Barbuda	1995	70	32.4	1.8	1.8	50.6	6.4	7.0	83.0	8.2	8.8
	2000	76	33.3	1.9	1.9	49.8	6.3	6.8	83.1	8.2	8.7
	2004	81	34.2	1.9	1.9	49.0	6.2	6.8	83.2	8.1	8.7
Argentina	1990	32 581	66.1	18.3	2.6	2.9	6.5	3.6	69.0	24.8	6.2
	1995	34 835	68.6	17.6	1.8	3.6	5.4	3.0	72.2	23.0	4.8
	2000	36 896	72.1	15.1	1.8	4.3	4.3	2.4	76.4	19.4	4.2
	2004	38 372	74.7	13.5	1.8	4.5	3.5	2.0	79.2	17.0	3.8
Bahamas	1995	279	59.3	24.9	1.7	11.2	0.8	2.1	70.5	25.7	3.8
	2000	301	61.4	25.8	1.8	8.8	0.7	1.5	70.2	26.5	3.3
	2004	319	62.1	26.0	1.8	8.0	0.7	1.4	70.1	26.7	3.2
Barbados	1990	257	44.1	0.9	0.0	0.0	55.0	0.0	44.1	55.9	0.0
	1995	262	46.5	0.5	0.0	0.0	53.0	0.0	46.5	53.5	0.0
	2000	266	50.0	0.0	0.0	0.0	50.0	0.0	50.0	50.0	0.0
	2004	269	52.0	0.0	0.0	0.0	48.0	0.0	52.0	48.0	0.0
Belize	1995	214	46.6	1.4		32.8	9.9	9.3	79.4	11.3	9.3
	2000	242	47.5	0.5	0.0	32.8	9.9	9.3	80.3	10.4	9.3
	2004	264	47.5	0.5	0.0	32.8	9.9	9.3	80.3	10.4	9.3
Bolivia	1990	6 669	43.7	7.3	5.0	9.7	11.9	22.4	53.4	19.2	27.4
	1995	7482	49.0	5.9	4.1	12.3	10.7	18.0	61.3	16.6	22.1
	2000	8 317	53.9	4.3	3.7	14.1	9.5	14.5	68.0	13.8	18.2
	2004	9 009	57.6	3.2	3.2	15.8	8.6	11.6	73.4	11.8	14.8
Brazil	1990	149 394	67.5	2.3	5.3	7.0	6.7	11.2	74.5	9.0	16.5
	1995	161 376	70.2	3.9	3.9	5.3	7.0	9.7	75.5	10.9	13.6
	2000	173 858	73.7	4.1	3.2	3.8	7.0	8.2	77.5	11.1	11.4
	2004	183 913	76.4	4.2	3.4	2.7	6.4	6.9	79.1	10.6	10.3

(Table 1.7 Continued)

Colombia	1990	34 970	64.9	2.8	1.4	12.7	11.5	6.7	77.6	14.3	8.1
	1995	38 542	68.4	2.2	1.4	12.6	8.4	7.0	81.0	10.6	8.4
	2000	42 120	72.0	2.3	0.8	12.3	5.8	6.8	84.3	8.1	7.6
	2004	44 915	73.9	2.3	0.8	11.7	4.6	6.7	85.6	6.9	7.5
Costa Rica	1995	3 475	55.4	0.6	0.0	35.6	4.8	3.6	91.0	5.4	3.6
	2000	3 929	58.4	0.6	0.0	33.2	4.5	3.3	91.6	5.1	3.3
	2004	4 253	60.4	0.6	0.0	31.6	4.3	3.1	92.0	4.9	3.1
Cuba	1990	10 537	57.0	13.3	3.7	8.1	…	…	65.1	…	…
	1995	10 867	59.3	12.0	3.8	9.5	9.9	5.5	68.8	21.9	9.3
	2000	11 125	60.8	10.5	3.8	11.5	7.9	5.5	72.3	18.4	9.3
	2004	11 245	62.3	9.9	3.8	11.8	6.9	5.3	74.1	16.8	9.1
Chile	1990	13 179	81.3	0.0	1.7	4.3	4.0	8.7	85.6	4.0	10.4
	1995	14 395	82.3	0.8	0.8	5.1	3.5	7.5	87.4	4.3	8.3
	2000	16 412	85.1	0.9	0.0	5.3	2.8	5.9	90.4	3.7	5.9
	2004	16 124	86.1	0.9	0.0	4.9	2.6	5.5	91.0	3.5	5.5
Dominica	1995	75	67.6	1.4	0.0	18	9.9	3.1	85.6	11.3	3.1
	2000	78	69.6	1.4	0.0	16.8	9.3	2.9	86.4	10.7	2.9
	2004	79	70.6	1.4	0.0	16.2	9.0	2.8	86.8	10.4	2.8
Ecuador	1990	10 272	40.7	4.4	9.9	14.4	13.1	17.6	55.0	17.5	27.5
	1995	11 396	44.7	5.8	7.5	16.0	13.9	12.2	60.6	19.7	19.7
	2000	12 306	48.6	6.6	4.8	17.6	14.8	7.6	66.2	21.4	12.4
	2004	13 040	50.8	9.3	1.9	17.1	16.7	4.2	67.9	26.0	6.1
El Salvador	1990	5 110	36.3	6.4	6.4	8.2	16.3	26.4	44.5	22.7	32.8
	1995	5 669	41.0	7.0	5.9	11.0	14.3	20.8	52.0	21.3	26.7
	2000	6 280	45.8	7.5	4.6	13.4	13.0	15.7	59.2	20.5	20.3
	2004	6 762	48.6	7.8	3.6	15.2	12.8	12.0	63.8	20.6	15.6
Grenada	1995	99	32.6	1.4	1.1	48.8	11.7	4.4	81.4	13.1	5.5
	2000	102	35.3	1.5	1.1	46.5	11.2	4.4	81.8	12.7	5.5
	2004	102	38.1	1.6	1.2	44.3	10.6	4.2	82.4	12.2	5.4

(Table 1.7 Continued)

Guatemala	1990	8 894	28.7	7.8	4.5	20.1	22.4	16.5	48.8	30.2	21.0
	1995	9 970	33.1	6.9	3.0	25.7	19.4	11.9	58.8	26.3	14.9
	2000	11 166	37.8	5.4	1.8	30.8	16.5	7.7	68.6	21.9	9.5
	2004	12 295	41.8	4.7	0.5	34.5	14.3	4.2	76.3	19.0	4.7
French Guiana	1995	139	62.1	3.8	9.0	16.3	1.5	7.3	78.4	5.3	16.3
	2000	164	62.1	3.8	9.0	16.3	1.5	7.3	78.4	5.3	16.3
	2004	183	62.1	3.8	9.0	16.3	1.5	7.3	78.4	5.3	16.3
Haiti	1990	6 867	7.8	9.6	11.6	1.4	28.4	41.2	9.2	38.0	52.8
	1995	7 391	8.6	10.2	14.2	2.0	30.2	34.8	10.6	40.4	49.0
	2000	7 939	8.6	10.8	16.6	1.9	32.6	29.5	10.5	43.4	46.1
	2004	8 407	9.1	10.6	18.2	1.9	32.9	27.3	11.0	43.5	45.5
Honduras	1990	4 867	32.8	4.0	3.2	25.2	22.2	12.6	58.0	26.2	15.8
	1995	5 625	36.1	2.9	2.9	29.0	17.4	11.7	65.1	20.3	14.6
	2000	6 424	39.2	2.2	2.6	32.5	12.9	10.6	71.7	15.1	13.2
	2004	7 048	41.9	1.8	2.3	33.5	10.3	10.2	75.4	12.1	12.5
Turks and Caicos Islands	1990	12	0.0	0.0	0.0	0.0	58.0	42	0.0	58.0	42.0
	1995	15	36.7	10.3	0.0	31.8	21.2	0.0	68.5	31.5	0.0
	2000	19	36.7	10.3	0.0	31.8	21.2	0.0	68.5	31.5	0.0
	2004	25	37.4	10.6	0.0	31.2	20.8	0.0	68.6	31.4	0.0
Jamaica	1990	2 369	44.9	5.1	1.0	16.2	26.0	6.8	61.1	31.1	7.8
	1995	2 484	46.3	4.7	1.0	17.8	24.0	6.2	64.1	28.7	7.2
	2000	2 585	47.3	3.6	1.0	20.2	21.6	6.3	67.5	25.2	7.3
	2004	2 639	47.8	3.1	1.0	22.1	20.2	5.8	69.9	23.3	6.8
Mexico	1990	84 296	61.9	2.2	7.9	14.6	3.4	10.0	76.5	5.6	17.9
	1995	92 523	65.7	2.2	5.1	15.9	3.5	7.6	81.6	5.7	12.7
	2000	100 088	70.5	2.3	2.3	16.5	3.5	4.9	87.0	5.8	7.2
	2004	105 699	73.0	3.0	0.0	17.3	3.6	3.1	90.3	6.6	3.1
Nicaragua	1990	3 960	45.1	3.2	4.8	7.5	14.1	25.3	52.6	17.3	30.1
	1995	4 477	45.4	3.8	4.9	9.2	15.2	21.5	54.6	19.0	26.4
	2000	4 959	47.0	3.4	5.6	10.6	15.4	18.0	57.6	18.8	23.6
	2004	5 376	48.7	3.5	5.8	11.3	15.1	15.6	60.0	18.6	21.4

(Table 1.7 Continued)

Panamá	1990	2 411	51.8	1.6	0.5	33.1	3.2	9.8	84.9	4.8	10.3
	1995	2 670	52.8	1.7	0.5	32.4	3.2	9.4	85.2	4.9	9.9
	2000	2 950	53.8	1.7	0.6	31.7	3.1	9.1	85.5	4.8	9.7
	2004	3 175	54.7	1.7	0.6	31.0	3.0	9.0	85.7	4.7	9.6
Paraguay	1990	4 219	29.4	10.3	9.3	1.0	21.4	28.6	30.4	31.7	37.9
	1995	4 829	35.4	10.4	6.2	4.3	21.1	22.6	39.7	31.5	28.8
	2000	5 470	41.8	9.9	3.3	8.1	19.8	17.1	49.9	29.7	20.4
	2004	6 017	47.6	9.9	0.6	10.4	18.1	13.4	58.0	28.0	14.0
Peru	1990	21 753	51.8	9.7	7.6	5.0	7.8	18.1	56.8	17.5	25.7
	1995	23 837	55.4	7.8	7.8	7.5	7.3	14.2	62.9	15.1	22.0
	2000	25 952	59.1	5.8	8.0	9.5	7.0	10.6	68.6	12.8	18.6
	2004	27 562	60.7	5.2	8.1	10.1	6.8	9.1	70.8	12.0	17.2
Dominican Republic	1990	7 090	46.8	7.2	1.1	15.8	14.0	15.1	62.6	21.2	16.2
	1995	7 672	49.6	5.7	1.7	18.9	13.3	10.8	68.5	19.0	12.5
	2000	8 265	52.2	4.1	1.7	22.7	12.6	6.7	74.9	16.7	8.4
	2004	8 768	55.2	3.0	1.8	24.8	11.6	3.6	80.0	14.6	5.4
St. Kitts & Nevis	1990	41	0.0	33.7	0.3	0.0	65.3	0.7	0.0	99.0	1.0
	1995	40	25.2	9.5	0.4	46.8	17.6	0.5	72.0	27.1	0.9
	2000	40	23.8	8.9	0.3	48.0	18.4	0.6	71.8	27.3	0.9
	2004	42	22.3	8.4	0.3	49.7	18.6	0.7	72.0	27.0	1.0
St. Lucia	1990	138	0.0	26.5	0.5	0.0	71.5	1.5	0.0	98.0	2.0
	1995	148	21.0	6.4	0.6	54.0	16.6	1.4	75.0	23.0	2.0
	2000	154	21.8	6.7	0.6	53.3	16.3	1.3	75.1	23.0	1.9
	2004	159	23.3	7.1	0.6	51.8	15.9	1.3	75.1	23.0	1.9
Surinam	1995	415	63.7	4.9	1.4	14.4	7.5	8.1	78.1	12.4	9.5
	2000	434	67.3	5.2	1.5	12.5	6.5	7.0	79.8	11.7	8.5
	2004	446	70.1	5.4	1.5	11.0	5.8	6.2	81.1	11.2	7.7
Trinidad and Tobago	1990	1 215	55.9	8.3	4.8	21.1	6.5	3.4	77.0	14.8	8.2
	1995	1 259	58.3	8.6	5.0	18.8	6.2	3.1	77.1	14.8	8.1
	2000	1 285	59.2	9.6	5.2	17.4	5.7	2.9	76.6	15.3	8.1
	2004	1 301	60.8	9.1	6.1	16.1	5.0	2.9	76.9	14.1	9.0

(Table 1.7 Continued)

Uruguay	1990	3 106	86.3	2.7	0	0	11	0	86.3	13.7	0.0
	1995	3 218	88.3	2.7	0	0	9	0	88.3	11.7	0.0
	2000	3 342	89.2	2.8	0	6.7	1.3	0	95.9	4.1	0.0
	2004	3 439	90.2	2.8	0	5.9	1.1	0	96.1	3.9	0.0
Venezuela (Bolivarian Republic of)	1995	22 087	70.5	2.6	12.9	8.5	1.3	4.2	79.0	3.9	17.1
	2000	24 418	73.1	0.9	13.1	7.9	1.2	3.8	81.0	2.1	16.9
	2004	26 282	73.9	0.9	13.2	7.3	1.1	3.6	81.2	2.0	16.8
Central America	1990	28 504	38	5	4	18	18	17	56.0	23.0	21.0
	1995	32 100	41	5	3	23	15	13	64.0	20.0	16.0
	2000	35 950	44	4	3	26	13	10	70.0	17.0	13.0
	2004	39 173	47	4	2	27	11	9	74.0	15.0	11.0
Caribbean	1990	35 071	43	10	5	9	15	18	52.0	25.0	23.0
	1995	36 989	46	9	6	11	15	13	57.0	24.0	19.0
	2000	38 799	48	9	6	12	15	10	60.0	24.0	16.0
	2004	40 177	49	8	7	13	14	9	62.0	22.0	16.0
South America	1990	29 7125	65	5	5	7	8	10	72.0	13.0	15.0
	1995	323 283	67	5	4	7	7	10	74.0	12.0	14.0
	2000	349 433	71	5	4	7	7	6	78.0	12.0	10.0
	2004	370 052	73	5	4	6	6	6	79.0	11.0	10.0
Latin America and the Caribbean	1990	443 751	61	5	5	9	8	12	70.0	13.0	17.0
	1995	483 611	64	5	4	10	7	10	74.0	12.0	14.0
	2000	522 931	67	5	4	10	7	7	77.0	12.0	11.0
	2004	553 725	70	5	3	10	6	6	80.0	11.0	9.0

Source: http://www.bvsde.paho.org/AyS2004/AguayS2004.html. Information from latest World Report on Monitoring of Goal 10 of the MDGs by the Joint Program for Monitoring Water and Sanitation Services, PAHO/WHO-UNICEF(Sep./2006) with information from 2004.

Note 1: Goal 10 of MDG 7 is defined as: To reduce by half, by 2015, the percent of persons who are lacking improved access to safe drinking water and sanitation. The indicators which measure access or coverage are:

Percent of the population (urban and rural) which uses improved sources of drinking water;

Percent of the population (urban and rural) who use improved sanitary installations.

TABLE 1.8

ACCESS TO SANITATION IN LATIN AMERICA AND THE CARIBBEAN, 1995 TO 2004

(Percentage of total population)

Country	Year	Total Inhabitants	Urban (%)			Rural (%)			Total (%)		
		(000)	Domiciliary connection	Other type	Without connection	Domiciliary connection	Other type	Without connection	Domiciliary connection	Other type	Without connection
Antigua & Barbuda	1995	70	0.0	35.3	0.7	0.6	59.5	3.9	0.6	94.8	4.6
	2000	76	0.0	36.3	0.7	0.6	58.6	3.8	0.6	94.9	4.5
	2004	81	0.0	37.2	0.8	0.6	57.7	3.7	0.6	94.9	4.5
Argentina	1990	32 581	33.9	40.9	12.2	0.1	5.7	7.2	34.0	46.6	19.4
	1995	34 835	37.8	40.5	9.7	0.2	6.8	5.0	38.0	47.3	14.7
	2000	36 896	40.9	40.1	8.0	0.4	7.7	2.9	41.3	47.8	10.9
	2004	38 372	43.2	39.6	7.2	0.5	7.8	1.7	43.7	47.4	8.9
Bahamas	1995	279	13.8	72.2	…	0.6	13.4	…	14.4	85.6	…
	2000	301	14.2	74.8	…	0.4	10.6	…	14.6	85.4	…
	2004	319	14.4	75.6	…	0.4	9.6	…	14.8	85.2	…
Barbados	1990	257	1.8	42.7	0.5	0.0	55.0	0.0	1.8	97.7	0.5
	1995	262	1.4	45.1	0.5	0.0	53.0	0.0	1.4	98.1	0.5
	2000	266	1.0	48.5	0.5	0.0	50.0	0.0	1.0	98.5	0.5
	2004	269	1.0	50.5	0.5	0.0	48.0	0.0	1.0	98.5	0.5
Belize	1995	214	18.7	15.4	13.9	0.0	13.0	39.0	18.7	28.4	52.9
	2000	242	20.2	13.9	13.9	0.0	13.0	39.0	20.2	26.9	52.9
	2004	264	20.2	13.9	13.9	0.0	13.0	39.0	20.2	26.9	52.9
Bolivia	1990	6 669	17.9	9.5	28.6	0.9	5.3	37.8	18.8	14.8	66.4
	1995	7 482	20.7	10.6	27.7	0.8	6.2	34.0	21.5	16.8	61.7
	2000	8 317	22.9	12.4	26.7	0.8	6.8	30.4	23.7	19.2	57.1
	2004	9 009	25.0	13.4	25.6	0.7	7.2	28.1	25.7	20.6	53.7
Brazil	1990	149 394	37.5	24.0	13.5	1.0	8.3	15.7	38.5	32.3	29.2
	1995	161 376	39.8	25.0	13.3	1.1	7.0	13.8	40.9	32.0	27.1
	2000	173 858	42.9	24.3	13.8	1.0	6.1	11.9	43.9	30.4	25.7
	2004	183 913	44.5	25.2	14.3	0.8	5.1	10.1	45.3	30.3	24.4

(Table 1.8 Continued)

Colombia	1990	34 970	61.4	4.1	3.5	5.6	10.5	14.9	67.0	14.6	18.4
	1995	38 542	64.1	5.0	2.9	5.3	9.5	13.2	69.4	14.5	16.1
	2000	42 120	67.5	4.5	3.0	4.8	8.8	11.4	72.3	13.3	14.4
	2004	44 915	69.3	4.6	3.1	4.6	7.8	10.6	73.9	12.4	13.7
Costa Rica	1995	3 475	25.8	24.1	6.2	0.4	42.2	1.3	26.2	66.3	7.5
	2000	3 929	28.3	24.2	6.5	0.4	39.4	1.2	28.7	63.6	7.7
	2004	4 253	29.3	25.0	6.7	0.4	37.4	1.2	29.7	62.4	7.9
Cuba	1990	10 537	28.9	44.4	0.7	0.0	24.7	1.3	28.9	69.1	2.0
	1995	10 867	33.8	40.5	0.8	6.1	17.5	1.3	39.9	58.0	2.1
	2000	11 125	37.5	36.8	0.8	6.1	17.5	1.3	43.6	54.3	2.1
	2004	11 245	38.0	37.2	0.8	6.0	16.8	1.2	44.0	54.0	2.0
Chile	1990	13 179	74.7	0.8	7.5	0.9	8.0	8.1	75.6	8.8	15.6
	1995	14 395	74.8	3.4	5.9	0.8	8.3	6.8	75.6	11.7	12.7
	2000	16 412	76.5	5.2	4.3	0.7	8.0	5.3	77.2	13.2	9.6
	2004	16 124	77.4	5.2	4.3	0.7	7.4	5.0	78.1	12.6	9.3
Dominica	1995	75	19.3	40.0	9.7	0.0	23.3	7.7	19.3	63.3	17.4
	2000	78	19.9	41.2	9.9	0.0	21.8	7.2	19.9	63.0	17.1
	2004	79	20.2	41.8	10.1	0.0	21.0	6.9	20.2	62.8	17.0
Ecuador	1990	10 272	30.3	12.1	12.7	3.2	17.1	24.6	33.5	29.2	37.3
	1995	11 396	33.6	14.5	9.9	4.6	19.7	17.7	38.2	34.2	27.6
	2000	12 306	36.6	16.8	6.6	6.0	22.8	11.2	42.6	39.6	17.8
	2004	13 040	38.4	19.8	3.7	6.1	25.1	6.9	44.5	44.9	10.6
El Salvador	1990	5 110	25.5	8.8	14.7	0.5	16.3	34.2	26.0	25.1	48.9
	1995	5 669	30.8	8.6	14.6	0.9	15.6	29.5	31.7	24.2	44.1
	2000	6 280	36.5	8.1	13.3	0.8	15.5	25.8	37.3	23.6	39.1
	2004	6 762	37.8	8.4	13.8	0.8	14.8	24.4	38.6	23.2	38.2
Grenada	1995	99	6.3	27.3	1.4	0.0	63.1	1.9	6.3	90.4	3.3
	2000	102	6.8	29.6	1.5	0.0	60.1	2.0	6.8	89.7	3.5
	2004	102	7.4	32.0	1.6	0.0	57.2	1.8	7.4	89.2	3.4

(Table 1.8 Continued)

Guatemala	1990	8 894	20.9	9.0	11.1	3.5	24.2	31.3	24.4	33.2	42.4
	1995	9 970	24.5	9.5	9.0	5.7	27.9	23.4	30.2	37.4	32.4
	2000	11 166	28.4	9.9	6.8	7.7	31.9	15.3	36.1	41.8	22.1
	2004	12 295	32.0	10.3	4.7	9.0	34.5	9.5	41.0	44.8	14.2
French Guiana	1995	139	24.8	39.0	11.3	6.5	7.8	10.6	31.3	46.8	21.9
	2000	164	24.8	39.0	11.3	6.5	7.8	10.6	31.3	46.8	21.9
	2004	183	24.8	39.0	11.3	6.5	7.8	10.6	31.3	46.8	21.9
Haiti	1990	6 867	0.0	7.3	21.8	0.0	16.3	54.6	0.0	23.6	76.4
	1995	7 391	0.0	11.6	21.5	0.0	13.4	53.5	0.0	25.0	75.0
	2000	7 939	0.0	18.4	17.6	0.0	10.2	53.8	0.0	28.6	71.4
	2004	8 407	0.0	21.7	16.3	0.0	8.7	53.3	0.0	30.4	69.6
Honduras	1990	4 867	19.2	11.6	9.2	2.4	16.2	41.4	21.6	27.8	50.6
	1995	5 625	23.1	10.9	8.0	4.1	19.1	34.8	27.2	30.0	42.8
	2000	6 424	27.3	10.1	6.6	5.6	21.8	28.6	32.9	31.9	35.2
	2004	7 048	30.4	9.7	6.0	5.9	23.2	24.8	36.3	32.9	30.8
Turks and Caicos Islands	1995	15	0.0	46.1	0.9	0.0	49.8	3.2	0.0	95.9	4.1
	2000	19	0.0	46.1	0.9	0.0	49.8	3.2	0.0	95.9	4.1
	2004	25	0.0	47.0	1.0	0.0	48.9	3.1	0.0	95.9	4.1
Jamaica	1990	2 369	20.4	23.5	7.1	4.4	27.0	17.6	24.8	50.5	24.7
	1995	2 484	19.2	26.0	6.8	2.9	28.8	16.3	22.1	54.8	23.1
	2000	2 585	17.7	28.6	5.7	1.9	30.7	15.4	19.6	59.3	21.1
	2004	2 639	16.1	31.2	4.7	1.0	32.2	14.8	17.1	63.4	19.5
Mexico	1990	84 296	47.5	6.5	18.0	1.4	2.2	24.4	48.9	8.7	42.4
	1995	92 523	52.6	7.3	13.1	2.7	4.1	20.2	55.3	11.4	33.3
	2000	100 088	57.8	8.3	9.0	3.5	5.8	15.6	61.3	14.1	24.6
	2004	105 699	60.8	8.4	6.8	3.8	6.0	14.2	64.6	14.4	21.0
Nicaragua	1990	3 960	18.0	15.9	19.1	0.5	10.8	35.7	18.5	26.7	54.8
	1995	4 477	15.7	16.7	21.6	0.5	12.4	33.1	16.2	29.1	54.7
	2000	4 959	14.0	17.9	24.1	0.0	14.1	29.9	14.0	32.0	54.0
	2004	5 376	12.8	19.7	25.5	0.0	14.3	27.7	12.8	34.0	53.2

(Table 1.8 Continued)

Panama	1990	2 411	31.3	16.7	5.9	0.5	23.0	22.6	31.8	39.7	28.5
	1995	2 670	31.9	17.1	6.1	0.5	22.5	21.9	32.4	39.6	28.0
	2000	2 950	32.5	17.4	6.2	0.4	22.0	21.5	32.9	39.4	27.7
	2004	3 175	33.1	17.7	6.3	0.4	21.5	21.0	33.5	39.2	27.3
Paraguay	1990	4 219	6.9	28.4	13.7	0.0	23.0	28.0	6.9	51.4	41.7
	1995	4 829	7.8	33.8	10.4	0.0	24.5	23.5	7.8	58.3	33.9
	2000	5 470	8.8	39.6	6.6	0.0	25.7	19.3	8.8	65.3	25.9
	2004	6 017	9.3	45.2	3.5	0.0	25.6	16.4	9.3	70.8	19.9
Peru	1990	21 753	37.3	10.4	21.4	0.9	3.7	26.3	38.2	14.1	47.7
	1995	23 837	42.6	7.8	20.6	1.5	4.9	22.6	44.1	12.7	43.2
	2000	25 952	47.5	5.8	19.7	1.9	5.9	19.2	49.4	11.7	38.9
	2004	27 562	49.6	5.2	19.2	1.8	6.5	17.7	51.4	11.7	36.9
Dominican Republic	1990	7 090	25.9	7.2	22.0	2.3	17.1	25.5	28.2	24.3	47.5
	1995	7 672	30.2	8.6	18.2	5.2	18.1	19.7	35.4	26.7	37.9
	2000	8 265	34.8	8.7	14.5	8.4	18.9	14.7	43.2	27.6	29.2
	2004	8 768	39.0	9.6	11.4	10.8	18.4	10.8	49.8	28.0	22.2
St. Kits & Nevis	1990	41	0.0	32.6	1.4	0.0	63.4	2.6	0.0	96.0	4.0
	1995	40	0.0	33.6	1.4	0.0	62.4	2.6	0.0	96.0	4.0
	2000	40	0.0	31.7	1.3	0.0	64.3	2.7	0.0	96.0	4.0
	2004	42	0.0	29.8	1.2	0.0	66.2	2.8	0.0	96.0	4.0
St. Lucia	1995	148	2.0	23.0	3.1	5.0	59.0	7.9	7.0	82.0	11.0
	2000	154	2.0	23.8	3.2	5.0	58.2	7.8	7.0	82.0	11.0
	2004	159	2.2	25.4	3.4	4.8	56.6	7.6	7.0	82.0	11.0
Surinam	1995	415	0.7	68.6	0.7	0.0	22.8	7.2	0.7	91.4	7.9
	2000	434	0.0	73.3	0.7	0.0	19.8	6.2	0.0	93.1	6.9
	2004	446	0.0	76.2	0.8	0.0	17.5	5.5	0.0	93.7	6.3
Trinidad and Tobago	1990	1 215	0.0	69.0	0.0	0.0	31.0	0.0	0.0	100.0	0.0
	1995	1 259	13.7	58.3	0.0	0.0	28.0	0.0	13.7	86.3	0.0
	2000	1 285	14.1	59.9	0.0	0.0	26.0	0.0	14.1	85.9	0.0
	2004	1 301	14.4	61.6	0.0	0.0	24.0	0.0	14.4	85.6	0.0

(Table 1.8 Continued)

Uruguay	1990	3 106	0.0	89.0	0.0	0.0	10.9	0.1	0.0	99.9	0.1
	1995	3 218	0.0	91.0	0.0	0.0	8.9	0.1	0.0	99.9	0.1
	2000	3 342	74.4	17.5	0.0	3.4	4.6	0.1	77.8	22.1	0.1
	2004	3 439	75.3	17.7	0.0	2.9	4.0	0.1	78.2	21.7	0.1
Venezuela (Bolivarian Rep. Of)	1995	22 087	55.0	6.0	24.9	2.0	4.8	7.3	57.0	10.8	32.2
	2000	24 418	53.1	8.7	25.2	1.8	4.4	6.8	54.9	13.1	32.0
	2004	26 282	53.7	8.8	25.5	1.7	4.1	6.2	55.4	12.9	31.7
Central America	1990	28 504	22.0	12.0	12.0	2.0	22.0	30.0	24.0	34.0	42.0
	1995	32 100	25.0	13.0	11.0	3.0	23.0	25.0	28.0	36.0	36.0
	2000	35 950	28.0	13.0	10.0	4.0	25.0	20.0	32.0	38.0	30.0
	2004	39 173	30.0	13.0	10.0	4.0	25.0	18.0	34.0	38.0	28.0
Caribbean	1990	35 071	20.0	26.0	12.0	1.0	20.0	21.0	21.0	46.0	33.0
	1995	36989	23.0	27.0	11.0	3.0	17.0	19.0	26.0	44.0	30.0
	2000	38 799	25.0	28.0	10.0	4.0	16.0	17.0	29.0	44.0	27.0
	2004	40 177	26.0	29.0	9.0	4.0	16.0	16.0	30.0	45.0	25.0
South America	1990	297 125	42.0	20.0	13.0	1.0	8.0	16.0	43.0	28.0	29.0
	1995	323 283	44.0	20.0	13.0	2.0	8.0	13.0	46.0	28.0	26.0
	2000	349 433	47.0	20.0	12.0	2.0	8.0	11.0	49.0	28.0	23.0
	2004	370 052	49.	21.0	12.0	2.0	7.0	9.0	51.0	28.0	21.0
Latin America and the Caribbean	1990	443 751	40.0	17.0	14.0	1.0	9.0	19.0	41.0	26.0	33.0
	1995	483 611	43.0	18.0	13.0	2.0	9.0	15.0	45.0	27.0	28.0
	2000	522 931	47.0	18.0	11.0	2.0	9.0	13.0	49.0	27.0	24.0
	2004	553 725	48.0	18.0	11.0	2.0	9.0	12.0	50.0	27.0	23.0

Source: http://www.bvsde.paho.org?AyS2004/AguayS2004.html.
Information from latest World Report on Monitoring of Goal 10 of the MDGs by the Joint Program for Monitoring Water and Sanitation Services, PAHO/WHO-UNICEF (Sep. /2006) with information from 2004.
Note 1**:** Goal 10 of MDG 7 is defined as: To reduce by half, by 2015, the percent of persons who are lacking improved access to safe drinking water and sanitation- The indicators which measure access or coverage are:

Percent of the population (urban and rural) which uses improved sources of drinking water;
Percent of the population (urban and rural) who use improved sanitary installations.

TABLE 1.9

MUNICIPAL SOLID WASTE GENERATION PER CAPITA IN LATIN AMERICAN AND CARIBBEAN COUNTRIES BY POPULATION CENTER SIZE

Country	Large (kg/inhab/day)		Medium (kg/inhab/day)		Small (kg/inhab/day)		Country Average (kg/inhab/day	
	Household	Municipal	Household	Municipal	Household	Municipal	Household	Municipal
Anguilla	[a]	[a]	[a]	[a]	1.08	1.22	1.08	1.22
Antigua y Barbuda	[a]	[a]	0.79	1.75	[a]	[a]	0.79	1.75
Argentina	0.83	1.13	0.84	1	0.62	0.69	0.82	1.12
Bahamas	[a]	[a]	2.67	2.67	[a]	[a]	2.67	2.67
Barbados	0.95	1.69	[a]	[a]	[a]	[a]	0.95	1.69
Belize	[a]	[a]	[b]	1.54	[b]	1.29	[b]	1.4
Bolivia	0.5	[b]	0.45	[b]	0.5	[b]	0.49	[b]
Brazil	[b]	1.18	[b]	0.75	[b]	0.63	[b]	0.88
Chile	0.77	0.98	0.68	0.93	0.4	0.65	0.69	0.93
Colombia	0.71	0.71	0.66	0.66	0.64	0.64	0.69	0.69
Costa Rica	[b]	1.06	[b]	0.76	[b]	0.74	[b]	0.81
Cuba	0.61	0.66	0.45	0.53	0.45	0.52	0.55	0.61
Dominica	[a]	[a]	0.48	0.91	[a]	[a]	0.48	0.91
Ecuador	0.71	[b]	0.69	[b]	0.59	[b]	0.69	[b]
El Salvador	0.48	0.72	0.44	0.62	0.49	0.61	0.46	0.66
Grenada	[a]	[a]	0.51	0.85	0.51	0.85	0.51	0.85
Guatemala	0.52	0.95	0.43	0.74	0.51	0.89	0.5	0.91
Guyana	[a]	[a]	0.65	1.53	[b]	[b]	0.65	1.53
Haiti	0.44	0.6	0.21	0.33	0.15	0.25	0.24	0.37
Honduras	0.54	0.68	0.49	0.58	0.38	[b]	0.5	0.65
Cayman Islands	[a]	[a]	[a]	[a]	1.1	[b]	1.1	[b]

(Table 1.9 Continued)

Brit. Virgin Islands	[a]	[a]	[a]	[a]	2.37	2.65	2.37	2.65
Jamaica	1	[b]	0.89	[b]	0.92	[b]	0.99	[b]
Mexico	0.86	1.12	0.61	0.79	0.59	0.78	0.81	1.05
Nicaragua	0.71	[b]	0.57	[b]	0.5	[b]	0.6	[b]
Panama	0.62	0.84	0.58	0.78	0.45	0.53	0.6	0.81
Paraguay	0.92	1.2	0.93	1.17	0.91	1.06	0.92	1.17
Peru	0.51	0.69	0.56	0.75	0.5	0.67	0.53	0.71
Dominican Republic	1.05	[b]	0.71	[b]	0.45	0.75	0.91	0.75
St. Kitts and Nevis	[a]	[a]	[a]	[a]	1.94	[b]	1.94	[b]
Saint Lucia	[a]	[a]	0.74	1.18	[b]	[b]	0.74	1.18
St. Vincent and Grenadines	[a]	[a]	0.34	0.79	0.34	0.79	0.34	0.79
Suriname	0.8	1	[a]	[a]	[b]	[b]	0.8	1
Trinidad & Tobago	[b]	2.2	[b]	1.53	[b]	1.07	[b]	1.59
Uruguay	0.9	1.13	0.72	0.72	0.62	0.62	0.82	0.96
Venezuela	0.9	1.03	0.79	1.11	0.8	1.05	0.89	1.03
Average LAC	0.88	1.09	0.58	0.75	0.54	0.62	0.79	0.91

Source: Report on the regional evaluation of municipal solid waste management services in Latin America and the Caribbean. OPS; 2005 Large:>200,000 inhabitants; medium: 50,000-200,000 inhabitants; small: <50,000 inhabitants.

[a] Without that size of population center

[b] Data not available.

TABLE 1.10

FINAL DISPOSAL COVERAGE IN LATIN AMERICA AND CARIBBEAN COUNTRIES ACCORDING TO THE SIZE OF THE POPULATION CENTER

(in percentage)

	Large			Medium			Small			Country		
Country	Landfill	Controlled Landfill	Oper air dumps of water ways	Landfill	Controlled Landfill	Oper air dumps of water ways	Landfill	Controlled Landfill	Oper air dumps of water ways	Landfill	Controlled Landfill	Oper air dumps of water ways
Anguila	[a]	[a]	[a]	[a]	[a]	[a]	99.9	[c]	[c]	99.9	[c]	[c]
Antigua & Baarbuda	[a]	[a]	[a]	95.0	[c]	[c]	[a]	[a]	[a]	[a]	[a]	[a]
Argentina	97.8	[c]	1.5	12.2	8.5	32.2	5.8	16.9	67.2	60.7	5.6	22.9
Barbados	35.0	48.0	[a]	[a]	[a]	[a]	[a]	[a]	[b]	35	48.0	[b]
Belize	[a]	[a]	[a]	[c]	99.0	1.0	[c]	95.0	5.0	[c]	96.8	3.3
Bolivia	70.7	13.5	7.9	55.6	16.1	5.3	[c]	21.3	39.2	55.5	15.3	13.0
Brazil	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	12.6	16.8	59.6
Chile	63.5	33.1	[c]	38.5	47.1	6.2	27.5	29.6	38.4	43.2	38.5	12.6
Colombia	74.0	6.5	16.6	40.5	8.6	46.5	40.8	4.0	54.0	32.0	15.0	54.0
Costa Rica	96.5	[c]	[c]	57.9	17.0	16.0	36.0	24.1	37.4	54.4	17.5	22.4
Cuba	19.4	73.9	6.6	17.7	39.0	42.7	39.5	16.7	42.0	21.4	57.6	20.5
Dominica	[a]	[a]	[a]	[c]	85.0	[c]	[a]	[a]	[a]	[c]	85.0	[c]
Ecuador	75.8	8.9	[c]	22.3	31.9	24.7	18.4	28.0	44.5	48.9	7.88	16.8
El Salvador	86.2	[c]	[c]	49.1	[c]	[b]	8.2	[c]	[b]	41.3	[c]	[b]
Grenada	[a]	[a]	[a]	90.0	[c]	[c]	90.0	[c]	[c]	90.4	[c]	[c]
Guatemala	[c]	32.2	[b]	[c]	[c]	[b]	[c]	[c]	[b]	[c]	22.0	[b]
Guyana	[a]	[a]	[a]	[c]	90.0	10.0	[c]	[c]	88.1	[c]	59.1	36.8
Haiti	[c]	[c]	34.3	[c]	[c]	20.3	[c]	[c]	3.3	[c]	[c]	24.1
Honduras	[a]	100.0	[c]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]	[b]
Cayman Islands	[a]	[a]	[c]	[a]	[a]	[a]	95.0	[c]	4.5	95.0	[c]	4.5
Brit. Virgin Islands	[a]	[a]	[c]	[a]	[a]	[a]	33.4	[c]	[c]	36.4	15.8	[c]
Jamaica	[c]	[c]	[c]	[c]	100.0	[c]	[c]	[c]	[c]	[c]	100.0	[c]

(Table 1.10 Continued)

Mexico	60.0	60.0	15.0	20.0	14.0	56.0	10.0	5.0	63.0	25.0	350	40.0
Nicaragua	[c]	[c]	[c]	15.9	[c]	38.1	20.1	[c]	56.5	12.6	15.6	33.5
Panamá	84.4	84.4	[b]	[c]	[c]	64.4	[c]	[c]	23.8	56.4	[c]	20.1
Paraguay	20.2	20.2	[c]	[c]	43.6	56.4	[c]	34.4	67.3	6.4	37.2	42.2
Peru	24.6	24.6	18.4	7.1	57.5	20.2	12.8	54.6	17.1	15.0	51.0	18.7
Dominican Republic	64.3	64.3	24.8	14.8	[c]	[c]	[c]	1.2	93.1	35.0	4.1	57.2
St. Kitts & Nevis	[a]	[a]	[a]	[a]	[a]	[a]	100.0	[c]	[c]	[c]	[c]	[c]
St. Lucia	[a]	[a]	[a]	70	17.5	[c]	[c]	[c]	[a]	70.0	17.5	[c]
St. Vincent & Grenadines	[a]	[a]	[a]	80	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]
Suriname	[c]	[c]	[c]	[c]	[c]	[c]	[c]	[c]	100.0	[c]	[c]	100.0
Trinidad & Tobado	[c]	100.0	[c]	[c]	91.1	8.9	[c]	[c]	[c]	[c]	93.5	6.5
Uruguay	[c]	70.7	29.3	24.8	29.1	46.1	[c]	[c]	100.0	2.6	65.5	31.9
Venezuela	[b]	40.6	18.9	[c]	[c]	[c]	[c]	[c]	100.0	[b]	24.3	59.2
Average LAC	60.1	14.2	12.4	19.3	23.8	44.1	13.6	12.4	58.8	22.6	23.7	45.3

Large: >200.000 inhabitants; medium: 50.000-200.000 inhabitants; small:<50.000 inhabitants.
[a] Without a population center that size
[b] Information not available
[c] Magnitude zero
Source: Report on the regional evaluation of municipal solid waste management services in Latin America and the Caribbean. OPS; 2005.
Note: The regional Report reviewers have provided the values of Colombia and Mexico and these are not the data that the countries have recorded. These values were taken because they are more coherent with prior values from some studies. The sources for the corresponding countries are: *Republic of Colombia, Ministry of the Environment, Housing and Territorial Development, Division of Potable Water and Basic Wastewater and Environmental. **Mexico's Environmental Performance Evaluation. OCDE, 2003 and Waste in limbo. Performance of local governments and private participation in waste management. Environmental Infrastructure Mexican Commission. Mexico, 2003.