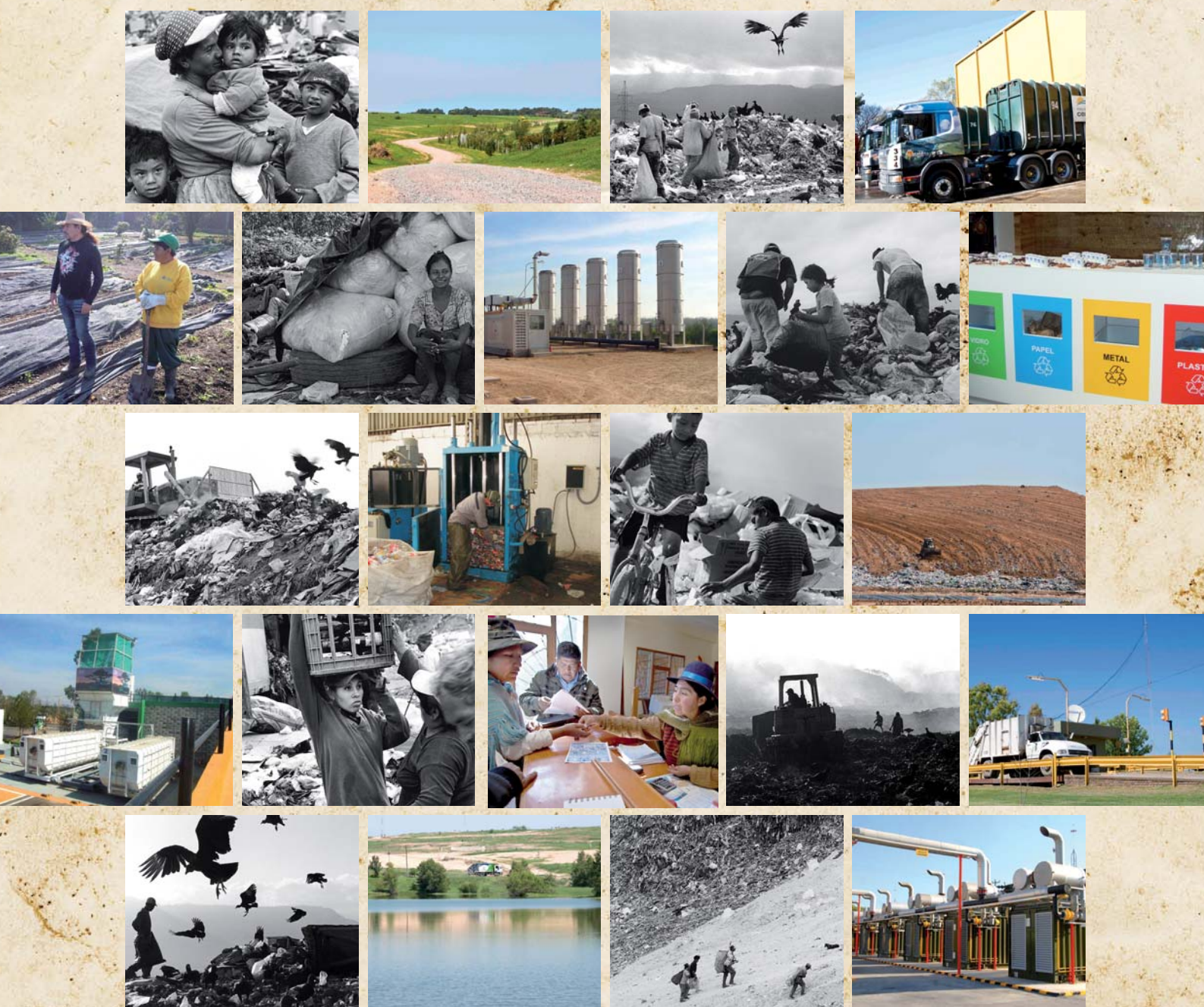


# REGIONAL EVALUATION ON URBAN SOLID WASTE MANAGEMENT IN LATIN AMERICA AND THE CARIBBEAN - 2010 REPORT



**Pan American  
Health  
Organization**

Regional Office of the  
World Health Organization

*This document reflects the joint efforts of the Pan American Health Organization (PAHO), the Inter-American Association of Sanitary and Environmental Engineering (AIDIS), the Inter-American Development Bank (IDB), and the governments of participating countries from Latin America and the Caribbean.*

*The opinions expressed in this publication are the exclusive responsibility of the authors and do not necessarily reflect those of the Inter-American Development Bank, its directors or technical advisers.*

REGIONAL EVALUATION ON URBAN SOLID  
WASTE MANAGEMENT IN LATIN AMERICA  
AND THE CARIBBEAN - 2010 REPORT

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# WELCOME MESSAGE

This regional report is the product of the joint efforts of the Pan American Health Organization (PAHO), the Inter-American Development Bank (IDB), and the Inter-American Association of Sanitary and Environmental Engineering (AIDIS). The report assesses solid waste management in Latin America and the Caribbean (LAC) in the year 2010, and is the result of a year-long research and information analysis project supported by governmental agencies, NGOs, and universities from several countries of the region.

This report presents an analysis of the solid waste management situation in Latin America and the Caribbean based on information collected from various municipalities of the region, and follows statistical procedures that facilitate the gathering of data that are representative of the reality in LAC countries. Moreover, the document describes several success stories from the region that may serve as examples of best practices to many LAC municipalities with less developed solid waste management programs.

We invite readers to learn of the progress made in solid waste management in Latin America and the Caribbean over the past eight years, as well as of the main challenges that remain, sector trends, and perspectives for the years to follow.



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We also wish to highlight the participation and cooperation in this assessment of many institutions and organizations from the different countries of the region:

- Argentina: the Undersecretary of Sanitation and Research of the National Ministry of Health; the General Coordinator on Waste of the National Environment and Sustainable Development Department (SAyDS); the Department of the Environment and Public Spaces of the City of Buenos Aires; the Metropolitan Area Ecological Coordination Society (CEAMSE); the Federal Council for the Environment (COFEMA); the Directorate of Municipal Solid Waste of the Provincial Agency for Sustainable Development (OPDS), the Government of the Province of Buenos Aires; the Solid Waste Research Association (ARS), a national member of ISWA; and various representatives of municipal environmental agencies.
- Belize: the Solid Waste Management Authority and the Land Information Centre of the Ministry of Natural Resources and the Environment.
- Bolivia: the General Directorate of Comprehensive Solid Waste Management of the Vice Ministry of Drinking Water and Basic Sanitation of the Ministry of Environment and Water.
- Brazil: the Brazilian Institute of Geography and Statistics; the Ministry of the Environment, SRHU; the City Ministry; the National Agency of Sanitation Monitoring; the National Health Foundation; the National Association of Municipal Sanitation Services; the Federal Economic Council; the Department of Environmental Health Monitoring of the Ministry of Health; the National Office of Environmental Sanitation of the City Ministry; and the National Confederation of Municipalities.
- Chile: the National Environmental Commission; RYA Engineering Consultants; and the Casa de La Paz Foundation.
- Colombia: the Superintendence of Residential Public Services; the National Department of Planning; the Regulatory Commission for Potable Water and Basic Sanitation Services; the Ministry of the Environment, Housing and Land Development; and the National Association of Public Service and Communications Companies.
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- El Salvador: the Corporation of the Municipalities of El Salvador; the Environmental Protection Office of the Ministry of Health; the Ministry of the Environment and Natural Resources; the Planning Office of the San Salvador Metropolitan Area; and the Salvadorean Municipal Development Institute.
- Guatemala: the National Commission on Solid Waste (CONADES).
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- Mexico: the Department of the Environment and Natural Resources (SEMARNAT); the Department of Social Development (SEDESOL); the National Bank of Public Works and Services (BANOBAS); the Government of the States of Mexico; and the Government of the City of Mexico.
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- Peru: the Ministry of the Environment.
- Uruguay: the Department of Environmental Development of Montevideo; the Department of the Environment of the cities of Melo, Maldonado, Rivera, and Tranqueras; and the Department of Hygiene of Mercedes.
- Venezuela: the Environmental Statistics Department of the National Institute of Statistics and the Vice Ministry of Environmental Conservation of the People's Ministry for the Environment.

Lastly, we thank the entire AIDIS administrative team, which facilitated the work of the team of international consultants, and Carl Bartone and Francisco Zepeda, who provided their time and expertise in the review of this document and whose contributions to the project were invaluable.

# PROLOGUE

The Latin American and Caribbean Region (LAC) is highly urbanized with 79 percent of its population living in cities, and one in five urban dwellers living in large urban agglomerations. The resulting concentration of people, commerce, and industry in urban areas gives rise to growing amounts of solid waste that need to be collected, transported, treated, and disposed of safely in order to protect the health of the population and the environment. Throughout LAC, mayors note that solid waste management is a priority, but achieving sustainable finances and full public cooperation with solid waste systems are a challenge, as are strengthening solid waste institutions and creating a trustworthy investment climate that attracts private sector investors.

The Regional Project for the Evaluation of Urban Solid Waste Management in Latin America and the Caribbean (EVAL 2010) provides an invaluable snapshot of how well LAC cities of all sizes are doing in meeting these challenges. This collaborative undertaking by three regional institutions – IADB, PAHO and AIDIS – also provides important insights into how countries and cities can do and some are doing a better job of providing solid waste management services.

An important finding of EVAL 2010 is that many countries have made significant progress in urban solid waste management over the past eight years. By comparing the EVAL 2010 data with data collected in an earlier regional survey (EVAL 2002) the evaluation reveals that service coverage rates have improved across the region for street sweeping, collection, transfer, and final disposal. For example, while the urban population in LAC increased by 63 million during the period, over 111 million additional urban population received collection services. More impressively, over half the urban population in LAC now has their waste disposed in proper sanitary landfills, up from less than one quarter eight years ago – equivalent to 167 million additional persons served. Many of these sanitary landfills have been financed in part by carbon credits from the recovery and flaring of methane in landfill gas, and the sale of recov-

ered energy. These are impressive gains, although they are not necessarily uniform across all countries, or all cities within a country.

The data also reveal that cities are spending more on solid waste management, and unit costs (\$ per ton) have increased significantly over the past eight years. However, cost recovery continues to lag behind costs as cities across the region still only manage to bill and collect about half of the current average costs from users through tariffs and fees.

Notwithstanding the achievements noted above for public cleansing, collection and disposal services, in other areas the EVAL 2010 data show that some waste management activities in LAC are best characterized as incipient – for example, with regard to waste reduction and resource recovery and recycling. Apart from the gains in landfill gas recovery, the region lags in areas such as selective collection, composting, materials recycling, and incineration with waste-to-energy recovery.

Based on the above considerations of what is occurring in the urban waste management sector in LAC, the EVAL 2010 report helps to identify six strategic areas for improvement. By focusing attention on these six key issues, or strategic objectives, countries can improve urban solid waste management and help achieve cleaner, healthier, and more equitable cities.

- First, an integrated, comprehensive strategic planning approach should be adopted at the national and local levels, especially for large metropolitan regions and regional clusters of smaller cities.
- Second, both municipal institutions responsible for solid waste service provision and national/provincial institutions responsible for guiding the sector need to be strengthened, and new legal and regulatory frameworks and institutional arrangements may be needed in the sector.
- Third, there is a need to guarantee the economic sustainability of urban solid waste systems – through better cost recovery and financial man-



agement at the municipal level, access to other sources of financing (such as targeted environmental grants and carbon finance opportunities), and selective involvement of the private sector to deliver services and provide capital.

- Fourth is the need for environmentally sustainable disposal systems to minimize negative environmental impacts on public health, natural resources, and global concerns such as climate change.
- Fifth, waste minimization and recycling efforts should be expanded and improved, especially by building on the incipient systems already in place, mainly in the informal sector.

- Finally, sixth is the need to support and strengthen social sustainability and inclusion, particularly with regard to community participation and to the incorporation of informal sector waste workers into formal activities.

The accomplishment of these strategic objectives will lead to the development of solid waste service delivery systems that are financially, economically, environmentally and socially sustainable. Hopefully, the next regional assessment when compared to EVAL 2010 will show major progress on all six fronts.

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The Regional Evaluations on Urban Solid Waste Management in LAC for 2002 and 2010 provide us with valuable information about the sector which helps us evaluate its development both quantitatively and qualitatively. The sector had shown slow progress in the region mainly due to the successive economic crises of the 1980s and 1990s, made worse for the sector by the vertiginous growth of the urban population which demands its services.

In the period between evaluations, the growth of the urban population and the improvement of the socio-economic situation in LAC were impressive. Urban inhabitants increased by almost 63 million people; that is an increase of 15% in the population in need of cleaning services. Meanwhile, the per capita gross domestic product increased by 23%. Fortunately, a strong decline in fertility rates and population growth were observed, which will help improve the socio-economic situation. Although poverty decreased from 44 to 33%, inequality decreased only slightly, maintaining the region's dishonorable distinction as the most unequal region in the world.

A very worrying aspect of the service is the large institutional failures at almost all levels, and especially at the municipal level. Perhaps the biggest concern is that cost recovery continues to be low and that subsidies cover nearly 50% of real costs. Although the sector cannot directly influence the socioeconomic conditions of the region, it can at least do its part by providing honest fees and reducing inequality not through general subsidies (which divide users in rich and poor) but through subsidies directed to those in greatest need via strategies of cross and direct subsidization, as in the fee system applied in Colombia.

In terms of the environment and sustainable development, in 1992 the United Nations Conference on Environment and Development adopted Agenda 21. Chapter 21 of the Agenda recommends that solid waste generation be reduced and that solid waste should be recycled and reused as much as possible. Further, solid waste should be treated and disposed of adequately, and collection coverage, and the coverage of other services, should be expanded. The first two recommendations address the ecology and conservation of resources, and

the last two address public health and the environment. However, the Agenda clarifies that: "The mix and emphasis given to each of the four programme areas will vary according to the local socio-economic and physical conditions, rates of waste generation and waste composition." In the Latin America and the Caribbean region, where the sector's financial resources are scarce, we should exercise care when using them, prioritizing the priority activities in each country and in each city, keeping in mind the differences in socioeconomic conditions and the composition of the solid waste for each case. Below is an analysis of the progress made by the sector between 2002 and 2010 with respect to the Agenda 21 recommendations:

- The minimization of waste generation has improved very little in the countries of the region during the period between the 2002 and 2010 evaluations. In the national solid waste laws passed by many countries during that period, this has become a legal obligation. Nonetheless, this has had little effect in practice because, to be effective, these laws must include two ingredients: regulations that require manufacturers and commercial businesses to minimize packaging, and consumer education to minimize waste.
- The re-use and recycling of solid waste has also not improved between evaluations, and the gap between the amounts recycled in developed countries and in LAC countries is very wide. The reasons may be found in some of the following factors: i) Waste generation and composition in the region is less and completely different than that of developed countries; nearly half of the waste is water, which is not recyclable and which permeates some recyclables like cardboard and paper; ii) selective collection, if not well designed, is more expensive than bulk collection; iii) unlike what occurs in developed countries, sanitary landfills, despite their increased costs throughout the region, still remain more economical than other methods, such as recycling, composting, and energy recovery from incineration; iv) although the legislation of several countries requires manufacturers to separate out certain special waste, compliance is low to non-existent; Uruguay seems to be an exception; and v)

in solid waste recycling, there is an inflection point in terms of quantity, and if recycling continues beyond that point, the environmental damage caused by the high energy use required, the wear on the equipment, and the human effort entailed outweighs the benefits of recycling.

- Treatment and final disposal are perhaps the areas that most improved during the period between evaluations. The greatest improvements were in the area of adequate final disposal, where both coverage and quality improved. In fact, the amount of the population with adequate final disposal coverage increased from 22.6% to 54.4% in just these eight years, and quality improved via incineration or the use of biogas through carbon credit financing. In terms of treatment coverage, progress has not been as great and has been mostly in the use of composting and incineration.
- Increases in service coverage have not been as spectacular as those in the area of final disposal, but progress has maintained a good pace. Street sweeping and collection coverage increased by 10 percentage points between evaluations, reaching 82% for the former and more than 93% for the latter;

in terms of the latter, universal collection coverage was attained by six countries: Argentina; Brazil; Chile; Colombia; Uruguay; and Venezuela. Lastly, it is curious that urban waste generation increased slightly to 0.93 kg/inhab./day despite the great increases in GDP and the improved socioeconomic conditions of the region. This parameter should be observed carefully in future sector evaluations.

Lastly, I wish to congratulate all the institutions and individuals that participated in Evaluation 2010, and the technical team that led the study. I also encourage these institutions to continue this type of analysis, which yields so many benefits to the countries when used correctly by authorities. For the future, I recommend including in the survey the gathering and analysis of information from national institutes that offer formal specialized training and short courses.

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# ACRONYMS AND ABBREVIATIONS

AECID	Spanish Agency for International Development Cooperation
AIDIS	Inter-American Association of Sanitary and Environmental Engineering
CABEI	Central American Bank of Economic Integration
CAF	Andean Development Corporation
CDM	Clean Development Mechanism
CEPAL	Economic Committee for Latin America and the Caribbean
CERs	Certified Emission Reduction(s)
CPI	Consumer Price Index
DIRSA/AIDIS	AIDIS Solid Waste Technical Division
EVAL 2002	Regional Evaluation of Municipal Solid Waste Management in LAC by PAHO/WHO 2002
EVAL 2010	Regional Evaluation of Municipal Solid Waste Management in LAC 2010
GDP	Gross Development Product
GEG	Greenhouse effect gases
GTZ	German Technical Cooperation (Deutsche Gesellschaft für Technische Zusammenarbeit)
HDI	Human Development Index
HFC	Hydrofluorocarbon
IBRD	International Bank of Reconstruction and Development
IDB	Inter-American Development Bank
IMF	International Monetary Fund
JICA	Japan International Cooperation Agency
KfW	KfW Bank (Kreditanstalt für Wiederaufbau)
LAC	Latin America and the Caribbean
MDG	Millennium Development Goals
NGOs	Non Governmental Organizations
PAHO/WHO	Pan American Health Organization/ World Health Organization
SECO	Swiss State Secretariat for Economic Affairs
SNIS	National Information System on Sanitation
UNCED	United Nations Conference on Environment and Development
UNDP	United Nations Development Programme
UNICEF	United Nations Children's Fund
USAID	United States Agency for International Development
USEPA	United States Environmental Protection Agency
USW	Urban Solid Waste
WCED	World Commission on Environment and Development



# GLOSSARY OF TERMS

- **Construction Waste:** Waste produced in the course of the construction or demolition of residences, offices, dams, industrial plants, schools, and other buildings. Construction waste materials normally include wood, a variety of metallic pieces, packing material, cans, boxes, wire, metallic plates, leftover concrete, and broken bricks, among other materials.
- **Controlled Landfill:** Final solid waste disposal site that does not have the infrastructure to qualify as a sanitary landfill, but that does include some control measures.
- **Direct Municipal Services:** Services provided directly by the municipality.
- **Entity in Charge of the Service:** Entity that operates or provides waste management services.
- **Fee:** Represents the value to be paid per unit for services delivered; the fee is set based on the cost of the service itself with or without municipal subsidies.
- **Final Disposal:** The action of permanently depositing or confining waste in different types of sites and facilities.
- **Formal Recycling:** Recycling activities performed directly by the organization in charge of urban cleaning at the municipal level and/or a company or institution authorized to manage solid waste by the appropriate officials.
- **Household Solid Waste:** Solid or semi-solid waste originating exclusively from residences and generated by household human activity.
- **Incineration:** Any process that uses heat to reduce the volume and decompose or change the physical, chemical, or biological composition of solid, liquid, or gas waste through thermal oxidation, in which combustion factors such as temperature, retention time, and turbulence can be controlled to achieve efficiency and effectiveness, and meet pre-established environmental parameters.
- **Informal Recycling:** Recycling activities performed by waste pickers in public areas or at final disposal sites.
- **Investment:** Economic financial resources required for the installation, expansion and/or improvement of solid waste management infrastructure, including the resources needed for training, environmental education, employee development, and the strengthening of solid waste management institutions.
- **Municipal or Urban Solid Waste:** Solid or semi-solid waste produced through the general activities of a population center. Includes waste from households, commercial businesses, services, and institutions, as well as common (non-hazardous) hospital waste, waste from industrial offices, waste collected through street sweeping, and the trimmings of plants and trees along streets and in plazas and public green spaces.
- **Open-Air Landfill:** Final solid waste disposal site where waste is dumped in an open space without any form of control and without any prior sanitary treatment. Also referred to as an open air dumpsite or simply as a dumpsite.
- **Rate:** Represents a fixed value (applied across all real estate property in the population group) or a differential value (varying according to the characteristics of the real estate property) to be paid for the effective or potential use of the waste management services, regardless of the level of use of such services.
- **Recyclable Material:** Materials with physical properties that allow for their re-use or transformation into new products after having served the purpose for which they were originally intended.
- **Recycling:** Activity through which certain urban solid waste products are sorted, collected, classified, and processed in order to reenter the cycle of use in households, commercial businesses, or industry.
- **Re-use:** The use of material or waste that was previously used without an intervening transformation process.
- **Sanitary Landfill:** Engineering technique for the confinement of municipal solid waste. It encompasses the spacing, placement, and compacting of waste on an impermeable bed and its burying with earth or an-

other inert material on at least a daily basis in order to control the proliferation of vectors and to adequately control gases and leaching so as to avoid environmental contamination and protect the health of the population. A sanitary landfill is the product of an engineering project, with controlled access, weighing, and no waste pickers on site.

- **Service Contract:** Arrangement under which a municipality grants a company the exclusive right to plan and provide services in all or some phases of solid waste management (usually for a sufficient period of time to recover initial investment costs). A service contract might also include the ability to directly bill consumers and financing for investments.

- **Solid Waste Sector:** The group of institutions and resources of diverse natures that exist in a country and are associated with urban cleaning services.

- **Special Services:** Services provided to a population center in addition to regular urban cleaning services. Special services include the collection of debris and weeds, the periodic collection of furniture and other over-sized objects, and the maintenance of parks and green spaces, as well as the washing of streets and plazas, and beach cleanup, among others.

- **Special Waste:** Waste generated during the production process that is considered neither hazardous waste nor urban solid waste, or that is produced by generators of large amounts of urban solid waste. Includes non-hazardous sludge, over-sized or heavy waste (furniture, mattresses, electronic appliances, abandoned cars, concrete, tar, tires, etc.).

- **Thermal Processing:** Any process that uses heat to reduce the volume and decompose or change the physical, chemical, or biological composition of solid, liquid,

or gas waste. This definition includes incineration, pyrolysis, gasification, and plasma.

- **Transfer Station:** A solid waste transfer station consists of the equipment and facilities necessary to transfer waste from collection or cargo vehicles to larger transportation vehicles that then transport the waste to final disposal sites; transfer stations sometimes also include compacting equipment.

- **Transfer Equipment with Gravity Unloading:** Transfer equipment that unloads solid waste using funnels or directly from the collection vehicles.

- **Transfer Equipment with Bulk Unloading:** Equipment that transfers waste once it has been unloaded on its cargo bed or platform, which is done with auxiliary equipment (shovels, etc.).

- **Unconventional Vehicles:** Used in small population centers and rural neighborhoods. Generally used to transport small amounts short distances. Unconventional vehicles include motorized vehicles as well as those drawn by animal or human power.

- **Urban Cleaning Services:** Services demanded by a population center (urban, suburban, and rural areas of different sizes and complexity) related to the cleaning of roadways and public spaces, and the collection, transportation, transfer, treatment, and final disposal of solid and semi-solid municipal waste.

- **Waste picker:** A person who makes a living recovering and selling discarded material for re-use or recycling. Waste pickers are referred to by several different local names, including cirujas, pepenadores, cachureros, recicladores informales, cartoneros, catadores, gancheros, and buzos, among others.

# EXECUTIVE SUMMARY

Eight years after the Pan American Health Organization prepared the urban solid waste management regional evaluation for Latin America and the Caribbean (LAC) 2002 (EVAL 2002), significant changes in the sector necessitated an updated evaluation. The principal positive developments that occurred during this time are as follows: (i) a greater awareness on the part of the central, regional, and local governments with respect to the importance of including unofficial workers in Urban Solid Waste (USW) management as part of the official, comprehensive management process; (ii) a growing public and consequently political awareness of the need to implement sustainable solid waste (SW) management systems; this is reflected in the implementation of trash collection systems that include sorting and containers, and the construction of sorting plants as an integral part of the system; (iii) awareness on the part of central and regional governments of the need to plan and establish long-term policies for the sector, exemplified by the creation of national laws on waste management in several countries of the region and the implementation of national and regional plans to close unregulated landfills and construct inter-municipal sanitary landfills; and (iv) the positive impact of increased financing for the sector through national plans, international cooperation, and carbon markets.

However, there are also areas that require improvement: (i) nearly 50% of the waste generated in the region is not disposed of properly; (ii) municipalities have been unable to establish financially self-sustaining services and this is an obstacle for the sector's development; (iii) collection is still poor in some marginal districts of urban areas; (iv) although the public at large and authorities now have a greater appreciation for the importance of improving recycling levels and the 3Rs in general, the absolute percentage of this activity is still low and is being led by the informal sector; (v) several cities of the region do not operate landfills that meet the control standards necessary to qualify them as sanitary landfills; (vi) energy savings from recycling remain poor and almost non-existent; (vii) the sector's lack of regulation, both

economic and technical, does not help close the asymmetrical information gap that exists between municipal authorities and the general public, on the one hand, and private workers, on the other; and (viii) the lack of political and legal will to address, as part of an integrated USW management plan, the need for the business sector to adequately treat the waste it generates.

The governments of LAC face the problems of waste management and their impacts in the context of worldwide concern over the economic, environmental, and social sustainability of these services. Today, governments include in their main discussion points problems such as: the proper disposal of waste, the difficult and complex reality of unofficial trash workers, the reduction and recycling of waste, climate change and carbon markets, and the role of national, regional, and municipal entities in the planning and regulation of these services.

Consequently, there is a need for an updated evaluation of this sector in LAC that will enable the region's national and sub-national governments to strengthen the areas in which they have shown improvement and to work more diligently in the areas that need improvement. Therefore, considering the many negative consequences of improper solid waste management on the health of the population and the environment, the PAHO/WHO, the Inter-American Association of Sanitary and Environmental Engineering (AIDIS), and IDB have decided to unite efforts and conduct the urban solid waste management regional evaluation for Latin America and the Caribbean 2010 (EVAL 2010). In relation to EVAL 2002, this new evaluation aims to consolidate findings and further support the advances that have been realized by adding new statistics on the existence of municipal solid waste management plans, the human resources municipalities count on to provide different services, the percentage of municipalities that bill for their services, the fee collection methods employed, and the entities that are designated to collect the fees.



Between 2001 and 2008, the LAC population increased from 518 to 588,6 million people, while the population residing in urban areas increased from 405.7 to 468,8 million people (from 78.3% to 79.6% of the total population), thus increasing the number of people in need of urban sanitation services by 63.1 million people. Following the crisis that befell LAC in the early years of this decade, the socio-economic situation of the region experienced a robust recovery from 2002 to 2008, with an increase in per capita GDP of nearly 23.2%. Despite the world economic crisis that followed, the socio-economic indicators of poverty, unemployment, inequality, and the human development index all improved during the period. Nonetheless, LAC remains the region with the greatest inequality in the world.

With respect to the region's institutional framework and the sector's organization, the management of USW is largely the responsibility of municipal governments; this is the case throughout most of the region, with the exception of some of the Caribbean's English-speaking nations. On the other hand, the establishment of policies, planning, and budgets for the sector remains a national responsibility and, in the case of the federated nations, a regional responsibility. The publication of national waste management plans by some of the region's countries during the past eight years demonstrates that national governments are taking responsibility for long-term planning and policy-making in the sector. However, LAC municipalities with management plans account for only 19.8% at the regional level. Even so, the hypothetical increase in the percentage of municipalities with a management plan does not guarantee the plan's quality, application, and possibly even implementation. In a large number of cases, the plans are not completely implemented, typically because they lack definition, technical feasibility, resources, trained personnel, and/or funding. The evaluation confirmed that information available for the sector is scarce for the purposes of policy-making and waste management planning, not shared among institutions, not centralized, outdated, and incomplete. This information problem is reflected in the scarcity of reliable data on coverage and quality, performance, infrastructure and equipment, and investment and funding, not only at local levels, but also at national levels.

An important change that was observed with respect to the organization of the sector is the more intense use of regional solutions to adequately manage solid waste throughout Latin America. A growing number of the region's municipalities are joining efforts to achieve significant economies of scale and to better apply regulations. This type of cooperation is especially important for large metropolitan regions, where the most urbanized municipalities and districts do not have enough land to properly treat and dispose of waste, as well as small cities, which are unable to afford by themselves the cost of a sanitary landfill for the proper disposal of waste. For both levels, a shared sanitary landfill is an economically attractive solution, given the joint savings and the high levels of economies of scale that can be realized.

As mentioned in the first paragraph, one of the positive developments observed in the sector over the past decade has been advances made in terms of a legal framework with the establishment of laws at the macro level to guide the sector in various countries of the region. These national laws highlight topics, such as waste valorization, sorting-at-the-source programs, recycling programs, and the importance of financially self-sustaining services, that have become key issues of the new tendencies of waste management in Latin America and the Caribbean.

With respect to the sector's regulations, the legal framework on sanitation and the environment contains areas that overlap and lack clarity. As a result, the regulatory entities tasked with environmental waste management frequently clash when carrying out their functions. The situation is most worrisome in terms of the economic and financial aspects of providing services; neither a designated regulator nor the legal framework to guide such a regulator presently exist. In most of the countries of the region, there is inadequate economic-financial regulation and no entity in charge of this area. In an ideal operational framework, governments should regulate the rates and fees that the sector applies to ensure that they meet the established quality standards, that the population served is capable of paying the amount levied, and that investments received and projected are on track, taking into account the gains and the operational expenses of the service provider and the just

compensation of contract workers, should there be any. Where necessary, such as in low-income households or municipalities, the regulations should also consider the establishment of a progressive subsidy system. Colombia was found to have the most thorough economic-financial regulation, with regulations that include an explicit methodology to be used to calculate fees and cost ceilings, both instruments to guarantee the service's financial sustainability.

In terms of the provision of services, in small municipalities, it is usually the municipal government that provides the services directly. The larger the municipality, the more common it is for these services to be contracted out. The EVAL 2010 found that in the region, waste management services are typically provided by municipal governments directly or by companies run by the municipal government, to the detriment of contracted service providers (principally, private companies), cooperatives, and services provided by the central government or government institutions other than those of the municipality, although the difference between the former two is small.

The municipal governments of the countries of Latin America and the Caribbean typically employ waste management workers at the rate of 21.7 per 10,000 inhabitants. These human resources are mostly dedicated to manual street sweeping (5.6%), followed by trash collection (4.7%), and, in third place, special services (3.1%). Trash disposal does not require a large number of employees (1.5%). Depending on the service, the predominant practice is to have municipal employees provide the work (administration, and manual and mechanical street sweeping) or employ contract workers who do not work directly for the municipality or for a company run by the municipality. In total, of the total number of municipal waste-management employees per 10,000 inhabitants, 12.2 are employed directly by the municipality and 9.6 are contract employees.

Among the economic-financial characteristics of the provision of services, it is worth noting the cost-per-unit of each service, as this information is useful for budgeting purposes and for designing a regulatory scheme that includes fees and subsidies that are fair and that assure the scheme's financial, environmental, and social

sustainability. The inadequate recovery of costs and the lack of management based on an adequate accounting of costs represent the two biggest obstacles to attaining self-sustaining waste management services. EVAL 2010 determined the following LAC unit costs: US\$24.89 per kilometer of road swept (estimated at US\$10/km in 2002), US\$34.22 per ton of trash collected (US\$25/ton in 2002), US\$12.01 per ton transferred (US\$13/ton in 2002), and US\$ 20.43 per ton disposed of (estimated at US\$9/ton in the previous evaluation). As may be observed, the cost-per-unit of the different services has increased significantly over the past eight years; this is due in large measure to the strong appreciation of the Brazilian real and other regional currencies during the period, as well as to the increase in fuel, labor, and other costs, and to the adoption of new, modern technology to improve the quality of the services provided. In the period between evaluations, the cost per ton of collecting, transferring, and disposing of solid waste increased by 42%, from US\$47/ton to almost US\$67/ton.

With respect to financial management, a key finding of EVAL 2010 is that only 64.9% of municipalities bill for their services, leaving 35% which do not, thereby undoubtedly greatly impacting their ability to be financially self-sustaining. The indicator obtained for LAC, keeping in mind that the population billed is greater than before, reached 76.2%, which reflects that the practice of not billing for services is most common in municipalities with smaller populations.

The typical household bill for the LAC region was US\$4.23 month/user. In terms of cost recovery, EVAL 2002 estimated that the regional average at the time did not reach 47%. Based on EVAL 2010 data on amounts billed, unit costs, and both generation and coverage, it is estimated that the cost recovery rate increased to 51.6%, constituting a slight improvement, but still insufficient for the financial self-sustainability of the service. It is estimated that, in order to achieve financial self-sustainability, the regional average household bill should amount to US\$8.19 per user, with the remaining indicators *ceteris paribus*. If we assume universal coverage for services of collection, transference, and final disposal, and use in our calculations the unit costs of a country like Colombia, in accordance with the quality of the services provided presently (including final

disposal in sanitary landfills), this amount increases to US\$11.60 per user per month.

The preferred form of billing in the region is by property tax (used by 60.4% of municipalities). Municipalities that bill for waste management services together with potable water and sewage services comprise 13.7% of the total, while 18% prefer to send a periodic bill to the user, and only 7.9% send the bill together with the electric bill, which is the method that results in the highest return of the four methods that were studied. The payment percentage for billing with electric service increases by 15.3% when considering the percentage of the population included in the different forms of billing. Even though the experience of the organizations of the region that participated in EVAL 2010 demonstrates that those municipalities that bill together with the electric service receive payment more efficiently, few municipalities of the region intend to apply this model. On the other hand, the collection entity with the best track record in LAC is the municipality, with 81.2% of them collecting the amounts they bill for as well as the service fees they levy.

EVAL 2010 estimated that the per capita generation of household solid waste (HSW) in Latin America and the Caribbean reaches 0.63 kg/inh/day, while urban solid waste (USW) reaches 0.93 kg/inh/day. The per capita indicators for the region suggest that daily solid waste generation is approximately 295,000 tons of HSW and 436,000 tons of USW.

Waste management services have increased their coverage areas during the past decade. The total street sweeping coverage in LAC increased by 10 points to 82.3%, with 5.56 manual street sweepers and 0.17 mechanical street sweepers per 10,000 inhabitants. Of the total coverage, nearly 91% is swept manually and the remaining 9% mechanically.

Additionally, EVAL 2010 estimated that the collection coverage in LAC also increased by more than 10 percentage points to 93.4%. In six countries of the region (Argentina, Brazil, Chile, Colombia, Uruguay, and Venezuela) the coverage is nearly universal. The collection frequency is daily for 45% of Latin Americans, while nearly 53% of the population receive collection services between two and five times a week, and nearly

2% weekly. Trash burning and uncontrolled disposal of waste increases when the frequency of collection decreases. Motorized collection equipment increased to 1.31 vehicles per 10,000 inhabitants, a third of which are more than 10 years old. Vehicles with compactors comprise 57.8% of the fleet.

EVAL 2010 estimated that of the waste collected in Latin America and the Caribbean, the percentage transferred decreased from 2002 to 2010, from 37.9% to 28.2%; however, the improvement in this statistic can be largely attributed to the inclusion of new countries such as Brazil and Colombia. In general, the region's adoption of regional plans will lead to the transfer of waste within the municipalities.

The main alternatives for the treatment of waste prior to final disposal include composting, recycling, and thermal treatment, including, in some cases, techniques to generate energy from waste. Although these activities are still incipient in LAC, they are widely used in developed countries. Waste treatment is more feasible when waste is sorted. In LAC, formal recycling in sorting plants is almost non-existent today. Informal recycling is widespread, but the amount recycled is not known with any accuracy. Composting, implemented many times in LAC, might receive a strong boost from the carbon market. The practice of incineration has not been used much in LAC, but more efficient thermal treatment technology capable of generating energy from waste may represent a valid treatment option in large cities; this should be studied on a case-by-case basis.

EVAL 2010 estimated that 54.4% of the waste generated by the inhabitants of Latin America and the Caribbean is disposed of in sanitary landfills, a significant increase with respect to the 22.6% estimate in 2002. At the same time, the use of open air landfills decreased from 45.3% to 23.3%. Perhaps the principal reasons that explain this phenomenon are found in regulations that have received a strong boost in some countries, requiring the closure of unregulated open air landfills and defining the specific technical characteristics that an adequate solution for the final disposal must have. In this regard, it is also worth highlighting other factors that have led to the notable improvement in final disposal: the environmental awareness and political will some

governments have demonstrated in enforcing these regulations, the effects of carbon financing and the changes in operational practices that this mechanism has motivated, and the adoption of regional plans for the final disposal of waste.

The effort undertaken by LAC countries to extend service coverage has been very important. From 2001 to 2008, the population in need of urban garbage removal increased by 15.6%, the equivalent of 63.1 million people. During this period, not only were waste management services able to absorb the natural growth rate of the population, the coverage rate was also significantly increased. The increase in coverage for street sweeping services incorporated 93 million new inhabitants, while collection services incorporated 109 million more people, and final disposal services, using sanitary landfills, were able to adequately dispose of waste generated by 225 million people, 164 million more than in 2002. It should be noted that improvements in service coverage are not uniform across the region or within different municipalities, within the same country.

EVAL 2010 also estimated that there are 8.57 waste pickers per 10,000 inhabitants in LAC, which projects to just more than 400,000 people. Their poor and informal work conditions lead to a variety of social, environmental, and management problems. Municipal governments have little experience in dealing with these problems and in finding solutions for them. Formalizing the work relationship and incorporating waste pickers into the municipal management system is a valid solution, but one that is incipient in the region; only 19% of waste pickers are employed directly by organizations. It is worth noting that programs to close open air landfills and replace them with sanitary landfills fail most often when there no program exists, led by municipal authorities, to incorporate waste pickers into a formal system.

In general, the information obtained in the Waste Management Evaluation for 2010 and the advances identified make it safe to assume that a growing number of Latin American and Caribbean governments are developing an awareness of the negative impacts of poor solid waste management on people and the environment. The advances in regulations and service coverage noted

during the last eight years lead us to this conclusion. Nonetheless, LAC has only just started down the road to adequate solid waste management. Further action in several areas is needed to achieve the common objective: the development of sustainable waste management services in the LAC countries.

In a very well-structured sector, the interaction among agents involved in the sector and the setting should occur in a way that is economically, environmentally, and socially sustainable. In this sense, it is encouraging to see that governments have begun to discuss problems such as the role of national, regional, and municipal entities in the planning and regulation of services; the reduction and recycling of waste products; the need to integrate waste pickers in the formal work system; the adequate final disposal of waste; and the relationship between the sector and the process of climate change. All of these elements constitute a systematic change toward the vision that should guide the region. It will take decades to implement but, in many cases, the economic conditions exist for the process of change to begin. It is essential that political decisions support this process.





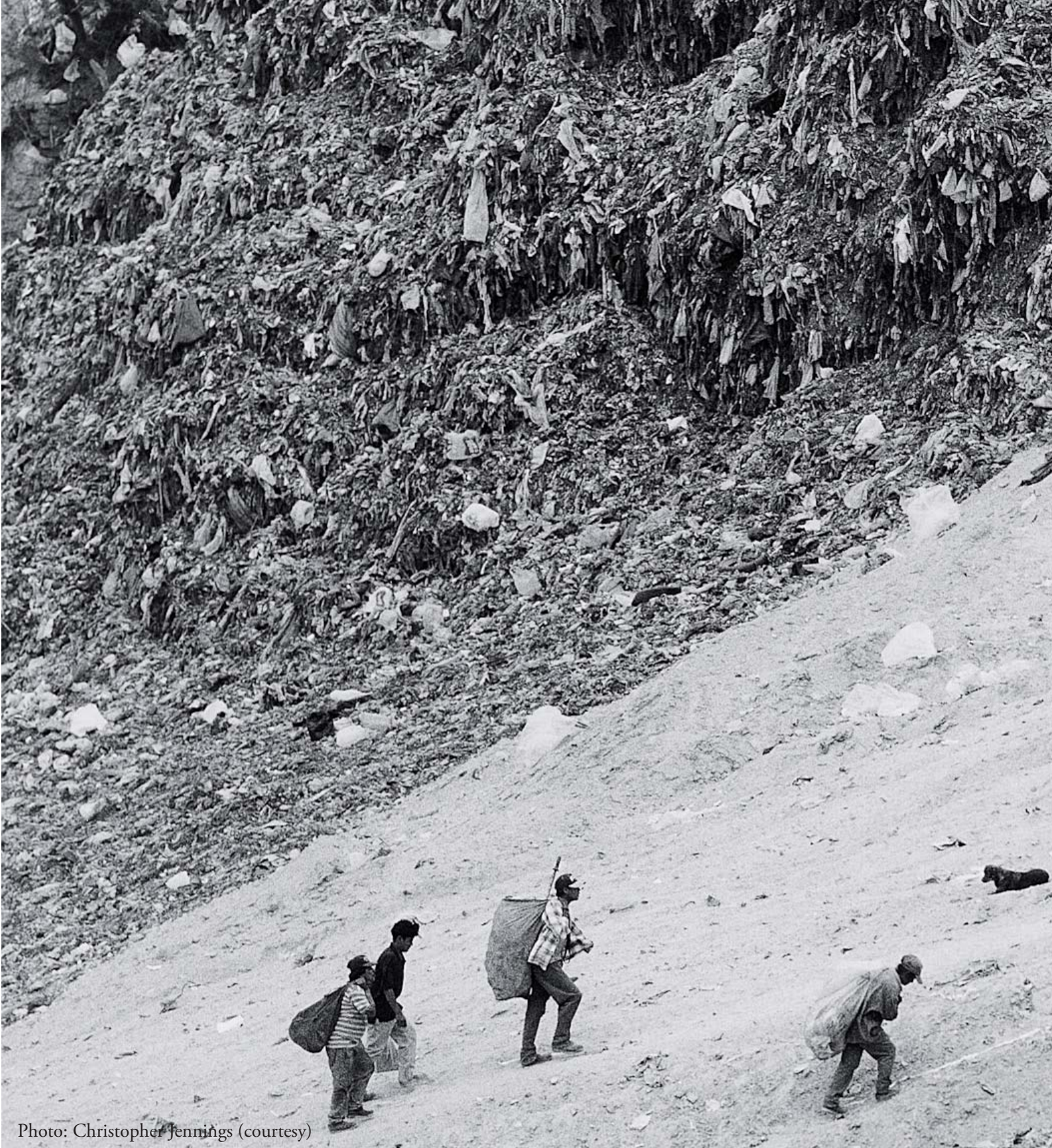


Photo: Christopher Jennings (courtesy)

# INTRODUCTION





# INTRODUCTION

The Regional Evaluation of Urban Solid Waste Management in LAC 2010 (EVAL 2010) arose from the need for relevant and reliable information about waste management services in the countries of Latin American and Caribbean (LAC). The objective of this report is to facilitate the establishment of policies and action plans to improve these services, through the use of methods that are environmentally, socially, and economically sustainable.

This document presents an analysis of the current situation in five sections: first, we begin with an introduction that describes the evaluation process and puts the issue in context; second, we describe the socio-economic situation of LAC; third, we analyze the functional and organizational structure of the sector; fourth, we present indicators on waste generation, and the coverage and quality of solid waste (SW) management services, and also analyze the participation of waste pickers in the management of solid waste; and lastly, we present our conclusions, identify current trends, and suggest future actions

## THE EVALUATION PROCESS

### PRIOR TO THE EVALUATION

In 1997, five years after the United Nations Summit on Environment and Development, an initial attempt to measure the progress made throughout the continent was undertaken by the Pan American Health Organization of the World Health Organization (PAHO/WHO) in collaboration with the Inter-American Development Bank (IDB), resulting in a report analyzing the solid waste management situation in LAC municipalities. This report was made possible with the assistance of in-situ experts from eight countries (Argentina, Brazil, Chile, Costa Rica, Mexico, Peru, Trinidad and Tobago, and Venezuela) and relied on research studies on the

solid waste management sectors of Guatemala, Colombia, Uruguay, and Mexico undertaken during 1995-1996, with the support of the PAHO, IDB, IBRD, and USAID. Due to high demand for the PAHO and IDB analysis, a second edition was issued in August 1998.

Afterwards, from 2002 to 2003, the PAHO/WHO undertook the Regional Evaluation of Solid Waste Management Services in LAC (EVAL 2002), in order to obtain updated information on the SW sector. This evaluation was complemented with the creation of an international public information system that allows researchers to view data for each country.

Eight years after EVAL 2002, significant changes in the sector necessitated an updated evaluation. The principal positive developments that occurred during this time are as follows: (i) a greater awareness on the part of central, regional, and local governments with respect to the importance of including unofficial workers in urban solid waste (USW) management as part of the official, comprehensive management process, exemplified in the inclusion of these groups in public requests for proposals issued by municipalities; (ii) a growing public and consequently political awareness of the need to implement sustainable SW management systems; this is reflected in the implementation of trash collection systems that include both sorting and containers, and the construction of sorting plants as an integral part of the system; (iii) awareness on the part of central and regional governments of the need to plan and establish long-term policies for the sector, exemplified by the publication of National Management Plans in six countries of the region<sup>3</sup>, creation of national laws on waste management in seven countries<sup>4</sup> e a implementação de planos nacionais ou regionais parand implementation of national and regional plans to close unregulated landfills and construct inter-municipal sanitary landfills; and (iv)

<sup>3</sup> National Solid Waste Management Plans: Argentina (2005), Chile (2005), Costa Rica (2007), Mexico (2008), El Salvador (2010), Peru (2010).

<sup>4</sup> National laws on solid waste management: Brazil (2010), Costa Rica (2010), Paraguay (2009), Mexico (2003), Venezuela (2010), Argentina (2002), Peru (2000) modified by legislative decree (DL No. 1065 in 2008).

the positive environmental, technical, safety, and economic impacts that participation in the CO<sub>2</sub> emissions reductions market has had on the sector, particularly with respect to final disposal and Clean Development Mechanisms (CDM); currently, all landfills operating in major South and Central American cities have active biogas extraction systems for its burning or usage.

However, there are also areas that require improvement: (i) approximately 50% of the waste generated in the region is not properly disposed of, ending up either in open air landfills or bodies of water, and sometimes burned; (ii) municipalities have been unable to establish financially self-sustaining services and this is an obstacle for the sector's development; (iii) collection is still poor in some marginal districts of urban areas; (iv) although the public at large and the authorities now have a greater appreciation for the importance of improving recycling levels and the 3Rs in general, the absolute percentage of this activity is still low and is being led by the informal sector; (v) several cities of the region do not operate landfills that meet the control standards necessary to qualify them as sanitary landfills; (vi) energy savings from recycling remain poor and almost non-existent; (vii) the sector's lack of regulation, both economic and technical, does not help close the asymmetrical information gap that exists between municipal authorities and the general public on the one hand, and private workers on the other; and (viii) the lack of political and legal will to address, as part of an integrated USW management plan, the need for the business sector to adequately treat the waste it generates.

Given the need for an updated evaluation of the sector in LAC that will enable the region's national and sub-national governments to strengthen the areas in which they have shown improvement and to work more diligently in the areas that need improvement, the PAHO/WHO, the Inter-American Association of Sanitary and Environmental Engineering (AIDIS), and the IDB decided to unite efforts and conduct EVAL 2010.

Taking into account the significant role urban cleaning services play in reducing health and environmental risk factors, the organizations decided that AIDIS should serve as the general coordinator of activities through its Technical Solid Waste Division (DIRSA). The IDB,

in addition to committing the financial resources for EVAL 2010, formed part of the advisory committee and executed activities with the active participation of experts on solid waste from its Water and Sanitation Initiative, personnel from the Water and Sanitation Initiative working in the countries covered by EVAL 2010, and statisticians; the IDB also contributed to the preparation of the final regional report.

## EVALUATION OBJECTIVES

The main objective of EVAL 2010 is to provide information about the present situation of urban solid waste management services in Latin American and Caribbean countries. In order to help establish policies, plans, and programs aimed at improving these services and contributing to the reduction of adverse health and environmental effects caused by inadequate SW management.

The Regional Evaluation has the following specific objectives:

- Prepare a Regional Report based on data obtained from each one of the participating countries that identifies urban solid waste management trends in the region and perspectives for the future.
- Compare the results of the 2010 evaluation with those of the 2002 evaluation and analyze advances and regressions.
- Create a permanent database that can be easily accessed via the Internet and that includes indicators on SW generation, coverage and quality of services, and model of management and associated financial aspects, which can be tracked during the different phases of SW management in LAC countries.
- Raise awareness in the countries of the region about the importance of having and using updated information on solid waste management for USW planning and management.
- Develop a permanent inter-institutional work/advisory/research group through cooperation among the IDB, AIDIS, PAHO/WHO and other organizations in LAC countries.

## EVALUATION METHODOLOGY

Eval 2010 commenced in August 2009 with a series of programming activities, including advisory committee activities to prepare the data collection survey. Later, from January 2010 to May 2010, activities focused on collecting information from the participating countries. Between May 2010 and October 2010, data was validated, aggregated indicators were created, and the website was developed. This was followed by the analysis of the indicators and the preparation of the final report in January 2011.

To update the evaluation, the 23 surveys used in Eval 2002 were adapted to meet the current information requirement needs and divided into priority areas. The new version of the survey contained five sections:

- Part I: information sources, identifying the sources that provided the information to complete the rest of the form.
- Part II: additional municipal information, noting general information about the municipality, such as the institutions associated with the solid waste sector.
- Part III: principal indicators, where municipal information on solid waste generation, street sweeping, collection, transport, treatment, and final disposal is provided. Data on other municipal services is also included.
- Part IV: financial aspects, providing billing, payment, and budget data related to the SW sector.
- Part V: general information, which includes basic information on the SW sector at the national level.

The surveys were accompanied with directives on how to provide analytical reports for each country, indicating the characteristics of the document, its objectives and format, and the specific content to be included.

Later, based on the information requested in the surveys, an information system was developed so that data could be entered directly as information on each municipality was collected. This system, as well as the evaluation website that was developed later ([http://www6.](http://www6.iadb.org/Waste/bienvenida/Inicio.IDB)

[iadb.org/Waste/bienvenida/Inicio.IDB](http://www6.iadb.org/Waste/bienvenida/Inicio.IDB)), were hosted under the IDB domain name, with access provided to PAHO/WHO and AIDIS.

### The Evaluation of Waste by Country

To carry out Eval 2010, a Regional Advisory Committee, comprised of representatives from AIDIS, IDB, and PAHO/WHO, was formed. The Committee appointed the AIDIS representative as the project's general coordinator.

Each participating country had at least one national advisor who was charged with gathering data and preparing an analytical report for that country. Similarly, a National Support Committee was formed, comprised of a representative from PAHO/WHO, another from the IDB's Water and Sanitation Initiative, one from DIRSA/AIDIS, and government authorities designated by the committee for each specific case. The support committee designated a member to convene authorities for work meetings. This member was either the PAHO/WHO, IDB, or DIRSA/AIDIS representative, depending on the specific case in each country.

A kick-off meeting was held in each country for all members of the National Support Committee, including government authorities. At these meetings, the national advisor delivered a presentation on the project, explaining its objectives, scope, sample selection methodology, and how aggregated variables would be obtained. Additionally, the list of municipalities that were randomly selected to participate in this study was shared with national authorities, so that they could analyze the proposed sample. The kick-off meeting was also useful in soliciting the support of national authorities in the effort to complete the project's survey.

After the data had been gathered and entered into the system, the Regional Technical Group validated the data and then calculated the aggregate indicators. Afterwards, the national advisor prepared an analytical report of the country and submitted it for the Regional Technical Group's consideration.

The indicators obtained for each country were presented in a closing ceremony with the authorities and

institutions that participated in the project. During the gathering, all members of the Support Committee had access to the information that would be used to prepare the analytical reports and the regional report.

The kick-off and closing celebrations, with the presentation and the joint analysis of project objectives and scope, the samples selected, and the indicators obtained were an integral part of a process of participation and inclusion of LAC countries in the preparation of EVAL 2010.

### Sample Selection in Each Country

Given the diverse population sizes of the municipalities of LAC and the impossibility of encompassing their totality in this evaluation, a stratified or segmented random sampling was used to determine the sample for each country.

In the first phase, samples were determined based on two previously established basic principles: the representativeness of different population sizes of the municipalities of each country and the socio-economic characteristics of each geographic region; these two principles are key determinants of solid waste generation.

Accordingly, using information from official national statistics institutes, municipalities were classified by population size and socio-economic geographic regions, thus allowing different strata or segments to be identified.

In terms of size, municipalities were classified according to population: Mega, with more than 5,000,000 inhabitants; Large, with between 300,001 and 5,000,000 inhabitants; Medium, with between 50,001 and 300,000 inhabitants; Small, with between 15,001 and 50,000 inhabitants; and Micro, with less than 15,000 inhabitants.

In terms of region, municipalities were classified according to the socio-economic geographic characteristics of each country. The number of regions identified varied between two and five, with more regional divisions found in countries with larger geographic extensions or with more greatly marked socio-economic divisions. Consequently, the strata or segments identified varied from country to country by between 10 (two socio-economic geographic regions and five population sizes) and 25 (five regions and five population sizes).

The number of municipalities needed to generate reliable estimates for each strata was determined with a margin of error of 5%, a confidence interval of 95%, and an assumed variance for each country based on previous studies. Municipalities were then selected randomly to comprise the sample for each strata of each country.

Once the data was gathered for the sample and individual variables estimated, aggregate variables were obtained for population size, socioeconomic geographic region, and for the overall country. Aggregate variables were adjusted based on population size or number of municipalities by either weighting or the use of coefficients. In this fashion, the aggregate variable (e.g.:  $X_a$ ) was obtained using the formula  $X_a = \sum X_{ij} * (P_{ij}/PT)$ , where ( $X_{ij}$ ) represents the average value of the individual variable for the stratum,  $P_{ij}$  the population size or the number of municipalities of the stratum that corresponds to the individual variable, and  $PT$  the total population or the total number of municipalities referred to by the aggregate variable.

A similar process was used to calculate aggregate indicators at the supranational level, such as the Mercosur, Southern Cone, Andean nations, South America, Central America and the Caribbean, and Latin America and the Caribbean.

## Limitations of the SW Evaluation

The lack of information with respect to different phases of SW management in LAC municipalities, particularly in those classified as Micro (less than 15,000 inhabitants), posed a challenge for the project teams in the different countries. In some municipalities, LAC studies on SW generation per capita were more than five years out of date, and, as a result, in those cases the EVAL 2010 was unable to update the information.

The lack of financial information for the sector was a recurring problem regardless of the size of the municipality, especially with respect to fees, the cost of services, and municipal budgets allocated to waste management.

Additionally, the project documented differences across the countries of the region in the use of certain terms, especially in terms of defining the characteristics of a sanitary landfill<sup>5</sup>. In some cases, the term was used to refer to another type of final disposal; this posed a challenge to technical teams in search of comparable information between countries.

Further, when making comparisons between countries or municipalities, the different levels of quality of service that exist in the municipalities must be taken into account. To cite an extreme example, the use of carts drawn by animals to collect waste is considered the same as the use of compacting vehicles when calculating service coverage. In the case of the collection phase, however, it is worth noting that quality indicators were constructed that capture the frequency and extent of service, and the type and antiquity of the vehicles used.

The statistical method that was selected for the survey is sensitive to incomplete information, and it is, therefore, a priority that the data collected be complete. Further, the sampling design anticipated these limitations that may be encountered with respect to information gather-

ing. In addition to the precautions taken, in cases where the lack of information impacted the representativeness of the indicators obtained, the regional team decided to either increase the number of municipalities in the sample or, if not possible, to discard the incomplete data.

Lastly, it should be noted that at the time of the report's preparation, Haiti had suffered the severe effects of the January 2010 earthquake. It was, therefore, decided to postpone research in this country until the situation improved. With respect to the other nations of LAC not included in this report, their exclusion is due to the lack of reliable information. We hope to access additional information in these cases so as to include these nations on the EVAL 2010 website.

<sup>5</sup> EVAL 2010 coordinating institutions consider a sanitary landfill to be an engineering technique to confine municipal solid waste. It encompasses the spacing, placement, and compacting of waste on an impermeable bed and its burying with earth or another inert material on at least a daily basis in order to control the proliferation of vectors and to adequately control gases and leaching, so as to avoid environmental contamination and to protect the health of the population. A sanitary landfill is the product of an engineering project, with controlled access, weighing, and no waste pickers on site.



## THE IMPORTANCE OF PROPER WASTE MANAGEMENT ON HEALTH AND THE ENVIRONMENT

The inadequate management of solid waste has many negative impacts on human health and the environment. For one, even though the few epidemiologic studies on the matter have not confirmed it directly, it is known that there are agents in trash that are adverse to people's health. Waste that is not collected or not adequately disposed of sanitarily may lead to increases in reported cases of illnesses such as dengue, leptospirosis, various gastrointestinal disorders, difficulty breathing, and dermal infections, all of which are more prevalent among populations that lack basic sanitation services. These illnesses, in turn, frequently cause diarrhea and parasitic infestations, which may lead to episodes of infant malnutrition.

When waste is disposed of in an open air landfill or unregulated dump site, it is also a source of disease vectors, such as insects and rodents. Further, since these places are not typically closed off, it is common to find animals such as dogs, cats, and even farm animals such as cattle and pigs roaming in the trash. Some diseases transmitted between animals and human beings, such as cysticercoids, taeniasis, and trichinosis, are closely associated with swine; many times outbreaks can be traced to pigs that have eaten waste products from kitchens, restaurants, and slaughterhouses, as well as to other animals that have eaten from garbage dumps. Precautionary measures to prevent zoonotic diseases strongly urge that farm animals not be raised in areas where solid waste is deposited.

Other negative impacts on human health that result from the inadequate management of waste are due to the emission of dangerous substances that are released into the air when trash is burned or incinerated out in the open without adequate controls. Populations exposed to the resulting gases may show signs of breathing

difficulties, dermal infections, and more severe symptoms. Given the absence of sorting prior to the practice of burning, as is common in open air dumps and rural areas, the incineration of plastic and industrial waste, household batteries, car batteries, etc. produces dioxins and furans, which are categories of toxic and carcinogenic substances.

Indeed, studies from Argentina, Cuba, Paraguay, Uruguay, and Colombia reveal that nearly half of the dioxin and furan emissions in LAC may be originating from the indiscriminate burning of household waste<sup>6</sup> The populations most at risk from exposure to dioxin and furan emissions are those that live or work near unregulated dump sites and in the generally poor communities where trash that is not picked up is burned.

In general, the health impacts of waste mismanagement can be observed throughout the population, but they are especially evident in the following groups, listed here from the least affected to the most affected: a) formal sector workers, b) urban populations without residential trash collection service, c) populations near or within a close radius of inadequate final disposal sites, d) people who work sorting and recovering recyclable materials in the streets, storage facilities, and final disposal sites, commonly known as waste pickers or informal waste sector workers, who work under unsanitary conditions, with a significant percentage of women and children, and e) children and adolescents living in the streets and other homeless people, who eat food directly from bagged household garbage and dumpsters.

In terms of the environment, the known principal impacts can be classified in the following manner:

- a) Atmospheric: the decomposition of organic material present in trash produces a mix of gases known as biogas, comprised mainly of methane (CH<sub>4</sub>) and carbon dioxide (CO<sub>2</sub>), which are known as greenhouse gases (GHG) because they contribute to climate change. Additionally, unregulated trash incineration is the major source of the previously mentioned emissions of dioxins and furans in LAC.

<sup>6</sup> National inventories of dioxin and furan emissions compiled using a standardized toolkit published by the United Nations Environment Programme (UNEP), 2005.

b) Soil and geomorphology: Contaminants including oils, grease, heavy metals, and acids alter soil fertility, and its physical and chemical properties.

c) Surface water and aquifers: adverse effects on water quality and other characteristics.

d) Biota: adverse impacts on flora and fauna.

The failure to collect and treat leachate liquids in final disposal sites is a clear example of one of many negative environmental impacts of deficient waste management. Its seepage, made possible by inadequate waste disposal, contaminates the soil and aquifers, damaging agricultural production and affecting the flora and fauna. Even surface waters can thus be contaminated, resulting in the loss of sources of drinking water and recreation.

The impact on the environment is even greater when the environmental damage is used in its widest sense. The emission of foul odors, smoke, and dangerous gases, and the deterioration of the scenic landscape caused by the improper final disposal of waste can potentially lead to decreases in the value of real estate in the area affected. Deficient SW management also impacts economic activity, adversely affecting exports, tourism, and local development.

Given essentially all that has been described above, today, governments include in their main discussion points issues such as: the proper disposal of waste; the difficult and complex reality of unofficial trash workers; the reduction and recycling of waste; climate change and the carbon market; and the role of national, regional, and municipal entities in the planning and regulation of these services<sup>7</sup>.

The governments of Latin America and the Caribbean face the problems of waste management and their impacts in the context of worldwide concern over the economic, environmental, and social sustainability of these services. While the concept of sustainable environmental development (in its broadest sense) is much discussed nowadays, it is important to review its origin, evolution, and application to the SW sector.

<sup>7</sup> Terraza, Horacio: *Solid Waste Management: Guidelines for a Sustainable and Inclusive Integral Service*; Inter-American Development Bank 2009; Technical Note No. IDB-TN-101.

## SUSTAINABLE DEVELOPMENT AND SOLID WASTE

The concept of sustainable development began to emerge in the 1960s. However, it wasn't until 1992 that the concept of environmental sustainability started being applied specifically to solid waste management.

In 1992, during the United Nations Conference on Environment and Development (UNCED), held in Rio de Janeiro, Brazil, the concept of sustainable development gained strong momentum. The United Nations Commission for Sustainable Development was created and five principal documents were approved: the Rio Declaration on Environment and Development, Agenda 21, the United Nations Framework Convention on Climate Change, the Convention on Biological Diversity, and the Statement of Principles for the Sustainable Management of Forests.

Agenda 21 recommends the implementation of practices to reduce waste generation, increase the recycling and reuse of waste, and ensure that waste is disposed of in an environmentally-safe manner. Section II (Conservation and Management of Resources for Development), Chapter 21 (Environmentally Sound Management of Solid Wastes and Sewage-Related Issues) establishes<sup>8</sup>:

*21.5. Accordingly, the framework for requisite action should be founded on a hierarchy of objectives and focused on the four major waste-related programme areas, as follows:*

*(a) Minimizing wastes;*

*(b) Maximizing environmentally-sound waste reuse and recycling;*

*(c) Promoting environmentally-sound waste disposal and treatment;*

*(d) Extending waste service coverage.*

*21.6. The four programme areas are interrelated and mutually supportive and must therefore be integrated in order to provide a comprehensive and environmentally-reasonable framework for manag-*

<sup>8</sup> Cited from the website of the United Nations Division of Sustainable Development <http://www.un.org/esa/dsd/index.shtml>

*ing municipal solid wastes. The mix and emphasis given to each of the four programme areas will vary according to the local socio-economic and physical conditions, rates of waste generation and waste composition. All sectors of society should participate in all the programme areas.*

Agenda 21 establishes specific goals and objectives for each of the four program areas and describes the activities necessary to achieve them, as well as the role each participating actor should assume, including governments, international organizations, NGOs, and consumers.

Highlights of the established objectives for each program area include: a) by the year 2000, ensure sufficient national, regional, and international capacity to access, process, and monitor waste trend information, b) by the same year, establish sufficient capacity to undertake waste-related pollution impact monitoring and conduct regular surveillance, c) ensure that by 2005 at least 50% of all solid waste is adequately treated, and d) by the year 2010, have a national SW program, including, to the extent possible, targets for efficient waste reuse and recycling.

Within the activities described under each program area to achieve these objectives, and which relate to this and prior evaluations, we highlight those activities related to obtaining data and information. For each program, the importance of gathering and analyzing data on each specific area of SW management is underscored and described in detail, as is the need to develop and apply monitoring methodologies and provide information to worldwide information systems. The need for support from international organizations to undertake these activities is also stressed.

In the years following the Rio Conference, governments, the private sector, and the communities of LAC began to work together to establish policies, programs, and national plans in which the service providers and the community play a fundamental role in achieving adequate SW management. Back then, the SW sector was marked by the lack of a guiding and regulatory framework that corresponded with the international context of the time, and by service providers with evident institutional, management, and financial weaknesses, due in large part to the lack of support at the national, regional, and local levels, resulting in service quality and coverage similar to that of sewage and water treatment operators, and inferior to that of power and water providers.

## MILLENNIUM DEVELOPMENT GOALS AND ENVIRONMENTAL SUSTAINABILITY

The Millennium Development Goals (MDG) announced in 2000 built on the international framework of the 1990s that established goals and led efforts to address issues such as poverty, gender inequality, edu-

cation, health, and the environment. The MDG goals were formally presented in the United Nations Millennium Declaration, which was adopted by 189 member states during the Millennium Summit of 2000. Two years later, at the Johannesburg World Summit on Sustainable Development, member states were called on to renew their efforts to guarantee environmental sustainability, and this led to the establishment of targets and indicators for Goal 7: Ensure Environmental Sustainability.

TABLE 1: MDG GOAL 7 – ENSURE ENVIRONMENTAL SUSTAINABILITY

Goals	Indicators
Target 7.A  Integrate the principles of sustainable development into country policies and programmes; reverse the loss of environmental resources	7.1 Proportion of land area covered by forest
	7.2 CO <sub>2</sub> emissions, total, per capita, and per \$1 GDP (PPP)
	7.3 Consumption of ozone-depleting substances
	7.4 Proportion of fish stocks within safe biological limits
	7.5 Proportion of total water resources used
Target 7.B  Reduce biodiversity loss, achieving, by 2010, significant reduction in the rate of loss	7.6 Proportion of terrestrial and marine areas protected
	7.7 Proportion of species threatened with extinction

## Target 7.C

Reduce by half, by 2015, the proportion of people without sustainable access to safe drinking water and basic sanitation

7.8 Proportion of population using an improved drinking water source

7.9 Proportion of population using an improved sanitation facility

## Target 7.D

4. Achieve significant improvement in lives of at least 100 million slum dwellers, by 2020

7.10 Proportion of urban population living in slums

Source: Based on CEPAL report, *Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges*, August 2010.

With respect to the contribution the sector can make to achieving MDG Goal 7, it should be noted that a small amount of carbon dioxide is produced during the initial storage of solid waste, its transportation, its treatment, and its final disposal in open air dump sites, and also during the oxidation processes of organic material, such as aerobic composting and incineration. Nonetheless, the reduction of these carbon dioxide emissions can be said to help diminish the generation of GHG. As described later in this report, the greatest generation of GHG occurs during anaerobic processes of decomposition, such as those that occur in sanitary landfills; these processes generate methane that has a greenhouse “forcing” effect that is more than 20 times that of carbon dioxide. Therefore, although the sector’s direct contribution to the reduction of carbon dioxide emissions is small, its overall contribution to the reduction of GHG should not be overlooked.

Goals 7.C and 7.D are directly related to urban and rural poverty, and to the lack of basic services for millions of inhabitants living in marginalized neighborhoods and shanty towns. For this reason, activities that aim to

improve the urban cleaning services provided to marginalized neighborhoods and the formalization of trash sorting activity, so as to provide for the social inclusion of the people who engage in it, are integral parts of the MDG.

According to the latest indicators, target 7.D will not be achieved in the region. The great decrease in the percentage of people living in slums that was registered between 1990 and 2005 (from 37% to 25%) does not represent a significant reduction in the absolute number of people living in these conditions (from 110 million to 106 million<sup>9</sup>). In the case of LAC, the population living in marginal neighborhoods should be reduced by 13.8 million by the year 2020. The current rate of improvement, therefore, is not sufficient to achieve this goal. In general, projections on the number of people living in marginalized neighborhoods have not been linear and have depended greatly on economic cycles.

With regards to human environmental sustainability (targets 7.C and 7.D), information on the following issues is included as complementary information: air

<sup>9</sup> CEPAL report, *Achieving the Millennium Development Goals with equality in Latin America and the Caribbean: Progress and challenges*, August 2010.



pollution, urban sustainability and eco-efficiency, and extreme events and natural catastrophes. Regarding air pollution, which causes respiratory and cardiovascular diseases in the population, dioxin and furan emissions (persistent organic compounds) released via the incineration of unsorted waste in rural areas, and open air dump sites are dangerous contributors to air pollution (they are toxic and carcinogenic substances). In any event, air pollution in the region is principally caused by reliance on fossil fuels for transportation, followed by electric power generation, industrial processes, food preparation, and household heating.

Further, policies aimed at improving the standard of living for people living in marginalized neighborhoods are overshadowed by the challenges of achieving sustainability in the cities of LAC. The great urbanization of the region (LAC as a whole is nearly 80% urbanized, while South America by itself is only less urbanized than northeastern Europe<sup>10</sup>) the fast rate with which urbanization occurs (50% in 1962 and a projection of 89% by 2050), and the context of economic and institutional weakness in which this process takes place has resulted in a precarious and informal situation for the cities. Under these circumstances, it is evident that cities face challenges that go well beyond attending to marginal neighborhoods in order to attain urban sustainability. Deficiencies in the provision of basic services also extend to inefficient urban transport and the lack of green space.

In the context of striving for urban sustainability and eco-efficiency, the inadequate management of solid waste implies significant direct and indirect social and environmental costs that mostly affect marginalized neighborhoods. For this reason, the adequate management of waste remains included as complementary in-



Photo: Christopher Jennings (courtesy)

formation in terms of meeting the human environmental sustainability targets referred to.

Lastly, the vulnerability of human environmental sustainability remains exposed to the increase in frequency and intensity of extreme natural phenomenon resulting from climate change. To lessen their impact, risk reduction mechanisms should be found, including financial mechanisms. The Caribbean region is the most affected by these events.

## CLIMATE CHANGE AND SOLID WASTE

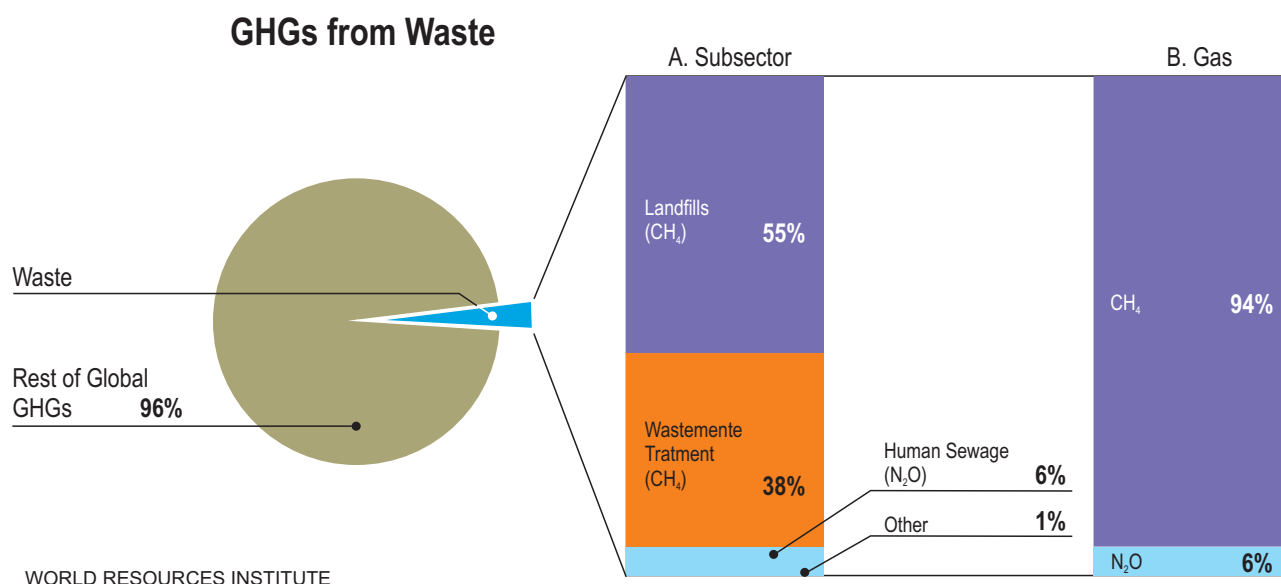
Extreme natural manifestations of the process of climate change are a consequence of modifications to precipitation patterns and global temperature increases caused by the increase in GHG generation resulting from human activities. In 2008, LAC countries were responsible for 8.6% of the world's population, 8.2% of global GDP, and 12% of total GHG emissions<sup>11</sup>. According to World Resource Institute (WRI), the waste sector (including waste water), through methane emissions (CH<sub>4</sub>), contributed 3.6% of total worldwide GHG emissions in 2000:

<sup>10</sup> See UN-HABITAT: *State of the World's Cities 2010/2011: Bridging the urban divide*, 2008.

<sup>11</sup> CEPAL and IDB: *Climate Change: A Regional Perspective*, February 2010.



FIGURE 1: CONTRIBUTION OF WORLDWIDE GHG EMISSIONS BY WASTE SECTOR (INCLUDES SOLID WASTE AND WASTE WATER)



Source: World Resources Institute (WRI), [www.cait.wri.org](http://www.cait.wri.org).

One of the instruments most used in the region to reduce GHG emissions is the Clean Development Mechanism (CDM), in which investment projects executed in developing countries may obtain additional economic income through the sale of carbon credits via an emission reduction certificate (ERC) issued to a developed country with emission reduction goals. The purpose of CDM is to help developing countries achieve sustainable development while also making it possible for developed countries to meet their emission reduction goals through the purchase of ERC<sup>12</sup>. During the recent conference in Copenhagen, held in December 2009, the recognition of carbon markets as a cost-effective measure to promote mitigation actions in developing countries was renewed.

LAC countries have found CDM to be a very useful tool. At the last meeting of the Executive Committee of the Clean Development Mechanism, held from October 12 to 14, 2010, it was stated that there are currently 2,446 registered project activities and almost 6,000 more in the pipeline.

The registered projects are found throughout the various regions as follows: Asia-Pacific 1,905 projects (77.9%), Latin America 480 (19.6%), Africa 48 (2%), and Eastern Europe 13 (0.5%). Of the 480 projects registered in Latin America, 124 (25.8%) correspond to waste management and disposal.

The countries with the greatest number of approved projects are: China (in first place with 40.7%), India (in second place with 22.2%), Brazil (in third, with 7.3%), and Mexico (in fourth with 5%). Other countries from Latin America rank as follows: Chile (tenth place with 1.6%), Colombia (in twelfth place with 1%), Peru (in thirteenth place with 0.9%), and Argentina (in fourteenth place with 0.7%).

Country rankings in terms of the worldwide expected average in annual reductions in ERC are: China (first again with 61.3%), India (second, with 11.2%), Brazil (third, with 5.5%), the Republic of Korea (fourth, with 4.4%), Mexico (fifth, with 2.5%), and Chile (seventh, with 1.2%). The worldwide rankings for the countries of LAC are:

<sup>12</sup> Eguren, Lorenzo: El mercado de carbono en América Latina y el Caribe: balance y perspectivas, CEPAL, Sustainable Development Division and Human Settlements, 2004.

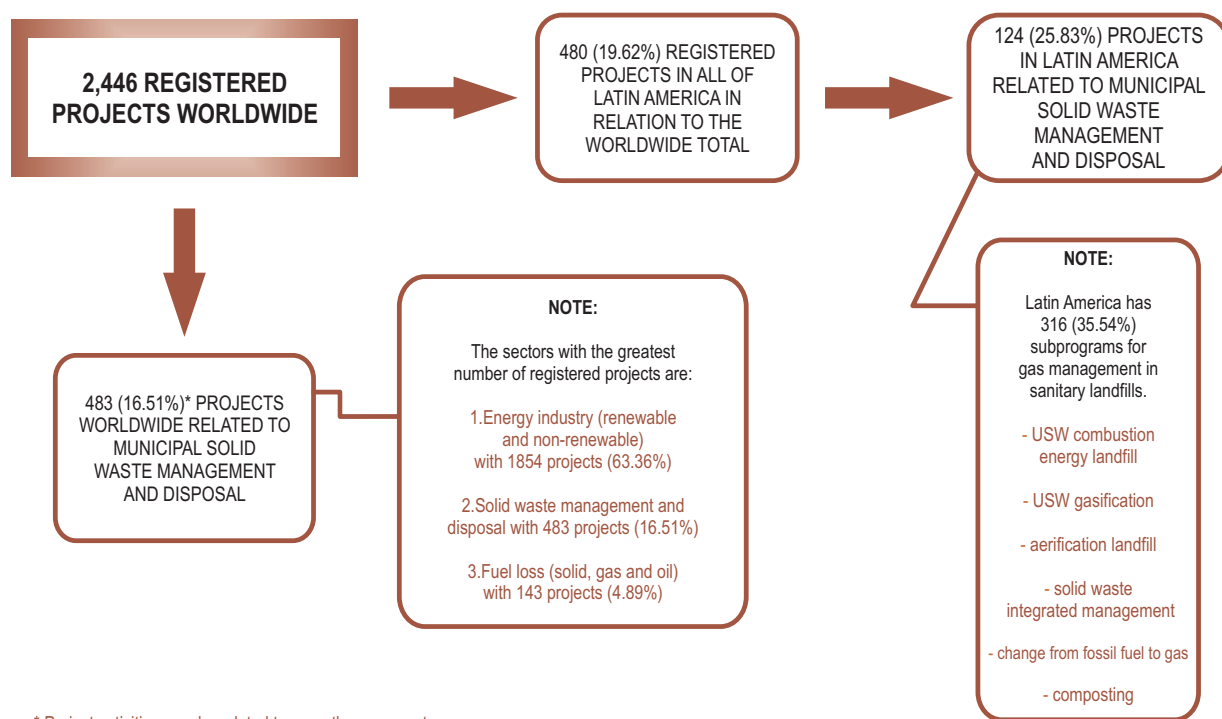
TABLE 2: WORLDWIDE RANKING OF LAC COUNTRIES BY ERC

WORLD-WIDE RANK	COUNTRY	YEARLY AVERAGE REDUCTIONS	%
3	Brazil	21,301,816	5.47
5	Mexico	9,597,832	2.47
7	Chile	4,726,558	1.21
10	Argentina	4,206,791	1.08
11	Colombia	3,222,850	0.83
14	Peru	2,492,026	0.64
22	Guatemala	864,760	0.22
23	Ecuador	713,266	0.18
25	El Salvador	619,535	0.16
26	Nicaragua	577,381	0.15
27	Bolivia	563,991	0.14
29	Dominican Republic	483,726	0.12
30	Cuba	465,397	0.12
35	Honduras	312,559	0.08
37	Costa Rica	293,640	0.08
38	Panama	291,579	0.07
41	Uruguay	251,213	0.06
59	Jamaica	52,540	0.01
60	Guyana	44,733	0.01
69	Paraguay	1,523	0,00

Source: Based on information presented at the meeting of the Executive Committee of the Clean Development Mechanism, held from October 12 to 14, 2010.

With respect to the sector's scope in terms of the project categories defined by the Executive Committee, as of October 1, 2010, the waste management and disposal sector accounts for 16.5% of all registered projects worldwide, which equals 483 activities. As shown in the figure below, this number of projects ranks the waste management sector as second behind the energy (renewable and non-renewable) industry category.

FIGURE 2: DISTRIBUTION OF REGISTERED WASTE MANAGEMENT PROJECTS



\* Project activities may be related to more than one sector.

#### Sources:

[1] CDM Statistics 2010. <http://cdm.unfccc.int/Statistics/index.html>

[2] CDM Pipeline Spreadsheet. <http://cdmpipeline.org/ji-projects.htm>

If all CDM pipeline projects are considered in greater detail with respect to classification, it can be observed that sanitary landfill gas exploitation projects rank fifth in GHG emission reductions, after projects classified as hydro-electric, hydrofluorocarbons (HFC) destruction, and wind energy.

In Latin America, the projects identified in the pipeline show the predominance of renewable energy activities (50%), followed by projects to avoid the emission of methane gas by either using it or burning it (25%). Of the total of subprojects identified in the pipeline, those that make use of sanitary landfill gas (totaling 316) include biogas burning projects in sanitary landfills, energy capture, integral management of solid waste, and replacement of fossil fuels with piped gas.

As evidenced by the information presented, the reduction of GHG emissions resulting from the implementation of solid waste management projects is highly relevant to the CDM framework and has contributed

to the technical development of sanitary landfills in the region that have had a strong environmental and safety impact in operations in a truly short period of time. At present, a large number of the region's metropolitan areas and large cities possess gas capturing, gas burning, and, in some cases, energy-use systems for gas. Without CDM, this key change in the operation of sanitary landfills would not have occurred.

With respect to the relationship between climate change and solid waste management, it is worth highlighting a paradigm shift that the world and the region are presently experiencing. The concept of solid waste management as an integral part of a cycle of rational and sustainable use of materials, where generated waste is viewed as an environmental resource, will not only benefit the environment in general, but will also serve as a climate change mitigation measure, in so much as the use of virgin raw materials is reduced and the use of fossil fuels is substituted with alternatives.



Photo: Christopher Jennings (courtesy)

# SOCIO-ECONOMIC SITUATION IN THE REGION





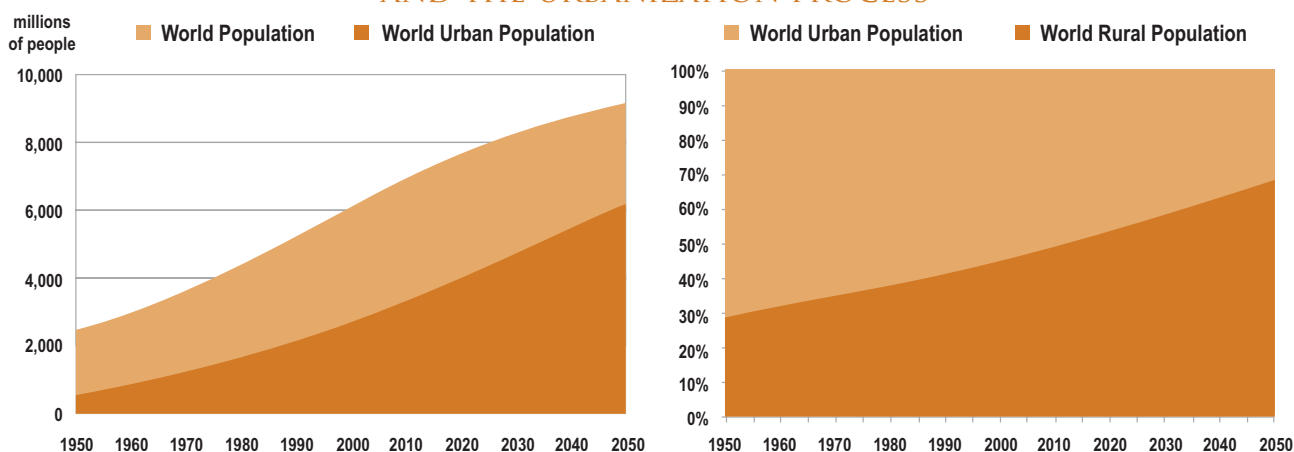
# SOCIO-ECONOMIC SITUATION IN THE REGION

## POPULATION GROWTH AND URBANIZATION

The accelerated population growth of the last several decades, and the concentration of that growth in urban areas, has led to an increase in the demand for public services in general, including solid waste management. This rapid urban growth has taken place primarily in the outskirts of cities and in marginalized areas, where there are numerous needs; this situation has highlighted the importance not only of increasing service coverage but also of implementing effective SW management that is socially and environmentally sustainable<sup>13</sup>. The process of urbanization is intense in the LAC region.

The world's population has grown from 2.5 billion in 1950 to 6.9 billion in 2010 (an increase by a factor of 2.8), with a projected population of 9.1 billion by 2050<sup>14</sup>. This growth was accompanied by a process of gradual urbanization that reached an inflection point in 2008: for the first time in history, more people live in urban areas (3.3 billion) than in rural areas<sup>15</sup>. Projections for 2050 predict that 68.7% of the global population will reside in urban areas. The figures below illustrate the growth described.

FIGURE 3: GROWTH OF TOTAL WORLD POPULATION AND THE URBANIZATION PROCESS



Source: Based on information from the United Nations Department of Social and Economic Affairs, Population Division.

<sup>13</sup> According to UN-HABITAT, the world's population living in slums and marginalized areas now totals 827 million people, a sum significantly larger than the total population of LAC.

<sup>14</sup> United Nations Department of Social and Economic Affairs, Population Division, (<http://www.un.org/esa/population/unpop.htm>).

<sup>15</sup> United Nations Population Fund (UNPFA): State of World Population 2007: Unleashing the Potential of Urban Growth.



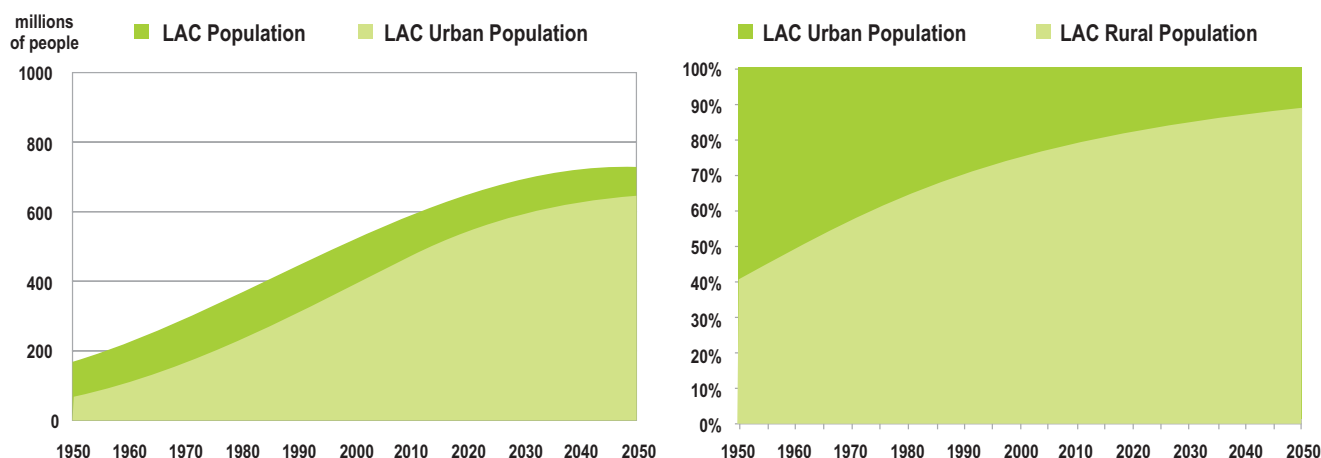
Within this global process, the LAC region has seen considerable growth in both total population and urban population. In 1950, the LAC population reached 167.3 million and in 2010 it is estimated that 588.6 million people live in the region (an increase by a factor of 3.5, which is above the global average). Of the current total population, 66.8% resides in four countries: Brazil (with 32.2%, 195 million people), Mexico (18.8%, 111 million people), Colombia (7.9%, 46 million people), and Argentina (6.9%, 41 million people<sup>16</sup>). Projections for 2050 predict an LAC population of 730 million.

With respect to urbanization, LAC was the first and only developing region to be predominantly urbanized

prior to 2008; at least half the population has been living in urbanized areas since 1962<sup>17</sup>. Currently, 79.4% of the LAC population lives in urban areas. The region's most urbanized countries are: Venezuela (93%), Uruguay (93%), and Argentina (92%). Details on total population and urban population for each country participating in this report are included at the end of this section.

The graphs below show that the urban population in LAC, in relation to the total population, is significantly more than the world average during the evaluation period:

FIGURE 4: POPULATION TRENDS IN LAC, URBAN POPULATION IN RELATION TO TOTAL POPULATION



Source: Based on information from the United Nations Department of Social and Economic Affairs, Population Division.

According to UN-HABITAT, the difference in the urbanization experienced by LAC and the other developing regions is attributable to the combination of three different factors: i) a very inequitable agricultural structure that is unable to retain the rural population, ii) the marked existence of centralized political power that led to the concentration of power in the capital cities, and iii) historic policies of import substitution that favor the use of manual labor in the industrial sector to the detriment of the agricultural sector.

The urbanization process has been accompanied by a series of problems (crime, contamination, traffic congestion, the lack of services, etc.) that require concomitant action in order to manage them adequately. The urbanization experience of the LAC has been very fast and difficult to manage, due to both the speed with which it occurred and the general economic and institutional weaknesses of the countries of the region; as a result, these problems have manifested themselves with their full force.

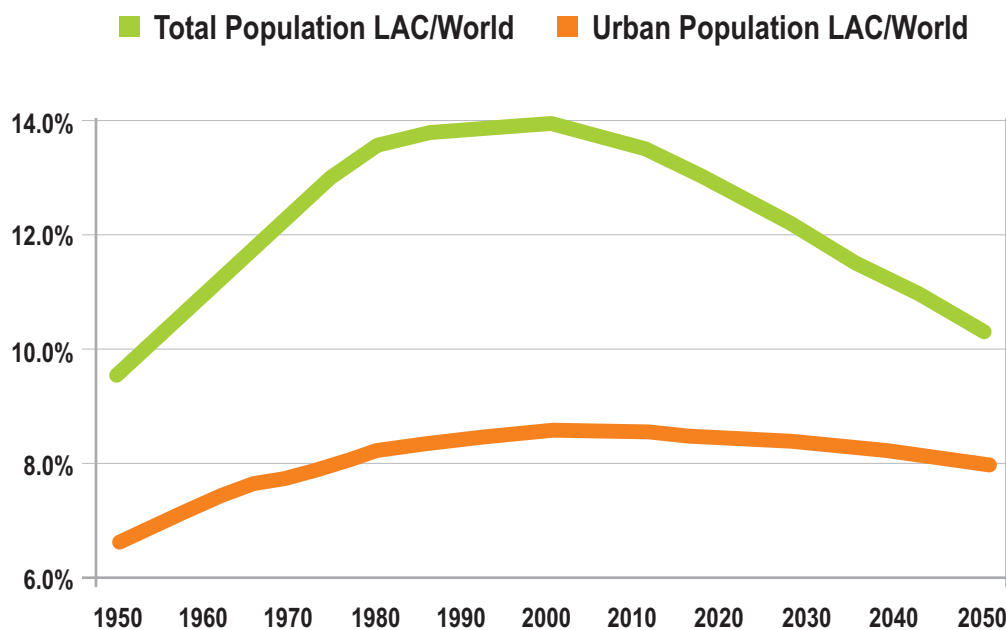
<sup>16</sup> CEPAL: Annual Yearbook for Latin America and the Caribbean 2009, January 2010.

<sup>17</sup> UN-HABITAT, as previously cited.

Nonetheless, as can be seen from the graph below, the region's rate of total and urban population growth above the world average seems to have peaked in 2000 and

began to decrease gradually, a trend that is projected to continue over the next 40 years.

FIGURE 5: GROWTH OF LAC TOTAL AND URBAN POPULATION COMPARED TO WORLD AVERAGE



Source: Based on information from the United Nations Department of Social and Economic Affairs, Population Division.

Even so, it is estimated that the LAC's current urban population percentage (79.4%) will increase over the years, reaching 88.7% by 2050, which would make LAC the world's most urbanized region<sup>18</sup>. This challenges the belief that urbanization may be used as an indicator of the level of development. Although it is unlikely that the region will, within the next 40 years, rank at the top in terms of per capital GDP or Human Development Index (HDI), other development indicators for the region, such as life expectancy and infant mortality, may well be on par with those of more developed regions.

These indicators are important for determining population growth. In the latter half of the last century, life expectancy in LAC was 52 years and the infant mortality rate was 127 deaths per 1,000 births, while during 2005

and 2010, life expectancy rose to 73.4 years and the infant mortality rate dropped to 21.8 per thousand<sup>19</sup>.

Another important indicator to determine LAC population growth is the world fertility rate, which decreased from 5.9 children per woman from 1950-1955, to 2.3 children per woman in the last five years. Presently, the annual number of births stands at 11 million, which is less than the maximum recorded from 1990-1995. Detailed information on the life expectancy, infant mortality, and fertility rate for the period 2005-2010 for each country participating in EVAL 2010 is included at the end of this section.

International migration also affected the LAC population during 2005-2010. Real population growth was less than it should have naturally been in most of the countries of the region: Colombia, Ecuador, El Salva-

<sup>18</sup> UN-HABITAT, as previously cited.

<sup>19</sup> CEPAL: América Latina: avances y desafíos de la implementación del Programa de Acción de El Cairo, con énfasis en el período 2004-2009, February 2010.

dor, Guatemala, Haiti, Honduras, Mexico, Nicaragua, Paraguay, Peru, the Dominican Republic, and Uruguay. In other countries, such as Chile, Costa Rica, and Panama, populations grew more than expected due to migrations. Finally, in Argentina, Bolivia, Brazil, and Venezuela, there were no signs that the population was affected by migrations.

The information presented in this section appears to indicate a tendency toward reduced population growth and, simultaneously, the aging of the region's population. Therefore, after 50 years of population growth as the main demographic process for the region, the most important change for LAC in the next 50 years is likely to be an expansion of older strata in the pyramid structure of the population.

**Between 2001 and 2008, the LAC population increased from 518 to 588.6 million. At the same time, the urban population increased from 405.7 to 468.8 million (from 78.3% to 79.6% of the total), increasing the population in need of urban sanitation services by 63.1 million people.**

TABLE 3: LAC TOTAL AND URBAN POPULATION, AND SELECTED INDICATORS - 2010

COUNTRY	TOTAL POPULATION (IN MILLIONS)	% URBAN	URBAN POPULATION (IN MILLIONS)	FERTILITY RATE (CHILDREN PER WOMAN)	LIFE EXPECTANCY AT BIRTH (YEARS)	INFANT MORTALITY (DEATHS PER 1,000 LIVE BIRTHS)
Argentina	40,666	92	37,572	2.3	75.3	13.4
Belize	313	52	164	2.9	76.2	16.7
Bolivia	10,031	67	6,675	3.5	65.6	45.6
Brazil	195,423	87	169,098	1.9	72.4	23.6
Chile	17,135	89	15,251	1.9	78.5	7.2
Colombia	46,300	75	34,758	2.5	72.8	19.1
Costa Rica	4,640	64	2,989	2.0	78.8	9.9
Dominican Republic	10,225	69	7,074	2.7	72.2	29.6
Ecuador	13,775	67	9,222	2.6	75.0	21.1
El Salvador	6,194	64	3,983	2.4	71.1	21.5
Guatemala	14,377	50	7,111	4.2	70.2	30.1
Guyana	761	29	218	2.3	66.8	42.4
Honduras	7,616	52	3,930	3.3	72.1	27.8
Jamaica	2,730	52	1,420	2.4	71.8	23.3
Mexico	110,645	78	86,113	2.2	76.1	16.7
Nicaragua	5,822	57	3,337	2.8	72.9	21.5
Panama	3,508	75	2,624	2.6	75.6	18.2
Paraguay	6,460	62	3,972	3.1	71.8	32.0
Peru	29,496	77	22,688	2.6	73.1	21.2
Uruguay	3,372	93	3,119	2.1	76.2	13.1
Venezuela	29,044	93	27,113	2.6	73.8	17.0
Latin America and the Caribbean	588,649	80	468,757	2.3	73.4	21.8

Source: Based on information from the United Nations Department of Social and Economic Affairs, Population Division and CEPAL: Panorama social de América Latina 2009, November 2009.2009.

## ECONOMICAL GROWTH, POVERTY, EMPLOYMENT, AND INEQUALITY

In the third quarter of 2008, due to the effects of the global economic crisis, the LAC region ended its longest period of economic expansion since 1970. Between

2002 and 2008, the region's per capita GDP, based on 2000 fixed prices, grew at an annual rate of 3.53% for a total growth of 23.2%, with notable improvements in tax collection and the general fiscal situation, an increase in the availability of currency, a decrease in debt, and control of inflation. During this period, economic growth led to improvements in poverty, indigence, employment, and inequality indicators.

TABLE 4: VARIATION IN PER CAPITA GDP BETWEEN 2002 AND 2008

COUNTRY	GDP 2002 (US\$/INHAB.)	GDP 2008 (US\$/INHAB.)	VARIATION (%)
Argentina	6,434	9,885	53.6
Belize	3,477	3,933	13.1
Bolivia	1,010	1,173	16.1
Brazil	3,742	4,446	18.8
Chile	5,055	6,235	23.3
Colombia	2,397	2,983	24.4
Costa Rica	4,049	5,189	28.2
Dominican Republic	2,885	3,688	27.8
Ecuador	1,386	1,745	25.9
El Salvador	2,280	2,677	17.4
Guatemala	1,550	1,699	9.6
Guyana	803	902	12.3
Honduras	1,179	1,452	23.2
Jamaica	3,509	3,713	5.8
Mexico	6,320	7,092	12.2
Nicaragua	778	897	15.3
Panama	3,902	5,580	43.0
Paraguay	1,299	1,521	17.1
Peru	2,098	2,926	39.5
Uruguay	5,385	8,161	51.6
Venezuela	4,358	5,925	36.0
Latin America and the Caribbean	3,993	4,921	23.2

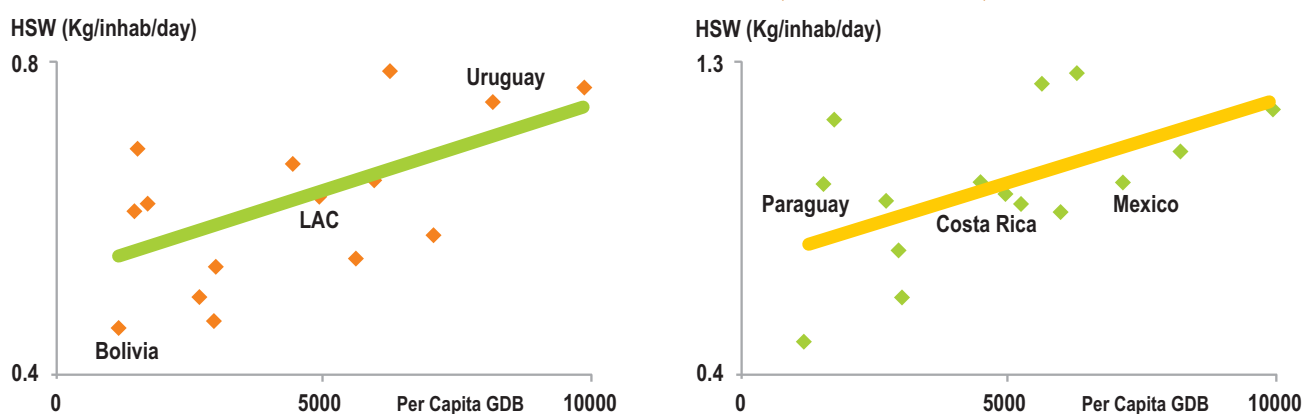
Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009.



In 2009, LAC countries collectively experienced a decrease in per capita GDP of 3%, though in the second half of the year, several countries of the region initiated a strong recovery. It is estimated that 2010 will see an expansion of per capita GDP of nearly 4.1% for the region, continuing economic growth and improvements in social indicators seen in prior years<sup>20</sup>. Among the most important factors that led to the recovery are an increase in the external demand for exports, an increase in the receipt of remittances and tourism, and actions taken by governments of the various countries of the region during the crisis and during the prior periods of growth.

As happens with population growth and increased urbanization, an increase in economic growth requires improvements in SW management services, in terms of greater coverage and the adequate management of SW. As shown below, there is a direct proportional relationship between the level of economic activity and the rate at which SW is generated, whether household solid waste (HSW) or urban solid waste (USW). With an increase in the amount of SW that must be managed, there is also an increase in the need for it to be managed in an adequate, and socially and environmentally sustainable manner.

FIGURE 6: RELATIONSHIP BETWEEN HSW-USW AND PER CAPITA GDP (US\$ IN 2000)



Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009 and EVAL 2010 software.

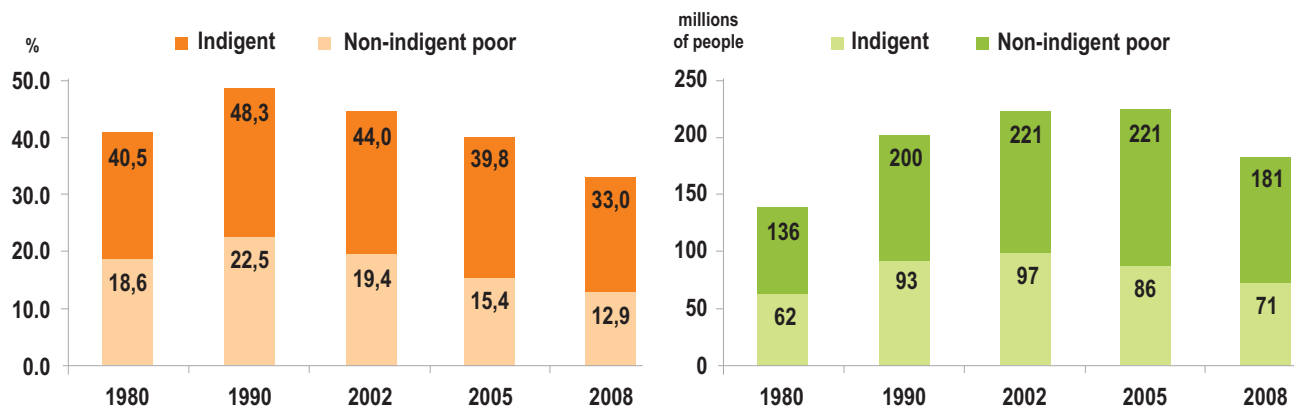
If we analyze the per capita SW generation values for the countries of the region in comparison with those established for OECD countries,<sup>21</sup> and we keep in mind the previously established relationship and the LAC region's expected economic growth, we see that SW generation in the region will continue its marked increase; therefore, unless urgent actions are taken to address the level of SW generation and the provision of SW management services, the problems related with inadequate management will continue to worsen.

Additionally, as can be seen in the figures that follow, the economic growth the region experienced between 2002 and 2008 contributed not only to decrease the percentage of the LAC population living in poverty or in a state of indigence, but also decreased the absolute number of people living in those conditions:

<sup>20</sup> CEPAL: Economic Survey of Latin America and the Caribbean 2009-2010, July, 2010.

<sup>21</sup> See Table 20: Per capita generation of HSW and USW in LAC (Kg/inhab/day) and Table 21: Per capita generation of HSW for the countries of Europe, the United States and LAC.

FIGURE 7: POVERTY AND INDIGENCE TRENDS IN LAC – 1980-2008



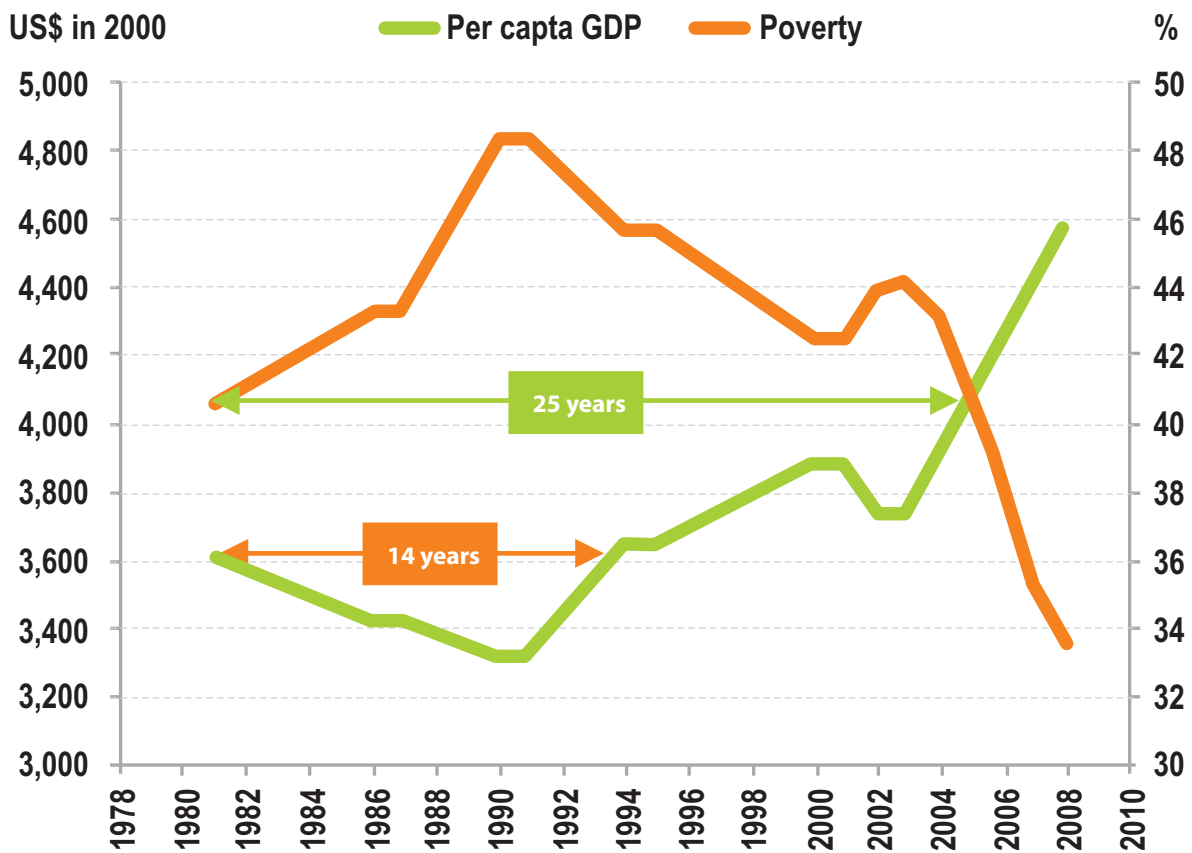
Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009.



Nonetheless, one out of three Latin Americans still find themselves living below the poverty line. The following graph shows that it took the region 25 years, from 1980 to 2005, to return to the poverty levels of 1980 and begin diminishing the absolute number of people living in conditions of poverty and indigence. In contrast, the region's economic recovery after the per capita GDP decrease of the 1980s was much faster: it took 14 years

to return to 1980 levels. This seems to indicate that although there exists a relationship between economic growth and poverty (as can be appreciated in Figure 8 below, in the form of an inverse image), other factors exist (such as a deficient social safety net, elevated labor flexibilization, the lack of preventive mechanisms in times of crisis, etc.) that can hinder the spread of benefits.

FIGURE 8: RELATIONSHIP OF PER CAPITA GDP (US\$ IN 2000) AND POVERTY IN LAC – 1980-2008



Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009 and América Latina: avances y desafíos de la implementación del Programa de Acción de El Cairo, con énfasis en el período 2004-2009.

The levels of poverty and indigence have an impact not only on the amount of solid waste generated but also on other aspects of SW management. First, high levels of poverty and indigence in an area generally lead to the establishment of informal settlements or marginalized neighborhoods, which tend to be difficult to access for the purposes of providing street sweeping and trash

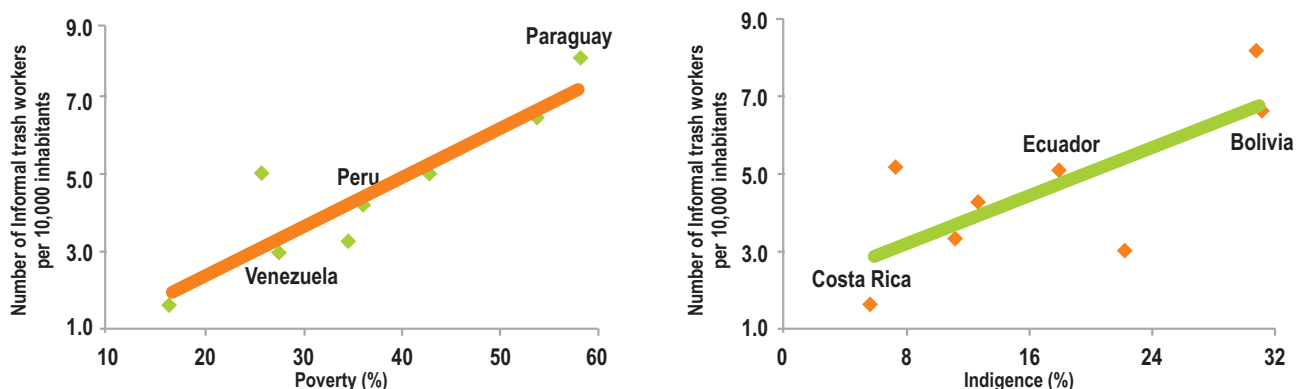
collection services, and this, in turn, causes significant health, environmental, and social problems. Second, it is precisely in those same areas that many waste pickers typically perform the tasks of sorting and storage, thereby increasing their health risks. Third, this population's inability to pay for services poses a challenge when

it comes to obtaining resources to ensure the financial sustainability of SW services.

An analysis included in EVAL 2010 establishes a relationship between the levels of poverty and indigence,

and the number of waste pickers in the countries of the region. As the graphs below show, the number of waste pickers is directly proportional to the levels of poverty and indigence:

FIGURE 9: RELATIONSHIP BETWEEN THE LEVEL OF POVERTY AND INDIGENCE AND THE NUMBER OF WASTE PICKERS IN LAC

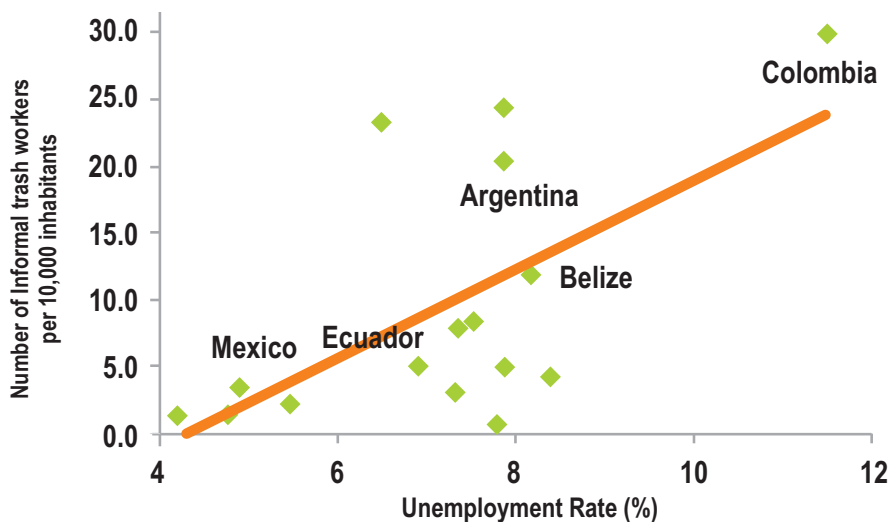


Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009 and EVAL 2010 software.

The relationship is more strongly observed when the number of waste pickers is plotted against the unemployment rate of the different countries. Once more we

find a direct relationship: as unemployment goes up, so does the number of waste pickers.

FIGURE 10: RELATIONSHIP BETWEEN UNEMPLOYMENT RATE AND NUMBER OF WASTE PICKERS IN LAC

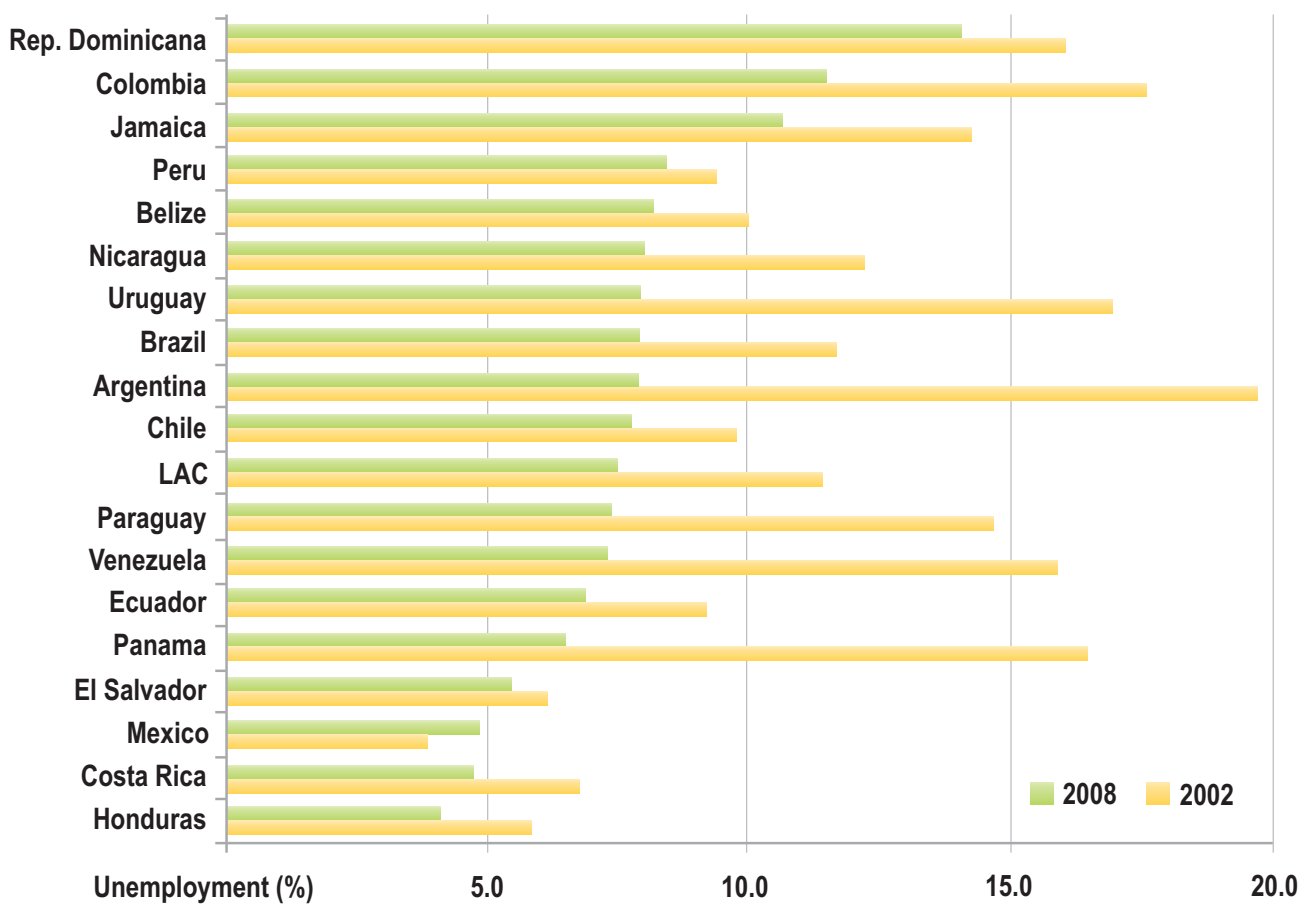


Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009 and EVAL 2010 software.

It should be noted, however, that in some countries, high levels of poverty, indigence, and unemployment existed beforehand, expanding the number of waste pickers in the population. EVAL 2002 highlighted the significant increases in waste pickers in Argentina and Colombia, due to disproportionate increases in poverty and indigence, and the critical unemployment situation. It is to be expected that this recent historical development would continue to be reflected to some degree in the variables observed presently.

In terms of employment in the region, the unemployment rate decreased between 2002 and 2008 in the majority of LAC countries (with the exception of Mexico, which, in any event, has one of the lowest unemployment rates in the region). As to be expected, following one of the region's longest periods of economic growth, the regional unemployment rate diminished significantly from 11.4% in 2002 to 7.2% in 2008.

FIGURE 11: UNEMPLOYMENT RATE BY LAC COUNTRY – 2002 TO 2008



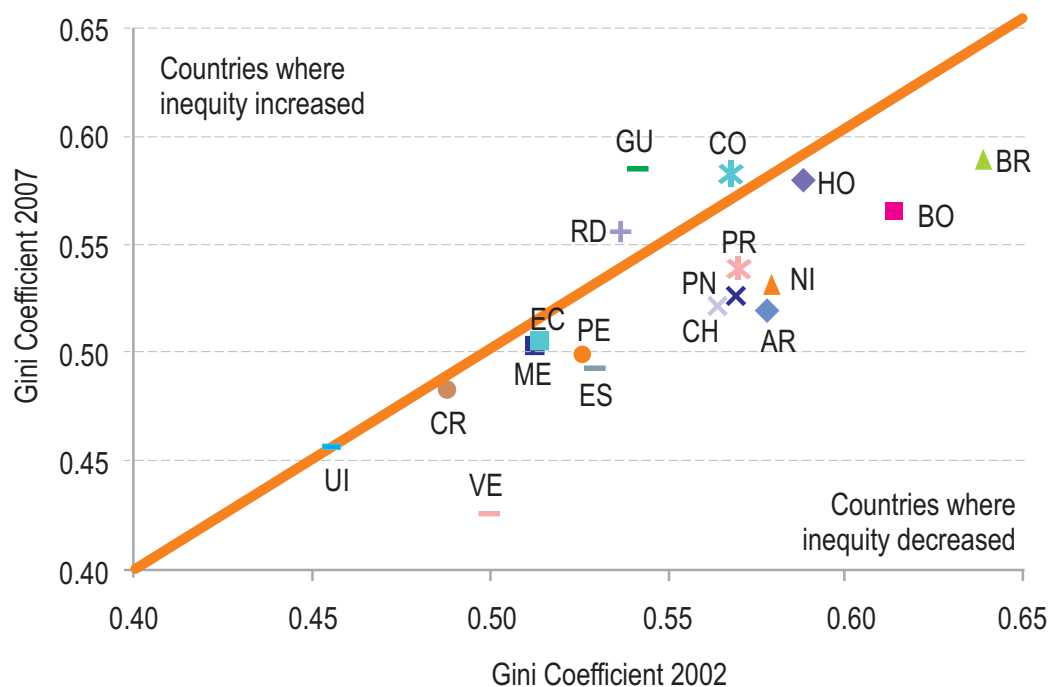
Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009.



Sustained economic growth and reductions in poverty, indigence, and unemployment rates have resulted in improved income equity for most LAC countries. As

can be seen from Figure 12 below, all of the countries of the region have seen lower income inequity except for Colombia, Guatemala, and the Dominican Republic.

DFIGURE 12: INEQUITY IN LAC – GINI COEFFICIENT<sup>22</sup> – 2002 TO 2007



Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009 and América Latina: avances y desafíos de la implementación del Programa de Acción de El Cairo, con énfasis en el período 2004-2009.

<sup>22</sup> The Gini coefficient measures inequality and is commonly used as a measure of inequality of income among the different percentiles of population. The Gini coefficient, which is calculated from the Lorenz curve, varies from 0 to 1, where 0 indicates a society with complete equality and 1 corresponds to complete inequality.

Nevertheless, overall, LAC is considered the most unequal region in the world in terms of income. According to CEPAL<sup>23</sup>, an IMF study (2007) showing the trajectory of the Gini index for the various regions<sup>24</sup>, reveals that LAC has been the most unequal of all since at least

1985. Additionally, the social asymmetry can be seen in statistics that show what percent of national consumption is attributable to the poorest 20% of the population. Again, LAC ranks as the most unequal region.

TABLE 5: PARTICIPATION OF THE POOREST PERCENTILE IN NATIONAL CONSUMPTION – 2005

REGION	PARTICIPATION (%)
North America	6.1
Sub-Saharan Africa	3.6
Latin America and the Caribbean	2.9
East Asia	4.3
South Asia	7.4
Southeast Asia	5.7
Western Asia	6.2
Commonwealth of Independent States (CIS)	7.0
Countries with economies in transition of Southwestern Europe	8.2

Source: Based on information from CEPAL: América Latina: avances y desafíos de la implementación del Programa de Acción de El Cairo, con énfasis en el período 2004-2009.



Foto: Christopher Jennings (cortésia)

<sup>23</sup> CEPAL: as previously cited, February 2010.

<sup>24</sup> Advanced economies, recently industrialized of Asia, LAC, Sub-Saharan Africa, Central and Eastern Europe, Commonwealth of Independent States, Middle East, and Northern Africa, and developing economies of Asia.

Lastly, the Human Development Index (HDI) is a widely used indicator to measure a country's socio-economic condition, combining health, education, and standard-of-life indicators<sup>25</sup>, . In this case, the region fares well in the global context, ranking close to Southwestern Europe and Central Asia:

TABLE 6: HDI BY REGION OR ASSOCIATION OF COUNTRIES – 2010

REGION / ASSOCIATION OF COUNTRIES	IDH
Organization for Economic Co-operation and Development (OECD)	0.853
Sub-Saharan Africa	0.389
Latin America and the Caribbean	0.706
East Asia and the Pacific	0.650
South Asia	0.516
Southeastern Europe and Central Asia	0.717

Source: Based on information from UNDP: <http://hdr.undp.org/es/datos/trends/1980-2010/>.

<sup>25</sup> The HDI was developed by the United Nations in 1990 in order to have a composite index to simultaneously measure health, education, and standard-of-life variables. For this purpose, a methodology was created to unify the indicators of life expectancy, average and expected years of education, and per capita GNP.

Between 2002 and 2008, per capita GDP increased by 23.2% for LAC countries. According to this economic indicator, the countries with the strongest recoveries were Argentina, Uruguay, and Panama, while those with the least or negative recovery were Haiti, Jamaica, Guatemala, and Mexico.

Due in part to this economic recovery, there was improvement in socioeconomic indicators on poverty, unemployment, inequality, and the human development index.

Nonetheless, LAC continues to be the region with the highest level of inequality in the world.

TABLE 7: SOCIOECONOMIC INDICATORS FOR LAC

INDICATOR	PER CAPITA GDP (US\$ OF 2000)		ANNUAL CONSUMER PRICE INDEX (%) VARIATION		URBAN UNEMPLOYMENT (%)		POVERTY (%)		INDIGENCE (%)		HDI
	2002	2008	2002	2008	2002	2008	2002	2008	2002	2008	
Argentina	6,434	9,885	41.0	7.2	19.7	7.9	-	-	-	-	2010
Belize	3,477	3,933	-	-	10 (a)	8.2 (a)	-	-	-	-	0.694
Bolivia	1,010	1,173	2.5	11.8	8.7	-	62.4	54.0 (d)	37.1	31.2 (d)	0.643
Brazil	3,742	4,446	12.5	5.9	11.7	7.9	37.5 (b)	25.8	13.2 (b)	7.3	0.699
Chile	5,055	6,235	2.8	7.1	9.8 (a)	7.8 (a)	18.7 (c)	-	4.7 (c)	-	0.783
Colombia	2,397	2,983	7.0	7.7	17.6	11.5	51.5	-	24.8	-	0.689
Costa Rica	4,049	5,189	9.7	13.9	6.8	4.8	20.3	16.4	8.2	5.5	0.725
Dominican Rep.	2,885	3,688	10.5	4.5	16.1	14.1	47.1	44.3	20.7	22.6	0.663
Ecuador	1,386	1,745	9.4	8.8	9.2	6.9	-	42.7	-	18	0.695
El Salvador	2,280	2,677	2.8	5.5	6.2	5.5	48.9 (b)	-	22.1 (b)	-	0.659
Guatemala	1,550	1,699	6.3	9.4	5.1	-	60.2	-	30.9	-	0.560
Guyana	803	902	-	-	-	-	-	-	-	-	0.611
Honduras	1,179	1,452	8.1	10.8	5.9	4.2	77.3	68.9 (d)	54.4	45.6 (d)	0.604
Jamaica	3,509	3,713	7.3	16.9	14.3 (a)	10.7 (a)	-	-	-	-	0.688
Mexico	6,320	7,092	5.7	6.5	3.9	4.9	39.4	34.8	12.6	11.2	0.750
Nicaragua	778	897	4.0	12.7	12.2	8.0	69.3 (b)	-	42.4 (b)	-	0.565
Panama	3,902	5,580	1.9	6.8	16.5	6.5	36.9	27.7	18.6	13.5	0.755
Paraguay	1,299	1,521	14.6	7.5	14.7	7.4	61 (b)	58.2	33.2 (b)	30.8	0.640
Peru	2,098	2,926	1.5	6.6	9.4	8.4	54.8 (b)	36.2	24.4 (b)	12.6	0.723
Uruguay	5,385	8,161	25.9	9.2	17.0	7.9	-	13.7	-	3.4	0.765
Venezuela	4,358	5,925	31.2	31.9	15.9	7.3	48.6	27.6	22.2	9.9	0.696
Latin America and the Caribbean	3,993	4,921	12.2	8.4	11.4	7.5	44	33	19.4	12.9	0.706

Source: Based on information from CEPAL: Panorama social de América Latina 2009, November 2009 and UNDP: Human Development Report 2010 – 20th Anniversary Edition: The Real Wealth of Nations: Pathways to Human Development (a) National total; (b) Data for 2001; (c) Data from 2003; (d) Data from 2007.







# INSTITUTIONAL FRAMEWORK AND SECTOR ORGANIZATION



# INSTITUTIONAL FRAMEWORK AND SECTOR ORGANIZATION

## INSTITUCIONAL FRAMEWORK FOR USW MANAGEMENT

With the exception of some English-speaking countries of the Caribbean, the management of urban solid waste is primarily a municipal responsibility in nearly all LAC countries. On the other hand, the establishment of policies, the development of management plans, and the assignment of budgets continue to be national and, in federated countries sometimes, regional responsibilities. During the last eight years, the institutional structure of USW management services at the national level has tended to become officially uniform, with the task falling under the mandate of national environmental ministries in nearly all countries of the region.

In this regard, the multilateral credit organizations acting in the region have played the role of catalyst. In many cases, implementation teams formed to execute a specific project later evolved into permanent entities, while, in other cases, they have strengthened existing entities. Although this represents a significant advance, given that few entities dedicated to SW management existed beforehand, there is still a long way to go in terms of consolidation, efficiency, and operations.

There are several governmental and non-governmental institutions throughout the region that are actively involved in waste management. Table 8 lists the types of institutional structures found in the USW management sector in LAC:

TABLE 8: INSTITUTIONAL FRAMEWORK OF USW MANAGEMENT SECTOR IN LAC

INSTITUTIONS	FUNCTIONS
NATIONAL	
Environmental and Natural Resource Ministry or Department	Usually the lead and principal institution responsible for developing policies, strategies, plans, and programs for managing urban and industrial solid waste. Responsible for regulating impacts on the environment and proposing both environmental legislation and environmental quality standards for the treatment, disposal, and management of SW, and for designing and locating sanitary landfills.

<p>Ministry of Health and General Administration of Environmental Health</p>	<p>Oversee regulations and rules governing the sanitary management of SW. Involved in actions to regulate and control sanitation issues. Responsible for public and occupational health, hygiene, and monitoring the collection, transport, and final disposal of SW. Develop policies, strategies, plans, and programs at the national level to manage hospital waste.</p>
<p>Other Ministries such as Housing, Industry, Planning, Economy, Zoning, Development, Interior, etc.</p>	<p>Responsible for planning, supervising, and regulating the management of SW in their respective areas. In some cases, various ministries provide resources for investment in municipal SW management systems.</p>
<p>National Development Banks/ Social Investment Funds for Local Development</p>	<p>Finance projects, provide technical assistance, and implement project work.</p>
<p>REGIONAL</p>	
<p>Autonomous Regional Corporations</p>	<p>Responsibilities include, among others, the promotion and preservation of the region's environmental health, as well as the implementation of a regional system of environmental management in coordination with the Environmental Ministry. Found mainly in Colombia and Peru.</p>
<p>STATE/ PROVINCIAL</p>	
<p>State/Provincial Environmental Ministries</p>	<p>Operate within the national constitution and national rules to fulfill functions similar to those of the national environmental department. In the case of Mexico, functions are restricted to special waste management, but they also provide support to municipalities in the establishment of SW management plans. This type of institution is found in federated countries such as Mexico, Brazil, and Argentina.</p>



<p>Provincial Municipalities</p>	<p>Responsibilities are similar to that of the national environmental department and include household and commercial solid waste management, and the management of similar waste generated by other activities throughout its jurisdiction. Regulate and control the final disposal of waste in the province and have the option of being involved in public cleaning and SW treatment systems when the centralization of these services in the province results in economies of scale.</p>
<p>MUNICIPALITIES</p>	
<p>Municipalities</p>	<p>Responsible for financing, administrating, and operating USW management services, such as trash collection, transport, final disposal, and the cleaning of roads and public spaces. The municipalities are autonomous and may opt to have a contractor or concessionaire provide SW management services within its jurisdiction. In several countries of the region, municipalities also reserve the legal right to associate with other municipalities nearby or in the same territory in order to dispose of SW.</p>
<p>Municipal Corporations, Municipal Development Institutes, etc.</p>	<p>Public entities responsible for enhancing local government management and providing technical, administrative, financial, and planning assistance to municipalities in areas that include SW management.</p>
<p>ASSOCIATIONS/NGOS</p>	
<p>Mayoral Associations/Municipal Associations</p>	<p>Institutional or professional associations that promote the interests and autonomy of municipalities, supporting the strengthening of municipal governments and the efficient delivery of municipal services, SW management among them.</p>



<p>Associations of Waste pickers, Recycling Cooperatives</p>	<p>Initially informal associations, they have become an important alternative force for waste reduction. They should be given greater consideration as integral players in SW management strategies</p>
<p>Associations of Environmental and Sanitation Engineers / National and Inter-American Public Health and Environmental Associations</p>	<p>Play an important part in matters related with SW management. DIRSA/AIDIS, for example, advises member countries on solid waste management.</p>
<p>NGOs</p>	<p>Exercise an important role with respect to environmental issues and the management of SW, particularly through programs that support micro-enterprises and cooperatives dedicated to SW management, environmental education programs, and their experience in the comprehensive management of waste, as well as their participation in the formulation of environmental legislative proposals and in engaging civic participation. Both international and national NGOs are active in the SW sector in LAC.</p>
<h2 style="text-align: center;">INTERNATIONAL AGENCIES</h2>	
<p>IDB, World Bank, PAHO/WHO, CAF, CABI, USAID, UNICEF, CEPAL, JICA, KfW, GTZ, AECID, CEHI, and others.</p>	<p>International, multilateral, and bilateral organizations that are involved in waste management at several levels by financing investment projects and providing technical and educational solutions, as well as contributing to the establishment of public policy and directly supporting municipalities.</p>
<h2 style="text-align: center;">UNIVERSITIES AND TECHNICAL TRAINING INSTITUTES</h2>	
<p>Universities, Technical Training Institutes</p>	<p>Offer human resource training, research projects, and educational courses aimed at strengthening national and local SW management capability.</p>

Source: Specially prepared for this report.



Photo: Christopher Jennings (courtesy)

## Regional Organization

The use of regional solutions to adequately manage SW has intensified throughout the region in recent years. Many municipalities of the region have associated with others in order to achieve significant economies of scale and improve the application of rules and regulations.

These types of associations are as important to large metropolitan regions (where inter-municipal cooperation is vital to successful comprehensive SW management because these highly urbanized areas lack the space to properly treat and dispose of waste) as they are to smaller cities (which are unable to independently afford the costs of sanitary landfills for the adequate final disposal of SW). In both cases, a shared sanitary landfill is an economically attractive solution, given the joint cost savings and the significant economies of scale that can be achieved.

In order for inter-municipal cooperation to cost effectively develop large, regional dumping grounds and transfer stations, the implementation of efficient mechanisms for inter-municipal and inter-sector coordination is required. These agreements should include mechanisms for joint decision making and rules that govern cost sharing to finance these installations and their operations.

The use of regional sanitary landfills is a practice that is expanding rapidly in the State of São Paulo, Brazil, which is home to more than 40 million inhabitants and produces one third of Brazil's GDP. A recent survey conducted by São Paulo's environmental agency, Companhia do Meio Ambiente do Estado de São Paulo (CETESB), found that out of a total of 645 municipalities, the number that send their waste to sanitary landfills outside their borders increased from 62 in 2002 to 156 in 2009. In at least 22 cases, a regional solution was implemented despite a distance of more than 100 kilometers between the producing city and the receiving city. According to CETESB, the percentage of waste that is adequately disposed of increased from 10.9% in 1997 to 83.9% in 2009<sup>26</sup>.

Other examples of comprehensive regional SW management include the Metropolitan Solid Waste Processing System (SIMEPRODESO) in Monterrey, Mexico, and the VIRCH-Valdés consortium, created to manage the USW in northeastern Chubut Province, located in the Patagonia region of Argentina<sup>27</sup>. The box that follows includes more detailed information on these two regional solutions.

<sup>26</sup> State Household Solid Waste Inventory, CETESB, 2009.

<sup>27</sup> The consortium encompasses the principal cities of the Valdés Peninsula and the lower valley of Río Chubut (VIRCH).

## EXAMPLES OF REGIONAL ORGANIZATION FOR SOLID WASTE MANAGEMENT

Created in 1987, SIMEPRODESO currently provides transfer, recycling, energy recovery, and final disposal services for various municipalities of the State of Nuevo León, Mexico, with nearly 4 million inhabitants. Member municipalities are responsible for organizing their own trash collection services either directly or through private operators. SIMEPRODESO runs three transfer stations and 14 regional sanitary landfills, one of which (Salinas Victoria in metropolitan Monterrey) receives more than 4,500 tons of waste per day and has a recycling plant with the capacity to process 1,000 tons of mixed waste daily and an energy plant that generates electricity from biogas with a 12MW production capacity (and which is in the process of being expanded; see page 137).

SIMEPRODESO can serve as an institutional model for the management of SW in metropolitan areas. The model calls for a decentralized public company (at the state or provincial level) that operates under commercial principles and has a Board of Directors comprised of the governor as president and representatives from the eight municipal mayoralties (three serve at a time on a rotating basis), the labor union, the chamber of commerce, and the industrial association. The main lesson learned from the creation of SIMEPRODESO is that the principal difficulties to overcome are not technical, but institutional and financial.

For its part, the public consortium VIRCH-Valdes was created in 2007 for the purpose of managing the GIRSU system, which is to be implemented in the region of Chubut Province that includes the municipalities of Puerto Madryn, Trelew, Rawson, Dolavon, and Gaiman, totaling approximately 200,000 inhabitants. The system is comprised of two waste sorting and transfer plants (one in Puerto Madryn and the other in Trelew) and the construction of a regional sanitary landfill (located between the two municipalities). The system, scheduled to begin operations in 2011, will be able to manage 250 tons of USW per day. Each municipality in the consortium will cover operational costs proportional to the amount of waste it contributes into the system.

## Planning

Waste management policies should possess a comprehensive vision, with a focus on preventive environmental and sanitation measures that aim to minimize waste in quantitative and qualitative terms (less waste generation and decreased environmental and health risks) and ensure the sector's sustainable and efficient development. In the establishment of general strategies to meet these goals and in the development of a hierarchy of plans to coordinate activities, the principal stakeholders ought to identify the direction in which the country wishes to head and how they can contribute to achieving that objective; this will help them better coordinate their activities, cooperate with each other, and work as a team. Without comprehensive planning, they might be working at cross-purposes and hindering the country's

efficient progress towards its objectives. The absence of a single SW management director has made it difficult to apply broad policies and has led to the overlapping of functions.

At the municipal level, various LAC cities already have a SW management plan to address the sector's demands, although there is not a national plan to guide them. As can be seen in Table 9 below, however, the regional percentage of LAC municipalities with management plans stands at 19.8%. Taking a closer look at population size, it can be seen that large cities comprise the majority of municipalities with SW management plans (51.9%). The percentage gradually decreases as the population size decreases, dropping to 13.8% for micro municipalities. For municipalities with more than 5 million inhabitants, the 25% figure is due to the lack of management plans for the municipalities of Peru and Brazil.

TABLE 9: LAC MUNICIPALITIES WITH SW MANAGEMENT PLANS (%)

COUNTRY	MICRO	SMALL	MEDIUM	LARGE	MEGA	OVERALL
Argentina	76	64.8	80.1	87.5	..	74
Belize	25	-	0	-	..	21.9
Bolivia	0	0	23.5	100	..	9.8
Brazil	0	0	14	24	0	1.6
Chile	52.9	23.7	97.3	-	..	53.4
Colombia	-	-	-	-	-	-
Costa Rica	39.3	39	100	100	..	57.1
Dominican Rep.	0	0	37	75	..	5.1
Ecuador	-	-	-	-	..	-
El Salvador	26.9	58.7	68.2	100	..	41.3
Guatemala	15.2	25.3	76.1	0	..	28.5
Guyana	-	-	0	-	..	*

COUNTRY	MICRO	SMALL	MEDIUM	LARGE	MEGA	OVERALL
Honduras	14.2	50	73.5	100	..	26.7
Jamaica	0	0	0	0	..	0
Mexico	31.8	29.4	53.4	88	100	35
Nicaragua	-	0	0	100	..	1.2
Panama	31.7	60.4	41.7	100	..	43.1
Paraguay	19.1	25	0	-	..	18.8
Peru	15.6	44.8	68.9	83.3	0	57.2
Uruguay	74.1	82.7	35.7	100	..	73.9
Venezuela	0	47.1	30.9	50	..	33.4
LAC	13.8	18.5	43.5	51.9	25	19.8

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants ;

Medium: 50,001 – 300,000 inhabitants ; Large: 300,001 – 5,000,000 inhabitants ; Mega > 5,000,000 inhabitants

- Information not available

.. No population of this size

\*Not enough data to calculate the aggregated variable at country level

The countries of Costa Rica, Argentina, Chile, and Peru stand out as having high overall levels of municipalities with management plans. On the opposite end of the spectrum are Bolivia (9.8% overall) and especially Brazil (1.6% overall). However, the high percentage of municipal management plans noted does not guarantee the quality, applicability, and execution of these plans. In a great number of cases, these plans have not been implemented due to the lack of resources, personnel training, or simply because they cannot be effectively applied due to the need for greater specification as to tasks, time-frames, stakeholders, and sources of financing.

Although it could be implemented more quickly, the Master Waste Management Plan of Montevideo and its metropolitan area, developed from 2003-2005, is an example of a model long-term plan that proposes the comprehensive planning of all the different classifications of waste over the next 25 years. Another example is the Comprehensive Waste Management Strategy of the Superintendence of Urban Cleaning (SLU) of Belo Horizonte, Brazil, which is described in greater detail in the box.



## COMPREHENSIVE SYSTEM OF SOLID WASTE MANAGEMENT IN BELO HORIZONTE, BRAZIL

In 1993, the Superintendence of Urban Cleaning of Belo Horizonte developed and began implementing a comprehensive waste management strategy in its city, which is located in the State of Minas Gerais and constitutes Brazil's third most populated metropolitan area. A mere four years later, Belo Horizonte's comprehensive system was completely implemented and served as a model for other municipalities in the region. The city's strategic plan continues to be updated and implemented. Presently, a new regional sanitary landfill is being planned.

The SLU strategy has three main parts: a) a technological model based on the concept of differentiated management and waste recycling, which provided a comprehensive and reasonable solution for waste such as construction debris, organic waste, recyclable materials, and hospital waste. For this purpose, the technological model includes a differentiated trash collection system, three recycling plants, two construction debris recycling plants, and composting plants; b) the modernization of SLU, including quality control based on worker participation, the use of efficient management instruments, and an intensive human resource development program; and c) active citizen participation through permanent dialogue between SLU and the community, emphasizing the concepts of mutual responsibility and accountability.

One of the principal objectives of the strategy was the inclusion of waste pickers, also known as waste pickers, in the official SW management process. In 1990, a clause was added to the city's comprehensive law stipulating that cooperatives (the organized informal sector) would be the preferred providers of recyclable material collection in Belo Horizonte and the principal beneficiaries of this activity. In 1993, the city formalized its first relationship with a sorting cooperative to implement a municipal recycling program.

Since 2003, officially recognized cooperatives of trash collectors and informal collectors of construction debris have joined forces at the Forum on Waste and Civic Duty in Belo Horizonte, which has become an important institutional channel to discuss the integration of all SW management organizations (UN-Habitat 2010).

In terms of the information on the sector that is available to develop SW policies and plans, EVAL 2010 confirms that it is scarce, not shared among institutions, dispersed, out of date, or incomplete. This is reflected in the scarcity of reliable data at the national and local levels on service coverage and quality, infrastructure and equipment, and investment and sources of financing.

However, some countries have initiated environmental information systems that include general systemized information on solid waste. For example, in the case of Brazil, the Diagnostic on USW Management 2007, available from the National Sanitation Information System (NSIS), provided useful data for various municipalities. Other advanced projects are found in Mexico,

which began a recyclable material information system through the Environment and Natural Resources Department (SEMARNAT) and Peru, which has developed the Solid Waste Management Information System (SIGERSOL), created by the Environmental Ministry in order to fulfill its obligations under the General Law on Solid Waste 27314 of 2000 that requires the Ministry to prepare an annual report on solid waste; municipalities send their information via SIGERSOL.

### Legal and Regulatory Framework for Solid Waste Management

With respect to the legal framework, the region has made significant advances during the past eight years. Seven countries of the region have proclaimed a national legal framework: Argentina, Peru (national law of 2000 modified by legislative decree of 2008), Paraguay, Mexico, Venezuela, Costa Rica, and Brazil. In some of these cases, this marks the first law on waste manage-

ment established in the country, while in other cases it repeals prior laws. There are various factors that delay the approval of national waste management laws, most of which are related to the interests of stakeholders. Among them are: the new responsibilities municipal authorities must assume related to poor SW management and resulting penalties, the interests of the private sector, and the new role of the sector's waste pickers.

The countries that have more recently promulgated SW management laws are: Paraguay (December 24, 2009), Costa Rica (July 2010), and Brazil (August 2, 2010), where the Brazilian National Congress approved the country's National Law on Solid Waste after 21 years of debate. The Brazilian law prohibits, among other things, the use of uncontrolled dump sites and obligates federal, state, and municipal governments to develop SW treatment plans and establish recycling goals and programs. All these laws underscore similar themes, such as the valorization of waste, sorting-at-the-source programs, recycling programs, and financial sustainability of services; these are the new trends in SW management in LAC.



## BRAZIL'S NATIONAL LAW ON SOLID WASTE

The Brazilian Senate recently approved Legislative Bill 384 of 1989, which establishes the National Policy on Solid Waste. The law requires that federal, state, and municipal governments develop SW treatment plans and establish recycling goals and programs. It also prohibits unofficial dumpsites and requires that members of industry properly dispose of certain products, such as electronics.

The new law requires that manufacturers, importers, distributors, and vendors practice inverse logistics. Under this system, products such as batteries, car tires, and electronic products are to be returned to the company by the consumer for adequate disposal after the product's useful life has expired.

The regulations put into practice the principles of shared responsibility among all parties involved, from the manufacturer through final disposal. The municipalities, for example, are now responsible for ensuring that illegal dump sites no longer exist and for implementing systems to separate recyclable materials from other waste, which is a service that only 7% of the country's municipalities currently provide.

The law greatly enhances recycling efforts in Brazil by strengthening the role of cooperatives that collect recyclable materials as waste management agents with access to financial support. The law also requires that packaging should be manufactured with reusable or recyclable materials.

A significant requirement included in the majority of legal and regulatory frameworks that govern SW management is the obligation to conduct environmental impact studies (article 26 of the rules for the waste management law of Peru, for example) and the assignment of responsibility for environmental damages. It is also worth noting other aspects, such as the application of criteria to minimize the amount of waste that enters a final disposal site, sorting-at-the-source (Brazil's National Law on Solid Waste, chapter III, articles 31 and 35, for instance), an increase in the number of recycling programs, strong support for the use of the Clean Development Mechanism, energy generation from biogas, the sale of carbon credits, and the valorization of waste, among others (General law on the prevention and comprehensive management of waste for the United States of Mexico, articles 1 and 2).

Nonetheless, these laws are far from making a concrete impact on the sector. These laws are generally written at the macro level and, therefore, are not specific; compliance is low because they are rarely regulated. Even

when they are regulated, their mechanisms of control and sanctions are not often applied, thereby limiting their effectiveness.

At the municipal level, ordinances are legal instruments proposed by the mayor and approved by the members of the city council, who are highly aware of the needs of the community they live in and, therefore, generally produce rules quickly and for immediate application. Given that the issue of USW is a high-profile municipal issue these days, many municipalities have passed key ordinances in the past few years, such as Zero Waste. This is the case of the municipalities of Santa Cruz de la Sierra, Bolivia, which established programs to gradually reduce waste (5% annually) through 2017, by which time the final disposal of valued waste will be prohibited. Another example is the City of Buenos Aires, which has also implemented the principle of the gradual reduction of the final disposal of waste, with concrete goals and timelines, as well as the adoption of a set of measures aimed at: reducing the generation of waste, sorting waste, recovery, and recycling. Although these

laws are well intentioned, in some cases they establish goals that are difficult for municipalities to meet.

In LAC, the legislative and regulatory framework clearly exemplifies a lack of uniformity in the use of terminology related to the management of solid waste. This is the case with terms such as solid waste, urban solid waste, municipal solid waste, household waste, special waste, etc. The differences in the terminology used to identify solid waste in LAC and the world makes it difficult to compare statistics such as, for example, the generation of waste in cities. In Mexico, for example, USW is defined as waste resulting from household activities, and encompasses street sweeping and the cleaning of public spaces, but not commercial and industrial waste. In Colombia, however, Decree 1713 defines solid waste as waste generated by industrial and commercial activities, institutions, and households. Even within a country there can be differences in the use of terms. This is the case in Argentina, where National Law 25916 and Law 13592 of the Province of Buenos Aires define urban solid waste and household solid waste in different ways.

With respect to the regulation of the sector, it may be said that it has, in general, not yet taken place. The regulation of the sector in LAC is contractually a municipal responsibility in terms of its technical and economic factors. Nonetheless, given the absence of a national regulator or institution that is capable of guiding the formulation of municipal contracts with some technical know-how in the area, a notorious asymmetric information situation exists between municipal authorities and operators. As a result of this, two situations have developed: contracts are executed that pay less than what is needed to provide an adequate service and operators offer a technically deficient service that the municipality is unable to detect, or excessive payment is made and the municipality is unable to evaluate this overpricing. Generally, this situation does not contribute to the transparency of the provision of services.

However, the greatest needs lie in the economic and financial factors of service provision. While in the en-

vironmental and sanitation legal framework there are overlapping responsibilities and a lack of clarity in its formulation, resulting in regulatory entities clashing as they execute their functions, with respect to the economic and financial factors of service provision, there is neither a designated regulator nor the legal framework for one to perform the needed functions. As occurs in the provision of other public services, such as energy, water, and sanitation, governments should regulate the fees and rates that are applied in the sector, seeking to achieve financial sustainability for the providers, in accordance with a predetermined level of quality of service and the population's capacity to pay.

Appropriate regulations to guide these economic and financial factors do not exist in the majority of countries in the region, nor is there an entity in charge of formulating the needed regulations. In Chile, the Law on Municipal Revenues establishes that municipalities should determine on an annual basis the real costs of residential cleaning services, so that the fee for each user may be calculated (dwellings or residential units, and commercial establishments). This fee covers the regular extraction service, not to exceed 60 liters per day. For "over producing" properties, the municipality is granted the authority to charge the user directly, applying its own criteria to fix the fee and the conditions of service.

Colombia is the only country in the region that has and applies an appropriate regulatory framework to set fees for all phases of SW management. This framework was established by Law 142 of the Residential Public Services Rules of 1994 and resolutions 351 and 352 of the Potable Water and Basic Sanitation Regulatory Commission of 2005, which led to the issuance of the Fee Regulation Rule that governs providers of public SW management services. The rules stipulate the methodology that is to be used to calculate fees and includes other provisions that establish cost ceilings to guarantee the service's financial sustainability. See page 100 for more information.





Photo: CEAMSE (courtesy)

## PROVISION OF SERVICES

### METHODS OF DELIVERY

The municipalities of LAC use a wide range of management alternatives to provide services, from completely public to completely private. Between these two possibilities, there are various options: autonomous municipal companies, autonomous companies with mixed public-private management, NGOs, cooperatives and micro-enterprises, and public management at the state, provincial, or national levels.

In EVAL 2010, the survey form used to gather information on the methods of USW management service delivery allowed for the following options: direct municipal service, including municipal companies (the municipality administers and operates the company us-

ing its own personnel and equipment, and assuming associated costs); service contract (mainly private companies); cooperatives; and service provided by the national government or non-municipal government institutions.

The aggregate variables on the delivery method for street sweeping, collection, and final disposal services are presented according to the population covered. SW management services are most commonly delivered as a direct municipal service. This is especially the case for the smaller municipalities, but as the size of the municipality grows, so does the likelihood that SW management services are contracted out.

As can be seen in Table 10, with respect to street sweeping, 59.4% of the LAC population receives this benefit as a direct municipal service, while delivery by other methods totals 40.4%. An analysis of the data based on municipality size in each country reveals that the larger the municipality, the more likely there is to be private sector involvement in SW management.

TABLE 10: DELIVERY METHOD FOR STREET SWEEPING SERVICE (% OF POPULATION RECEIVING THIS BENEFIT)

COUNTRY	MICRO		SMALL		MEDIUM		LARGE		MEGA		OVERALL	
	DIRECT MUNICIPAL SERVICE	OTHER	DIRECT MUNICIPAL SERVICE	OTHER	DIRECT MUNICIPAL SERVICE	OTHER	DIRECT MUNICIPAL SERVICE	OTHER	DIRECT MUNICIPAL SERVICE	OTHER	DIRECT MUNICIPAL SERVICE	OTHER
Argentina	92.6	7.4	98.3	1.7	69	31	14.9	85.1	..	..	55.1	44.9
Belize	-	-	-	-	-	-	-	-	..	..	-	-
Bolivia	100	0	100	0	82.7	17.3	0	100	..	..	53.4	46.6
Brazil	41.7	58.3	89.6	10.4	51.8	48.2	36	64	0	100	49.2	51.8
Chile	98.7	1.3	5.2	94.8	34.5	65.5	50	50	..	..	35.6	64.4
Colombia	56.6	43.4	18.2	81.8	10.2	89.8	0	100	0	100	12.7	87.3
Costa Rica	100	0	85.9	14.1	94.6	5.4	100	0	..	..	92.4	7.6
Dominican Rep.	100	0	100	0	91.1	8.9	92.4	7.6	..	..	94.5	5.5
Ecuador	100	0	100	0	100	0	56.4	43.6	..	..	82.7	17.3
El Salvador	100	0	100	0	10	0	75	25	..	..	97.2	2.8
Guatemala	100	0	84.5	15.5	94.3	5.7	0	100	..	..	74.4	25.6
Guyana	-	-	-	-	100	0	-	-	..	..	*	*
Honduras	84.9	15.1	100	0	86.6	13.4	100	0	..	..	93	7
Jamaica	0	100	0	100	0	100	0	100	..	..	0	100
Mexico	99.2	0.8	100	0	86.1	13.9	65.1	34.9	80	20	81.3	18.7
Nicaragua	-	-	71.7	28.3	54.7	45.3	80	20	..	..	68.9	31.1
Panama	100	0	100	0	18.8	81.2	100	0	..	..	64.4	35.6
Paraguay	85.6	14.4	100	0	95.8	4.2	100	0	..	..	95.4	4.6
Peru	100	0	100	0	99.2	0.8	100	0	0	100	71.9	28.1
Uruguay	78.2	21.8	59.7	40.3	73.2	26.8	66	34	..	..	69.2	30.8
Venezuela	100	0	91.4	8.6	75.2	24.8	50	50	..	..	70.1	29.9
LAC	64.3	35.7	83.3	16.7	67.3	32.7	44.3	55.7	17.4	82.6	59.4	40.6

FSource: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 - 50,000 inhabitants; Medium: 50,001 - 300,000 inhabitants; Large: 300,001 - 5,000,000 inhabitants; Mega > 5,000,000 inhabitants  
 - Information not available

\*No population of this size

\*Not enough data to calculate the aggregated variable at country level



In terms of trash collection, EVAL 2010 found that direct municipal service is the most common method of delivery in the region, with 50.6% of the population receiving this service in this fashion. Contracted trash collection services also cover a high percentage of the population (45.4%). The other options, coopera-

tives and national government, do not register significant percentages (3.3% and 0.6%, respectively). Table 11 shows the percentage of the population covered in the different countries of the region by type of delivery method for trash collection services.

TABLE 11: DELIVERY METHOD FOR TRASH COLLECTION SERVICE  
(% OF POPULATION COVERED)

COUNTRY	OTHER DELIVERY METHODS				TOTAL FOR OTHER METHODS OF DELIVERY
	DIRECT MUNICIPAL SERVICE	CONTRACTED SERVICE	COOPERATIVES	OTHER PUBLIC INSTITUTIONS	
Argentina	45.6	54.3	0.1	0	54.4
Belize	35.9	64.1	0	0	64.1
Bolivia	53.7	37.9	8.4	0	46.3
Brazil	41.9	54.3	1.3	0	58.1
Chile	18.8	81.2	0	0	81.2
Colombia	30.6	69.0	0.4	0	69.4
Costa Rica	72.3	27.7	0	0	27.7
Dominican Rep.	77.2	22.8	0	0	22.8
Ecuador	79.9	19.9	0.2	0	21.1
El Salvador	79.4	20.6	0	0	20.6
Guatemala	55.6	25.2	19.2	0	44.4
Guyana	-	100	-	-	100
Honduras	35.5	64.5	0	0	64.5
Jamaica	0	0	0	100	100
Mexico	66.5	25.3	8.2	0	33.5
Nicaragua	73.7	22.1	4.2		26.3
Panama	52.4	47.6	0	0	47.6
Paraguay	59.0	41.0	0	0	41.0
Peru	66.1	33.9	0	0	33.9
Uruguay	78.3	21.2	0.5	0	21.7
Venezuela	59.9	24.1	12.0	4.0	40.1
LAC	50.6	45.4	3.3	0.6	49.4

Source: EVAL 2010 software.  
- Information not available

Looking more closely at the data for individual countries, it is clear that Chile is the country in the region with the highest percentage of the population covered by contracted services (81.2%), followed by Colombia (69.4%). On the other end of the spectrum, Ecuador, El Salvador, Uruguay, Nicaragua, the Dominican Republic, and Costa Rica show the highest percentages for direct municipal service as the preferred method for trash collection, at more than 70% each. The role of cooperatives in providing this service is significant in the countries of Guatemala, Venezuela, Bolivia, and

Mexico, while other public institutions stand out in Jamaica, where 100% of the trash collection service in that country is provided by a public company run by the national government.

In terms of final disposal, the indicators on the population covered by the different delivery methods show that 52.8% are covered by direct municipal service, 40.8% by private companies, 0.4% by cooperatives, and 6% by other public institutions. See Table 12 for the data obtained.

TABLE 12: DELIVERY METHOD FOR FINAL DISPOSAL  
(% OF POPULATION COVERED)

COUNTRY	OTHER DELIVERY METHODS				TOTAL FOR OTHER METHODS OF DELIVERY
	DIRECT MUNICIPAL SERVICE	CONTRACTED SERVICE	COOPERATIVES	OTHER PUBLIC INSTITUTIONS	
Argentina	45.2	24.1	0	30.7	54.8
Belize	46.4	45.5	8	0	53.5
Bolivia	70.8	29.2	0	0	29.2
Brazil	50.3	49.3	0.4	0	49.7
Chile	17.1	82.9	0	0	82.9
Colombia	17.3	82.4	0.3	0	82.7
Costa Rica	32.5	67.5	0	0	67.5
Dominican Rep.	90	10	0	0	10
Ecuador	74.8	25.2	0	0	25.2
El Salvador	8.1	91.1	0.8	0	91.9
Guatemala	80.8	1	0	18.2	19.2
Guyana	-	100	-	-	100
Honduras	72.9	27.1	0	0	27.1
Jamaica	0	0	0	100	100
Mexico	65.7	22.3	0.3	11.7	34.3
Nicaragua	63	36.4	0.6	0	37
Panama	37.9	62.1	0	0	62.1
Paraguay	48.5	51.5	0	0	51.5
Peru	67.4	32.6	0	0	32.6
Uruguay	96.2	3.8	0	0	3.8
Venezuela	66.1	22.1	2.5	9.4	34
LAC	52.8	40.8	0.4	6	47.2

Source: EVAL 2010 software.  
- Information not available

El Salvador, Colombia, and Chile are the countries that most rely on privately contracted services for final trash disposal. Other countries, including Costa Rica, Panama, Jamaica, and Paraguay, employ alternatives other than direct municipal service to provide this service to more than 50% of the population.

The tables included in this section show that the population coverage percentage of the direct municipal service delivery method varies in accordance not only with population size, but also with the type of service being provided. For instance, private companies, given their equipment and machine maintenance programs and their specialized knowledge, among other things, may be better able to guarantee frequent trash collection and continuity of operations at sanitary landfills. On the other hand, it is not as evident what value-added service private contracting can provide in the area of street sweeping, especially considering that it is predominantly manual labor and, therefore, does not pose operational challenges for municipal governments, although it would increase the payroll.

In general, private involvement has been acquiring increasing relevance in the region, where contract lengths vary from between five to seven years for trash collection and transportation, and 20 years for final disposal, considering the useful life of investments. In Mexico, one of the problems that could impair this delivery method is the possibility of contract revisions. Despite having entered into a contractual agreement, there are no legal mechanisms to maintain the contract terms in the case of a change in municipal authority; this situation poses grave problems for a private contractor that must continue operations while forgoing payment until the situation is resolved. For this reason, the Association of Waste Management Contractors was created for the purpose of protecting the interests of its members in Mexico.

Other delivery methods that have shown a marked increase in LAC involve private micro-enterprises, cooperatives, and NGOs that provide street sweeping, trash collection, and SW transportation. This is a more economical alternative for municipalities and cleaning companies run by municipalities. These methods offer several advantages including: the intensive use of manual labor; the use of low-cost technologies that use animal, human, and mechanical (tricycles) power; the promotion of a greater level of community participation to facilitate collection and sorting-at-the-source operations; and the creation of manual labor employment opportunities in the same community that receives the service. Although delivery by these methods is still minimal (only 3.3% coverage in collection), it has grown considerably in large cities (7.8%). This is due in large part to the difficulty that municipalities and the companies responsible for SW management have in accessing peripheral and marginalized neighborhoods with conventional trash collection vehicles; for this reason, there is an increase in the use of cooperatives formed by the neighborhood to provide this service.

The contributions made by small- and micro-enterprises to environmental management and labor creation are significant. They provide services that include: the sweeping and cleaning of streets and commercial avenues; the collection and transportation of solid waste, especially in areas that lack urban planning and are difficult to access; the final disposal of waste; the maintenance of public parks and gardens; and recycling. In the case of recycling, micro-enterprises tend to operate independently of municipalities, whereas in other areas, they typically work for and in coordination with the municipal government. A special case exists in Venezuela, where the national government, through the Ministry of Community Action for the Environment (MPPA), established the contracting of cooperatives to provide services for small- and medium-sized municipalities

## MUNICIPAL HUMAN RESOURCES AND CONTRACT EMPLOYEES

OIn LAC, there are 21.7 workers dedicated to SW management per 10,000 inhabitants. These human resources are mainly engaged as follows: manual street sweeping (5.56), trash collection (4.69), and special services (3.1)<sup>28</sup> Final disposal services do not require a large number of employees (1.54). Depending on the type of service, there is a tendency for the municipalities to either dedicate their own personnel to the task (trash collection, administration, maintenance, and manual and

mechanized street sweeping) or to contract employees that do not work for the municipal plant or for a municipal company (treatment and transfer)<sup>29</sup> In the cases of special services and final disposal, there is no tendency in favor of one over the other. Overall, of the 21.7 municipal employees per 10,000 inhabitants involved in SW management, 12.1 are municipal employees and 9.6 are contract employees. See Figure 13 for a detailed breakdown of municipal versus contract employee per service type:

FIGURE 13: A COMPARISON OF MUNICIPAL EMPLOYEES TO CONTRACT EMPLOYEES IN THE SW MANAGEMENT SECTOR IN LAC (PER 10,000 INHAB.)



Source: Based on information generated with EVAL 2010 software.

<sup>28</sup> Special services encompass the collection of debris and landscape waste, beach cleaning, maintenance of public parks and gardens, and the washing of streets and public plazas, among others.

<sup>29</sup> Generally, contract employees are people who are waste pickers or who later become municipal employees. It does not include the employees of private companies or co-operatives contracted by municipalities or municipal companies.

The municipal human resource estimates included in Figure 13 are based on the information gathered for each LAC country. The per-country detailed information on municipal personnel involved in SW management is presented in Table 13.

TABLE 13: MUNICIPAL HUMAN RESOURCES INVOLVED IN SW MANAGEMENT BY SERVICE TYPE (PER 10,000 INHAB.)

COUNTRY	MSS	MecSS	TC	TRS	TRT	FD	MAN	SPS	ADM	OVER-ALL
Argentina	5.84	0.58	5.85	0.58	2.51	1.91	0.84	2.39	0.66	21.15
Belize	-	-	8.60	-	-	-	-	11.87	1.20	21.67
Bolivia	4.08	-	1.91	-	-	0.52	-	0.15	0.59	7.25
Brazil	7.48	0.51	5.56	2.54	2.08	1.90	0.78	5.80	1.77	28.42
Chile	2.78	0.10	2.42	-	-	0.93	-	1.62	0.97	8.82
Colombia	3.97	-	4.18	-	12.91	3.26	2.03	1.49	2.04	29.88
Costa Rica	2.83	-	2.81	-	-	2.24	-	0.45	0.71	9.04
Dominican Rep.	17.61	-	7.63	0.24	0.79	0.46	-	2.53	2.01	31.27
Ecuador	2.64	-	3.23	-	-	0.36	-	0.58	0.70	7.51
El Salvador	8.26	-	7.41	1.12	-	0.96	-	2.07	1.70	21.52
Guatemala	1.55	-	2.68	-	0.89	0.30	1.01	0.38	0.30	7.11
Guyana	-	-	-	-	-	-	-	-	-	-
Honduras	7.81	-	5.07	-	-	1.68	-	4.31	4.10	22.97
Jamaica	-	-	-	-	-	2.05	-	-	1.30	3.35
Mexico	4.30	0.09	4.52	0.39	0.77	1.13	0.82	1.61	0.99	14.61
Nicaragua	1.30	-	1.98	2.18	1.67	2.29	-	-	2.63	12.05
Panama	6.37	-	5.40	-	0.43	2.35	2.43	2.96	1.78	21.71
Paraguay	3.17	-	2.88	-	0.64	2.07	-	2.31	0.98	12.06
Peru	2.21	-	1.17	0.07	0.57	0.28	-	0.32	0.26	4.89
Uruguay	4.69	-	6.38	-	0.80	1.64	1.31	2.99	1.82	19.62
Venezuela	4.74	-	4.98	-	-	0.48	-	1.73	0.53	12.46
LAC	5.56	0.37	4.69	1.48	2.69	1.54	0.96	3.10	1.33	21.72

Source: EVAL 2010 software.

MSS: Manual Street Sweeping; MecSS: Mechanized Street Sweeping; TC: Trash Collection; TRS: Transfer; TRT: Treatment; FD: Final Disposal; MAN: Maintenance; SPS: Special Services; ADM: Administrative Personnel  
- Information not available

The countries with the greatest number of SW management employees per 10,000 inhabitants are, from highest to lowest, the Dominican Republic, Colombia, and Brazil, with close to 30 employees per 10,000 inhabitants. Several countries have close to 20 SW employees per 10,000 inhabitants: Uruguay, Panama, Honduras, El Salvador, Belize, and Argentina. Peru is on the other end of the spectrum, with the services where data is available all ranking among the lowest three; Guatemala is in a similar condition except for its trash collection and treatment services. Not counting Jamaica, where little information is available, Peru is the country with the lowest number of SW management employees (mu-

nicipal and contract) per 10,000 inhabitants (4.89) in the entire region; Guatemala has the next lowest, with 7.11 employees per 10,000 inhabitants.

A situation that is often observed in the majority of LAC countries is that personnel from one particular area of service sometimes also perform tasks in other areas, even if temporarily. This is especially the case for special services.

Table 14 shows detailed information on the human resources in the SW management sector for each country that participated in EVAL 2010, including totals for municipal and contract employees.



Photo: Eng. Pilar Tello (courtesy)



TABLE 14: MUNICIPAL AND CONTRACT SW MANAGEMENT EMPLOYEES PER 10,000 INHABITANTS

COUNTRY	MANUAL SWEEPING		MECH. SWEEPING		TRASH COLLECTION		TRANSFER		TREATMENT		FINAL DISPOSAL		MAINTENANCE		SPECIAL SERVICES		ADMINISTRATIVE		TOTALS	
	ME	CE	ME	CE	ME	CE	ME	CE	ME	CE	ME	CE	ME	CE	ME	CE	ME	CE	ME	CE
Argentina	3.01	2.82	0.48	0.10	3.32	2.53	0.28	0.30	1.72	0.79	1.35	0.56	0.49	0.35	1.87	0.52	0.52	0.14	13.04	8.12
Belize	-	-	-	-	5.29	3.30	-	-	-	-	-	-	-	-	8.56	3.30	0.76	0.44	14.62	7.05
Bolivia	1.75	2.32	-	-	1.39	0.53	-	-	-	-	0.31	0.21	-	-	0.13	0.02	0.47	0.12	4.05	3.20
Brazil	4.44	3.04	0.42	0.09	3.12	2.44	0.16	2.38	1.15	0.93	0.71	1.19	0.73	0.04	2.61	3.19	1.50	0.27	14.85	13.57
Chile	0.76	2.02	0.02	0.08	0.31	2.11	-	-	-	-	0.17	0.76	-	-	0.34	1.27	0.19	0.78	1.79	7.03
Colombia	1.11	2.86	-	-	2.02	2.16	-	-	3.23	9.68	0.70	2.56	0.00	2.03	0.04	1.45	0.67	1.37	7.76	22.12
Costa Rica	2.54	0.30	-	-	2.07	0.74	-	-	-	-	0.25	1.99	-	-	0.30	0.15	0.62	0.09	5.78	3.26
Dom. Rep.	17.61	0.00	-	-	7.12	0.51	0.17	0.07	0.79	0.00	0.46	0.00	-	-	2.53	0.00	2.01	0.00	30.69	0.58
Ecuador	2.17	0.48	-	-	2.35	0.88	-	-	-	-	0.34	0.02	-	-	0.44	0.14	0.67	0.03	5.97	1.54
El Salvador	6.49	1.77	-	-	6.26	1.15	1.06	0.06	-	-	0.96	0.00	-	-	1.97	0.10	1.70	0.00	18.44	3.08
Guatemala	1.43	0.12	-	-	1.45	1.23	-	-	0.33	0.57	0.22	0.07	1.01	0.00	0.38	0.00	0.28	0.03	5.09	2.02
Guyana	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Honduras	6.40	1.40	-	-	2.40	2.66	-	-	-	-	1.33	0.36	-	-	4.29	0.02	4.02	0.09	18.44	4.53
Jamaica	-	-	-	-	-	-	-	-	-	-	2.05	0.00	-	-	-	-	1.30	0.00	3.35	0.00
Mexico	4.07	0.23	0.07	0.03	2.82	1.71	0.30	0.09	0.21	0.56	1.04	0.09	0.65	0.17	1.49	0.11	0.97	0.02	11.62	2.99
Nicaragua	1.13	0.17	-	-	1.44	0.55	1.73	0.45	0.76	0.91	1.84	0.46	-	-	-	-	2.35	0.28	9.23	2.82
Panama	6.36	0.01	-	-	5.07	0.32	-	-	0.03	0.39	2.23	0.12	2.43	0.00	2.93	0.04	1.71	0.07	20.76	0.95
Paraguay	2.60	0.57	-	-	2.37	0.51	-	-	0.60	0.04	0.84	1.23	-	-	1.50	0.82	0.98	0.00	8.90	3.17
Peru	1.83	0.37	-	-	1.06	0.11	0.06	0.01	0.23	0.34	0.22	0.06	-	-	0.28	0.04	0.22	0.04	3.91	0.98
Uruguay	1.60	3.08	-	-	5.1	1.26	-	-	0.56	0.24	1.29	0.35	0.95	0.36	2.32	0.67	1.67	0.15	13.52	6.11
Venezuela	2.45	2.28	-	-	2.84	2.13	-	-	-	-	0.44	0.04	-	-	0.63	1.10	0.50	0.03	6.87	5.59
LAC	3.66	1.9	0.3	0.07	2.78	1.91	0.24	1.24	1.07	1.62	0.77	0.77	0.63	0.33	1.64	1.46	1.07	0.26	12.16	9.56

Source: EVAL 2010 software.

- Information not available

ME: Municipal Employees; CE: Contract Employees

## FINANCIAL SUSTAINABILITY AND FINANCIAL-ECONOMIC FACTORS

There is widespread recognition in LAC society of the importance of environmental sustainability with respect to SW management. This is especially true in the strict sense of the term, referring to the environment itself, although awareness is increasing as to the term's wider implications, including those in the social sphere. Nonetheless, for diverse reasons, another important notion that should be incorporated in the delivery of SW management services is often overlooked: financial sustainability.

Independently of the method chosen to deliver services, there is a simple equation that should be adhered to in order to guarantee the financial sustainability of services: income received by the service provider should at least cover costs. In a professional operational framework, governments should regulate the fees and rates that are applied for the sector in accordance with: a predetermined quality of service, the population's ability to pay, and consideration of present and projected investment, keeping in mind the earnings and operational costs of the service provider and, in the case of contractors, the fair price. If necessary, regulations should also consider establishing a progressive subsidy structure.

One of the serious problems affecting financial sustainability of services in the SW management sector in LAC is the lack of information on income and costs. Resources are generally deposited in a common municipal fund and are used according to what the administration considers a priority. This makes it difficult to establish a budget for the SW management sector that is directly related to its income sources, resulting in these monies being used for other purposes.

In this way, the budget for the sector is generally part of a broader budget that includes items such as environmental cleanup, which is primarily focused on potable water and sewage. Consequently, emergency situations or decisions related with other services consume the estimated urban cleaning budget. In cases where a budget is allocated specifically for the sector, it is done in a global

fashion for household and urban cleaning, without a breakdown for sweeping, trash collection, transportation, and final disposal. Given these inconveniences, it is not common practice to track SW management costs (even less so for the costs per service type) nor the end use of the financial resources it generates.

With respect to identifying resources, it is worth taking a look at Peru, where the General Law on Solid Waste establishes that monies generated by SW management should be deposited in a special account that can only be used for municipal SW management. This is a significant advance that serves as an example of the measures that can be taken to gradually achieve financial sustainability of services.

### Unit Costs for Service

Unit cost indicators are useful for the purposes of determining budgets that ensure the financial, environmental, and social sustainability of SW services in a regulatory structure with both fees and subsidies. These indicators make it possible to establish systems to compare competencies, which, in addition to being part of the regulatory structure, can serve to motivate providers to improve their services. Additionally, cost accountability is a fundamental element to ensure efficiency and detect irregularities. Finally, the establishment of unit costs is fundamental to the bidding process, because unit costs make it possible to compare offers that are structured differently.

## RECORDING AND COMMUNICATING UNIT COSTS IN BELO HORIZONTE, BRAZIL

The Urban Cleaning Superintendency of Belo Horizonte, Brazil, provides a good example of unit cost recording and reporting, as well as the importance of routine communication with the community. Every year, the Superintendency prepares separate reports on activities, finances, and costs.

These reports are sent to city hall and released publicly. Additionally, the Superintendency uses this information for monitoring, evaluating, and long-term planning purposes. Comparative unit costs of activities for services provided by the municipality, as well as private contractors, are reported every year, making it possible to identify trends. Similarly, the unit costs of trash collection, street sweeping, composting, and recycling are calculated per trimester. (UN-Habitat 2010)

In LAC, there is a general lack of essential financial information for service planning and administration. Few countries have accounting, budgeting, and information management systems at the municipal level to allow for adequate cost analysis. As a result, it is difficult to determine the most efficient average cost, implement subsidies and fees that are fair to users, and monitor and detect any irregularities in service operations.

The major obstacles to achieving self-sustaining services are insufficient cost recovery and the lack of management based on an adequate cost accounting system. It is especially important to improve cost accounting, budgeting, and information management systems, as well as introduce better cost recovery systems. Total cost accounting systems should have sufficient detailed information to correctly measure operational and maintenance costs, billing effectiveness, the administration of contracts (if applicable), debt, and depreciation, as well as distinguish between residential, commercial, and industrial SW management services. Additionally, information management systems are also necessary to develop appropriate indicators to measure the efficiency of SW management services.

Without a doubt, the failure to identify budget and financial expenditures for services provided during the different stages of SW management leads to the scarcity of available information on accounting and financial aspects of the SW management services. EVAL 2010 was unable to gather unit cost information for any of the municipalities in Belize, Guyana, Jamaica, the Dominican Republic, Nicaragua, Panama, and Venezuela.

On the other hand, the case of El Salvador is noteworthy. The unit cost of final disposal services in most of these municipalities is available for the past three years. This is due, in large part, to the widespread use of contracted services for this stage of SW management (in general, the only actors that identify costs are private contractors). In any case, it is still difficult to calculate the unit cost statistic, given the lack of uniformity and adaptability of the accounting systems for each stage of SW management.

As previously mentioned, in the special case of Colombia, the unit costs presented in Table 15 (which shows unit costs for each LAC country and the region overall) correspond to the cost ceilings stipulated in CRA Reso-



Photo: CEAMSE (courtesy)

lution No. 351 of 2005, updated to reflect December 2009 costs in each municipality. These costs are used to calculate fees according to market size, and vary according to the efficiency of the provider at each stage of SW management.

It should be noted that a distinction is not made in terms of quality of service and technologies used for the SW management services of street sweeping, trash collection, transfer, and final disposal. For this reason, the unit cost of final disposal includes, depending on the country, varying proportions of the costs associated with sanitary landfills and controlled garbage dumps.

Table 15 shows the unit costs for each LAC country that participated in EVAL 2010. In general, given its large population, the overall regional values are strongly biased toward the high values presented by Brazil, which, in turn, were affected by the appreciation of the Brazilian real in recent years. LAC unit costs rose to US\$24.89 per kilometer swept, US\$34.22 per ton collected, US\$12.01 per ton transferred, and US\$20.43 per ton for final disposal. Therefore, the total cost per ton for collection, transfer, and final disposal is US\$66.66.

TABLE 15: UNIT COST FOR SOLID WASTE MANAGEMENT SERVICES IN LAC

COUNTRY	SWEEPING (US\$/KM) <sup>30</sup>	COLLEC- TION (US\$/ TON)	TRANSFER (US\$/TON)	FINAL DISPOSAL (US\$/TON)	SUBTOTAL, COLLECTED AND DIS- POSED (US\$/TON)
Argentina	38.93	54.02	15.09	17.63	86.74
Belize	-	-	-	-	-
Bolivia	5.25	15.27	-	7.89	23.16
Brazil	28.05	42.46	-	31.48	73.93
Chile	31.68	23.34	4.63	11.43	39.40
Colombia (a)	9.41	34.12	-	23.31	57.43
Costa Rica	-	22.65	-	18.81	41.47
Dominican Rep.	-	-	-	-	-
Ecuador	-	30.05	-	5.61	35.66
El Salvador	-	30.42	-	21.02	51.45
Guatemala	9.94	10.84	-	-	10.84
Guyana	-	-	-	-	-
Honduras	6.62	20.81	-	8.16	28.97
Jamaica	-	-	-	-	-
Mexico (b)	-	26.39	-	10.56	36.94
Nicaragua	-	-	-	-	-
Panama	-	-	-	-	-
Paraguay	4.92	6.59	-	5.88	12.47
Peru	26.35	15.02	-	5.98	21.01
Uruguay	16.73	47.85	-	9.19	57.04
Venezuela	-	-	-	-	-
LAC	24.89	34.22	12.01	20.43	66.66

Source: EVAL 2010 software.

- Information not available

\*Not enough data to calculate aggregated variable at country level

(a) In Colombia, unit costs correspond to cost ceilings that are adapted to the different municipalities.

In the case of final disposal, treatment costs are also included.

(b) Due to lack of financial information available in Mexico, sample data was supplemented with information gathered from other municipalities in the country.

<sup>30</sup> Units correspond to the same period of time. In the case of sweeping, monthly costs were divided by kilometers swept during that month.



The unit cost of street sweeping services in LAC ranges from US\$5 per km to US\$6 per km in Paraguay, Bolivia, and Honduras, and from US\$30 per km to US\$40 per km in Chile, Brazil, and Argentina. This indicator is also high in Peru, where a small percentage of the street sweeping in the capital is done mechanically, and this may be the reason for the high value calculated for this city. It should be noted that the chosen unit of measurement is justified by the need to unify measurements in LAC and make it possible to compare indicators across countries. This is relevant to the estimation used for street sweeping costs; in different countries, some municipalities use a special collection vehicle that allows them to measure unit cost according to \$/ton as they provide the service, but this is not possible for other municipalities where the trash swept is left by the side of the road to be picked up by the same vehicles that collect household SW.

Unit costs for collection services also varied greatly, with Paraguay on the low end (US\$6.60/ton) and Argentina on the high end (US\$54.02/ton). Only Argentina, Uruguay, and Brazil were above the LAC indicator for this service, with the latter influencing the regional indicator. Even so, Colombia, Ecuador, and El Salvador had indicators close to the regional value.

The low values for Costa Rica and Chile (both close to US\$23/ton) deserve special attention, considering that both countries use relatively sophisticated collection equipment (these countries have the highest percentage of collection vehicles with compactors by a wide margin, at above 93% in both cases). One would expect, therefore, to see a high collection unit cost. However, this appears to be countered by the low indicator

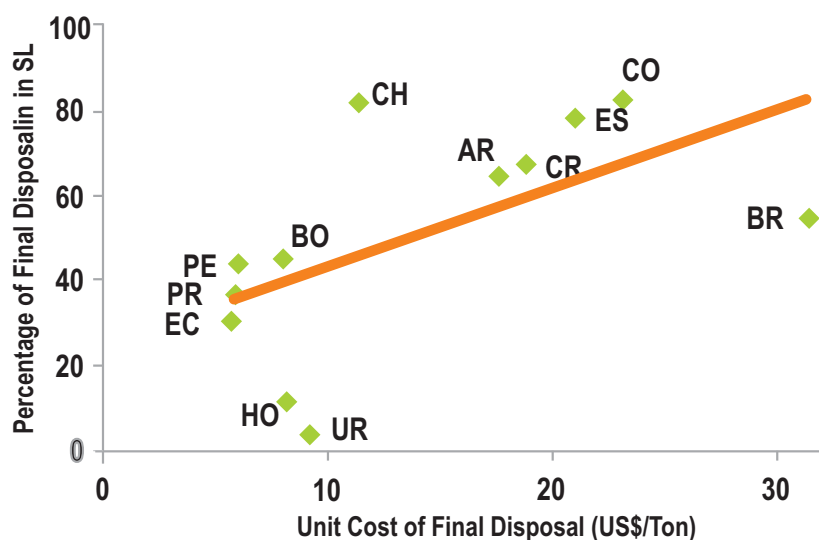
on fleet size (among the lowest values in LAC in terms of collection vehicles per 10,000 inhabitants), the fact that the vehicles are fairly new, and the low frequency of daily collection, which are factors that reduce the operational costs of collection while increasing its efficiency in both countries. In Argentina, on the other hand, daily collection service is provided to more than 70% of the population, which requires the greater use of vehicles that are halfway through their useful life. These factors decidedly contribute to Argentina having the highest unit cost for collection in LAC.

The widely dispersed results for the unit cost indicator for final disposal indicate little homogeneity in the region. While one group of countries has values close to or less than US\$10/ton (Ecuador, Paraguay, Peru, Uruguay, Honduras, Bolivia, Mexico, and Chile), a second group has values close to US\$20/ton (Argentina, Costa Rica, and El Salvador), and then there is Brazil at just over US\$30/ton. The case of El Salvador stands out; it presents a high value that is likely the result of the strong pressure on municipalities to implement adequate final disposal solutions resulting from the passage of a national decree prohibiting the use of dumpsites by 2007. The case of Chile deserves further research; it attained a level of final disposal in sanitary landfills of 80% at a cost of US\$11.40/ton, which speaks of the efficiency achieved by this country in this area.

Perhaps with the exception of this last case, there is a strong general correlation between the unit cost and adequate final disposal, as can be seen in Figure 14, which examines the relationship between the unit cost of final disposal and the percentage of municipalities that use sanitary landfills in each country.



FIGURE 14: RELATIONSHIP BETWEEN UNIT COST FOR FINAL DISPOSAL AND PERCENTAGE OF MUNICIPALITIES WITH SANITARY LANDFILLS



Source: EVAL 2010 software

When comparing unit cost indicators from EVAL 2002 to those of EVAL 2010, an increase can be observed in unit costs for all stages of SW management with the exception of transference. This increase can be attributed mainly to the increase in the use of more complex technology and to increases in the costs of fuel, labor, and other items. Further, the values in EVAL 2010 were

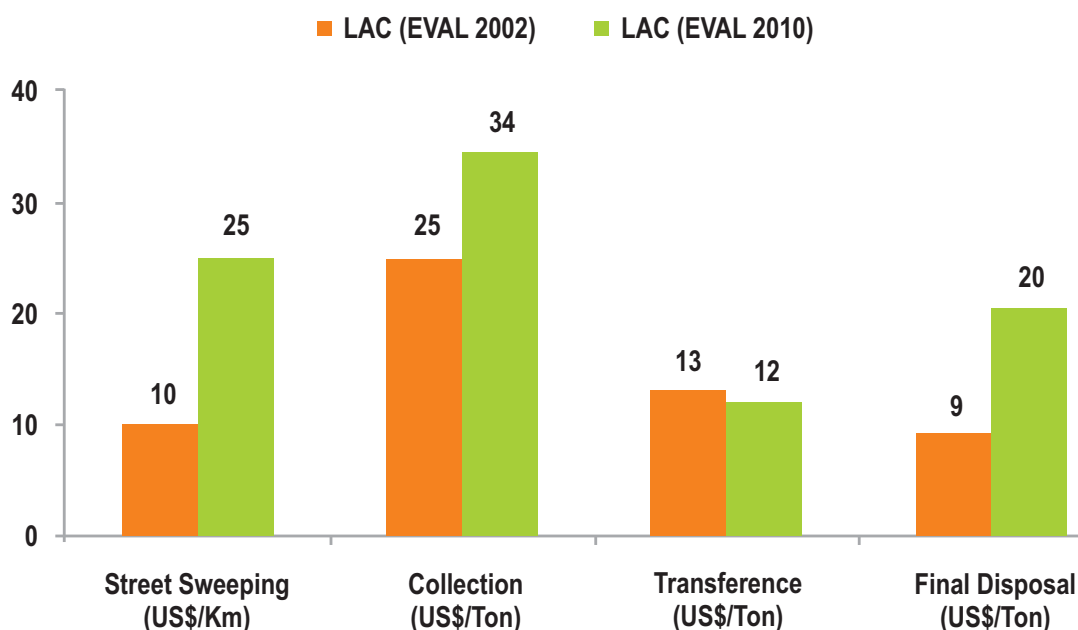
driven in part by the high costs presented by Brazil, with its large population size, which did not provide unit cost data for EVAL 2002. Other no-less influential factors include the general appreciation of regional currencies with respect to the dollar during this period<sup>31</sup>. Figure 15 shows unit cost comparisons between EVAL 2002 and EVAL 2010.

Photo: Eng. Pilar Tello (courtesy)



<sup>31</sup> While the Argentine and Mexican pesos have maintained their exchange rates with respect to the dollar close to 2002 levels, the Colombian and Chilean peso, and the Brazilian real have appreciated considerably during this period (especially the real).

FIGURE 15: COMPARISON OF EVAL 2002 AND EVAL 2010 UNIT COST INDICATORS FOR LAC



Source: EVAL 2010 software

### Invoicing: Amounts and Forms of Payment

In LAC, the amounts invoiced for SW management services do not generally reflect the costs of the service provider. However, not all of the region's municipalities allow us to confirm or discredit this statement. A significant percentage of them, especially the smaller municipalities, do not bill for services, or, better said, do not invoice for them. In these cases, the cost for services is covered by other municipal income, generally property taxes.

EVAL 2010 collected data in this respect that allowed for the creation of two indicators: percent of municipalities that invoice for services and percentage of the population invoiced by them<sup>32</sup>. This exercise revealed that only 64.9% of municipalities bill for providing services, which means 35.1% do not; this undoubtedly has a great impact on their financial sustainability. As previously mentioned, the percentage of municipalities that do not bill for services decreases as population

<sup>32</sup> This indicator takes into consideration the total population living in municipalities that invoice for services. It does not make a distinction for the possible existence of clandestine users.

size increases, and, for this reason, the indicator on the population billed for services (76.2%) in LAC is greater than the indicator of municipalities that invoice.

Clearly, Brazil is the country that most influenced these indicators at the regional level. Only 50% of municipalities in Brazil bill for services. This figure is among the lowest in LAC, together with Guatemala (37.9%) and Bolivia (39.7%), and is similar to the EVAL 2002 results, where the indicator stood at 46% of municipalities. The only countries where 100% of municipalities billed for services were Costa Rica and Uruguay.

It is worth mentioning Mexico's management of solid waste, which, as is characteristic of the region, lacks information on earnings. There is no official record of invoicing by municipal authorities and service providers, but there is a tacit rate that the population has decided on and that is paid in the form of a tip to the collection vehicle personnel, which in many cases is greater than the official rate would be. This method of payment does not contribute to the sustainability of services because these unofficial funds cannot be invested to improve services.

Table16 shows detailed country information on the percentage of municipalities that invoice SW management services and the percentage of the population that is billed for services.



TABLE 16: PERCENTAGE OF MUNICIPALITIES THAT INVOICE FOR SW SERVICES AND PERCENTAGE OF POPULATION BILLED IN LAC

COUNTRY	MICRO		SMALL		MEDIUM		LARGE		MEGA		OVERALL	
	MUNICIPALITIES	POPULATION	MUNICIPALITIES	POPULATION	MUNICIPALITIES	POPULATION	MUNICIPALITIES	POPULATION	MUNICIPALITIES	POPULATION	MUNICIPALITIES	POPULATION
Argentina	77.7	78.3	100	100	100	100	100	100	...	...	92	99.1
Belize	100	100	-	-	-	-	-	-	...	...	-	-
Bolivia	18.3	20.4	33.3	35.2	61.8	63.6	100	100	...	...	39.7	72
Brazil	57.5	53.1	30.3	30.6	56	58	64.5	66.2	100	100	50	57.7
Chile	53.2	56	100	100	100	100	66.7	66.7	...	...	78.2	93.5
Colombia	83.8	79.8	100	100	43.3	43.4	100	100	100	100	85.9	85.5
Costa Rica	100	100	100	100	100	100	100	100	...	...	100	100
Dom. Rep.	91.4	92.1	48.4	48	100	100	100	100	...	...	80.2	88.1
Ecuador	90.9	90.5	85.1	83.8	100	100	100	100	...	...	91	96.8
El Salvador	80.8	79.7	92	91.1	100	100	100	100	...	...	86.4	94.7
Guatemala	0	0	45.7	46.3	100	100	100	100	...	...	37.9	67.4
Guyana	-	-	-	-	100	100	-	-	...	...	*	*
Honduras	85.8	84.9	100	100	100	100	100	100	...	...	90.1	96.4
Jamaica	0	0	0	0	0	0	0	0	0	0	0	0
Mexico	-	-	-	-	-	-	-	-	-	-	*	*
Nicaragua	-	-	96.1	95.9	100	100	100	100	...	...	96.8	98
Panama	82.5	79.6	89.6	89.4	83.3	89.1	100	100	...	...	85.1	90.8
Paraguay	80.9	80.7	100	100	100	100	100	100	...	...	88	96.2
Peru	46.9	45.4	80.3	80.3	100	100	100	100	100	100	89.2	98.2
Uruguay	100	100	100	100	100	100	100	100	...	...	100	100
Venezuela	68.4	66	100	100	95	95.9	100	100	...	...	92.8	97.3
LAC	54.9	53.3	62.9	63.5	76.7	78.4	82.6	82.7	100	100	60.6	76.1

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 - 50,000 inhabitants; Medium: 50,001 - 300,000 inhabitants; Large: 300,001 - 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available ...No population of this size \* Not enough data to calculate the aggregated variable at country level

TABLE 17: MONTHLY AMOUNTS INVOICED BY POPULATION SIZE IN LAC (US\$/MONTH)

Country	Micro		Small		Medium		Large		Mega		Overall	
	FRB	DRB	FRB	DRB	FRB	DRB	FRB	DRB	FRB	DRB	FRB	DRB
Argentina	4.95	-	5.95		5.44	13.34	4.34	-	..	..	5.45	*
Belize	2.5	-	-	-	-	-	-	-	..	..	*	*
Bolivia	1.14	-	0.62	-	2	1.39	-	2.48	..	..	1.56	2.04
Brazil	-	-	-	0.77	-	2.56	-	5.04	-	-	*	3.36
Chile	-	-	10.06	-	6	-	-	-	..	..	8.65	*
Colombia	2.99	-	3.23	3.23	5.45	-	5.82	-	7.9	-	5.74	*
Costa Rica	3.14	-	4.04	-	3.02	-	4.13	-	..	..	3.45	*
Dom. Rep.	-	1.48	0.81	1	-	3.61	-	5	..	..	*	3.57
Ecuador	1.75	-	2.26	-	6.96	2.8	-	-	..	..	5.97	*
El Salvador	1.5	-	1.53	-	3.84	-	7.66	-	..	..	3.34	*
Guatemala	-	-	3.8	3.57	2.69	3.52	4.12	-	..	..	3.46	3.55
Guyana	-	-	-	-	-	-	-	-	..	..	-	-
Honduras	1.39	3.24	1.86	3.03	0.78	3.98	3	7.68	..	..	1.97	3.91
Jamaica	-	-	-	-	-	-	-	-	..	..	-	-
Mexico	-	-	-	-	-	-	-	-	-	-	-	-
Nicaragua	-	-	1.24	2.6	4.24	4.56	4	10	..	..	2.72	4.86
Panama	2.3	-	2	3.75	4.6	3.6	7.5	-	..	..	4.88	3.64
Paraguay	2.3	-	3.45	-	3.98	2.1	-	2.3	..	..	3.44	2.14
Peru	2.1	-	1.75	2.04	2.83	1.94	1.2	1.54	-	-	2.14	1.78
Uruguay	-	-	-	-	-	-	-	-	..	..	-	-
Venezuela	-	-	1.16	2.03	-	3.75	1.41	6.94	..	..	1.34	4.52
LAC	2.7	2.47	3.33	1.59	4.6	4.36	3.79	4.93	*	-	4.23	3.32

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 - 50,000 inhabitants; Medium: 50,001 - 300,000 inhabitants; Large: 300,001 - 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available .. No population of this size \* Not enough data to calculate the aggregated variable at country level  
FRB: Fixed Residential Billing; DRB: Differentiated Residential Billing



Com relação à Tabela 17, que apresenta os montantes de faturamento mensal da ALC extraídos do faturamento domiciliar fixo e diferenciado <sup>33</sup>, On average, the amount invoiced does not cover service costs. EVAL 2002 estimated that this was the case for 47% of LAC municipalities. Based on EVAL 2010 data on amounts invoiced, unit costs, SW generation, and service coverage, the cost recovery percentage rose to 51.6%, a slight increase though insufficient for financial sustainability of services. The regional average monthly fixed amount that should be invoiced to finance services is estimated at US\$8.19 per user, with other indicators *ceteris paribus*. Assuming universal coverage of collection, transfer,

and final disposal services, and using the reliable unit cost estimates of a country like Colombia, in accordance with the present quality of services (including final disposal in sanitary landfills), the amount increases to US\$11.60 per user per month.

In the City of Cuenca, Ecuador, the Municipal Public Urban Cleaning Company (EMAC–EP-) has, for almost a decade, been applying a fee structure that has allowed it to recover the investment and operational costs of services, becoming a model to be emulated throughout the region. See the box for more information.

## COST RECOVERY IN CUENCA, ECUADOR

The City of Cuenca, Ecuador, is located 450 km south of Quito with a population of approximately 630,000 inhabitants. In order to provide comprehensive biohazard and urban solid waste management services, the city created the Municipal Urban Cleaning Company (EMAC) in 1998, which became the Municipal Public Urban Cleaning Company (EMAC – EP-) in 2009, pursuant to Ecuador’s Organic Law of Public Companies.

EMAC –EP- provides services that include the street sweeping of 662 km daily, trash collection with 94% coverage, final disposal of an average of 300 tons per day in the sanitary landfill of Pichacay, recycling, composting and humus, maintenance of green spaces, management of debris, and collection of biohazardous waste. The company achieved ISO 9001, 14001, and OHSAS 18001 certifications and operates with administrative and financial autonomy, billing for its services through the electric utility bill. It is an environmentally efficient and socially accepted company that enjoys political support through coherent and applicable legislation.

The fee structure is regulated by an April 2001 municipal ordinance that establishes criteria for determining the fee for trash collection and public cleaning, and how it will be collected, with amendments to its manner of collection in August 2001 and a general reform in 2003. First, a fixed overall monthly charge is calculated and used to determine the fees for all users, taking into consideration the associated costs of acquiring equipment, developing infrastructure, and servicing debt, if any.

<sup>33</sup> In LAC, fees are generally either fixed (applied equally to all properties in the municipality) or differentiated (scaled according to the characteristics of different properties) and payment is to be made for the effective or potential use of SW management services, independent of the level of use.



Later, in the case of the common waste generators (residential, commercial, industrial, and public entities), the monthly operational cost (OC, unit cost per ton of waste generated by user) is calculated and then the formula for common generators is applied:  $TSG = (OC * Fr + CF * Fi) * Ks$ , where Fr is the operational cost adjustment factor, Fi the interest adjustment factor, and Ks is the subsidy factor. Fr accounts for variations in manual labor, equipment, replacement parts, and fuel costs, among others. Fi takes into consideration variations in interest, while Ks is estimated differently for residential, commercial (including public entities), and industrial (excepting generators of special waste) categories; for all categories, the user's energy consumption is taken into consideration.

In the case of the generators of special waste, the fee is calculated substituting OC in the formula for the product of the unit cost, the number of containers picked up per month, and the average volume and weight of each generator's waste. The fee for generators of hazardous waste is calculated by substituting OC in the formula with the product of the collection cost unit established via contract and the weight of the hazardous waste picked up each month; further, Ks is substituted by a factor that reflects the hazardousness of the waste being handled.

The fee structure applied in Cuenca, Ecuador, makes EMAC—EP- one of the few SW service providers in LAC that is able to recover its investment and operational costs, incurred in its provision of solid waste management services, thus fairly achieving financial sustainability for the services provided.

Given the absence of a regulator at the national or state/provincial level, municipal authorities are generally the ones to establish rates and fees, as well as criteria for the application of subsidies in the municipality. Nevertheless, the lack of up-to-date information on the cost structure for services and the population's capacity to pay leads to erroneous estimates, which results in the invoicing of inadequate amounts. This results in a lack of acceptance on the part of the population in two ways: firstly, when the new amounts established are disproportionate to ability to pay or secondly, in the lack of resources to make the necessary investments to improve services when they are inadequate; in the latter case, the population does not perceive any improvement in service quality resulting from the fee increase and are, therefore, reticent to accept new fee increases in the future.

A payment system should be established to receive the amounts invoiced. In this sense, the forms of payment for SW management services in LAC continue to vary greatly, although generally they can be catalogued as: property tax with or without a specific line item for

solid waste management services; included in electric or water and sewage bill; and a periodic bill sent directly to the user. Beyond the method for sending invoices and the payment system, the service providers should determine which users should be invoiced. One of the biggest problems in the region is the lack of invoice coverage, which is typically caused by the lack of an up-to-date cadaster of users.

In some countries of the region that invoice via property tax, the rate is established based on the cadastral value of the property and is not associated with the actual cost of providing the service. To be effective, this system requires an up-to-date cadaster, something that is lacking in the majority of municipalities. In a few large cities, rates are applied that are exclusively tied to street cleaning services. In small cities, the criteria used to establish rates are generally based on some type of cost factor adopted by the municipality that reflects historical data or the total amount needed to cover the estimated annual budget.

The use of a payment system through other public service providers, such as that of electric, water, and sewage services, with a structure already in existence that is time tested, makes economies of scale possible and increases the payment percentage, since consumers pay for various essential services simultaneously. Further, the possibility of shutting off service in response to the failure to pay is a feasible option with the other services, but not for SW management. Even though the experience of organizations in the region that participated in EVAL 2010 show that those municipalities that used the electric bill to obtain payment were more effective in receiving funds, few municipalities in the region have attempted to replicate this model.

Another invoicing option is to send a periodic bill for SW management services directly to the user. This last option may incur greater general administration costs (by 10% or 12% compared to 5% for the other options) due to the need to hire payment personnel and tends to be less effective because the population places a higher priority on the availability of electric and water services.

Table 18 lists the different forms of payment used in LAC and shows percentages for the municipalities that use each form and the population covered.



Photo: Christopher Jennings (courtesy)

TABLE 18: FORMS OF PAYMENT IN LAC

COUNTRIES	PROPERTY TAX		ELECTRIC BILL		POTABLE WATER AND SEWAGE BILL		DIRECT BILL TO USER	
	POPULATION	MUNICIPALITY	POPULATION	MUNICIPALITY	POPULATION	MUNICIPALITY	POPULATION	MUNICIPALITY
Argentina	68.2	65.6	3.9	5.9	0	0	27.9	28.5
Belize	100	100	0	0	0	0	0	0
Bolivia	0	0	95.6	78.8	0	0	4.4	21.2
Brazil	79.1	91.9	0	0	9.2	6.9	11.8	1.3
Chile	58.6	71.3	0	0	0	0	41.4	28.7
Colombia	0	0	34.5	23.2	65.5	76.8	0	0
Costa Rica	31.8	17.3	0	0	0	0	68.2	82.7
Dom. Rep.	0	0	0	0	8.8	0.7	91.2	99.3
Ecuador	7.1	6.3	75.9	47.7	16.3	41	0.8	5.1
El Salvador	0	0	40.9	8.8	0	0	59.1	91.2
Guatemala	0	0	0	0	0	0	100	100
Guyana	*	*	-	-	-	-	-	-
Honduras	62.6	31	0	0	10.5	9.9	26.9	59.1
Jamaica	-	-	-	-	-	-	-	-
Mexico	-	-	-	-	-	-	-	-
Nicaragua	0	0	0	0	0	0	100	100
Panama	3	5.1	0	0	69.4	16.2	27.7	78.7
Paraguay	15.1	16.3	0	0	4.1	3.9	80.8	79.8
Peru	85.1	91.3	0	0	0.2	2.6	14.7	6.1
Uruguay	100	100	0	0	0	0	0	0
Venezuela	0	0	90.9	87.9	0	0	9.1	12.1
LAC	52	60.4	15.3	7.9	12.4	13.7	20.2	18

Source: EVAL 2010 software.

-Information not available . No population of this size

There are few countries in the region where all municipalities opt for the same form of payment: Uruguay and Belize, where 100% of municipalities rely on the property tax to bill, and Guatemala and Nicaragua, where 100% send a periodic bill directly to their users. With respect to the latter form of payment, it is interesting to note that it is widely used by small municipalities in a

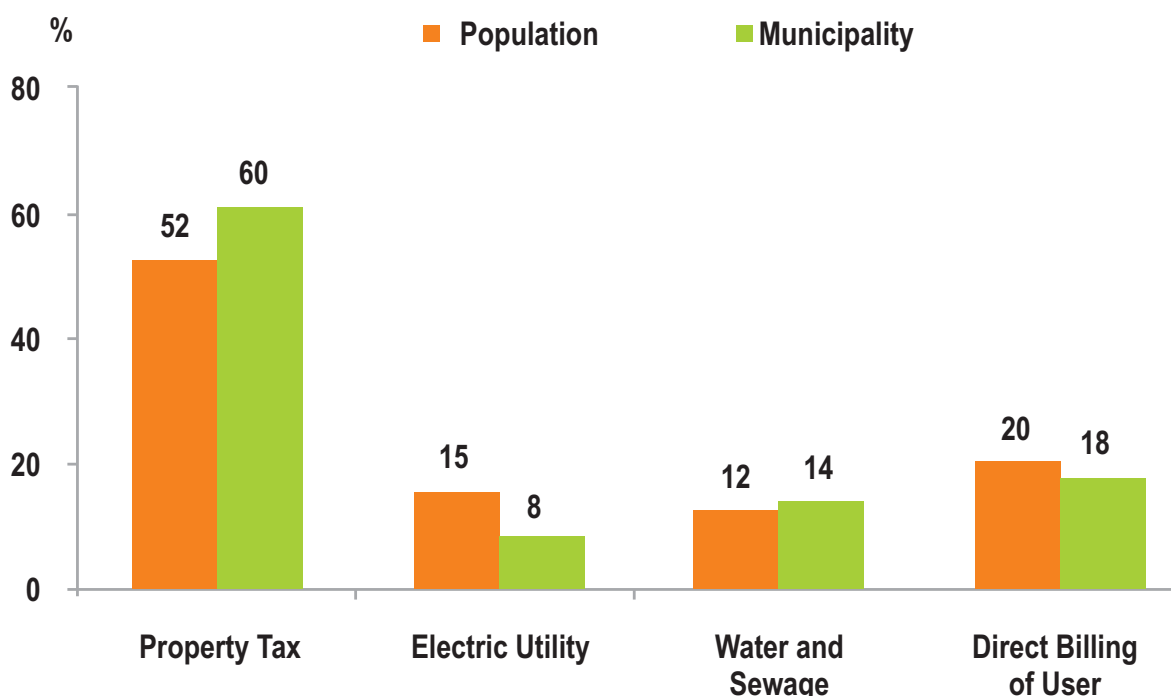
number of countries (Costa Rica, Bolivia, El Salvador, Honduras, and Panama), which shows that there is a sizable group that can be moved to other forms of payment. Its use is likely motivated by the longer billing period for SW management services, compared to that of other services and of property tax billing. The reasons for using this form of payment are different for mu-

nicipalities of greater size in other countries (São Paulo, for example), where larger service providers are more specialized and can, therefore, create their own payment structures.

In the region overall, differences between the number of municipalities using different forms of payment and the size of the population they serve are not noticeably marked. This shows that there is not a tendency to use a certain form of payment for a certain population size, or

if there is, it disappears when data from multiple countries is analyzed. The only form of payment that shows a regional tendency toward greater use/the larger the population size, is billing through the electric utility (3.9% for micro municipalities, 9.3% for small municipalities, and around 20% for medium and large municipalities). This shows a significant relationship between this form of payment and population size.

FIGURE 16: FORMS OF PAYMENT USED BY LAC MUNICIPALITIES COMPARED TO POPULATION SIZE SERVED



Source: EVAL 2010 software

The amounts invoiced and paid are generally collected by the municipalities, contracted companies, or through concessionaire schemes, although there are also special cases in which there are different collection agents, such as cooperatives or the national government.

In LAC, the municipality is the most common collection agent, with 81.2% of municipalities in the region acting in this capacity. This suggests that the service provider and the biller are generally different. The prepon-

derance of municipalities that act as collection agents can be appreciated in Table 19, where even countries such as Bolivia, Honduras, Peru, and Uruguay register 100%. On the other hand, in Colombia, Chile, Guatemala, and Venezuela, the municipality is not the most common collection agent; generally, it is the company that provides the service that acts as biller, in accordance with their service contacts.

TABLE 19: COLLECTING AGENT BY POPULATION SIZE IN LAC (% OF MUNICIPALITIES)

COUNTRY	MICRO			SMALL			MEDIUM			LARGE			MEGA			OVERALL		
	M	P	O	M	P	O	M	P	O	M	P	O	M	P	O	M	P	O
Argentina	81.2	18.8	0	100	0	0	100	0	0	100	0	0	100	0	0	93.2	6.8	0
Belize	100	0	0	-	-	-	-	-	-	-	-	-	-	-	-	*	*	*
Bolivia	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0
Brazil	100	0	0	100	0	0	87.2	0	12.8	100	0	0	100	0	0	98.2	0	1.8
Chile	19.4	0	80.6	38.8	59.4	1.9	55.5	0	44.5	0	100	0	100	0	..	33.9	20.8	45.4
Colombia	41.3	58.7	0	32.7	36.9	30.4	9.6	21.3	69.1	26.3	73.7	0	100	0	0	35.1	47.6	17.3
Costa Rica	100	0	0	75	14.5	10.5	100	0	0	100	0	0	100	0	0	86.7	7.7	5.6
Dom. Rep.	80.2	19.8	0	64	0	36	45.7	28.3	26.1	100	0	0	100	0	0	73	15.6	11.4
Ecuador	47.6	37.7	14.7	42.5	12.6	44.8	59.9	4.6	35.5	60	0	40	..	..	..	48.9	19.1	32.1
El Salvador	100	0	0	100	0	0	36.4	63.6	0	0	100	0	100	0	0	91.2	8.8	0
Guatemala	-	-	-	17.5	82.5	0	33	28.4	38.6	0	100	0	100	0	0	20.4	71.8	7.9
Guyana	-	-	-	-	-	-	100	0	0	-	-	-	..	..	..	*	*	*
Honduras	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0
Jamaica	-	-	-	-	-	-	-	-	-	-	-	-	..	..	..	-	-	-
Mexico	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nicaragua	-	-	-	81.4	18.6	0	85.7	14.3	0	100	0	0	100	0	0	82.4	17.6	0
Panama	59.6	19.2	21.2	85.4	14.6	0	25	50	25	100	0	0	100	0	0	64.2	21.8	14
Paraguay	98.6	1.4	0	42.9	57.1	0	33.3	66.7	0	100	0	0	100	0	0	77	23	0
Peru	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0
Uruguay	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0	100	0	0
Venezuela	50	50	0	27.4	27.4	45.1	20	80	0	0	100	0	100	0	0	26.2	53.1	20.6
LAC	87.9	9.4	2.7	77.8	14.3	7.8	70.5	13.8	15.7	78	20.8	1.2	100	0	0	81.2	12.4	6.4

Source: EVAL 2010 software

Micro: ≤15,000 inhabitants; Small: 15,001 - 50,000 inhabitants; Medium: 50,001 - 300,000 inhabitants; Large: 300,001 - 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available .. No population of this size

\* Not enough data to calculate the aggregated variable at country level M: municipality; P: private contractor; O: other



## FEE SYSTEM FOR SOLID WASTE MANAGEMENT SERVICES IN COLOMBIA

The Regulations on Public Services for Households, through Law 142 of 1994, declares: that public services should be self-financing and guarantee both quality service and the expansion of service; that fees should reflect the comprehensive costs of the service and, thus, make it possible for the self-financing of services; and that each service should be managed separately and include a precise accounting system, since fees will be based on this information.

Resolutions 351 and 352 of 2005 issued by the Potable Water and Basic Sanitation Regulatory Commission (CRA) establish the fee mechanism to achieve financial sustainability of cleaning services from user payments. To calculate fees, cost ceilings were determined based on the value of the peso in June 2004 and afterwards updated with the corresponding index published by CRA. The calculation considers the number of users of the cleaning service, the kilometers covered of street sweeping, the total tonnage received by sanitary landfills, the distance to the final disposal site, the proximity to the coastline, and the possibility of association with other municipalities, among other factors. CRA is presently reviewing this fee mechanism.

Payment for cleaning fees varies by socio-economic strata (there are six strata in Colombia) and user type (residential, industrial, government, and commercial). The state is responsible for subsidizing low-income segments of the population. Billing may be done directly, although at the national level, it is done through the water and sewage services; Cartagena of the Indies is the only municipality that bills through the electric utility.

According to Law 1,151 of 2007, strata 1, 2 and 3 should be subsidized, with stratum 1 paying 30% of the corresponding fee, stratum 2 paying 40%, and stratum 3 paying 85%. Stratum 4 pays the full unsubsidized fee, and strata 5 and 6, as well as the commercial and industrial sectors, pay the full unsubsidized fee plus a percentage established by municipal accord. In cases where there is a deficit between subsidies and payments, the municipality must assume the cost.

In addition to income received from the payment of fees, resources are available from: the General Fund System, with a specific allocation of 5.4% in accordance with Law 1,176 of 2007; the transfer of monies to departments and municipalities to cover subsidies for low-income population segments; infrastructure investments; and the regionalization and optimization of services.



Photo: Eng. Pilar Tello (courtesy)

# WASTE GENERATION, COVERAGE AND QUALITY OF SERVICES



# WASTE GENERATION, COVERAGE AND QUALITY OF SERVICES

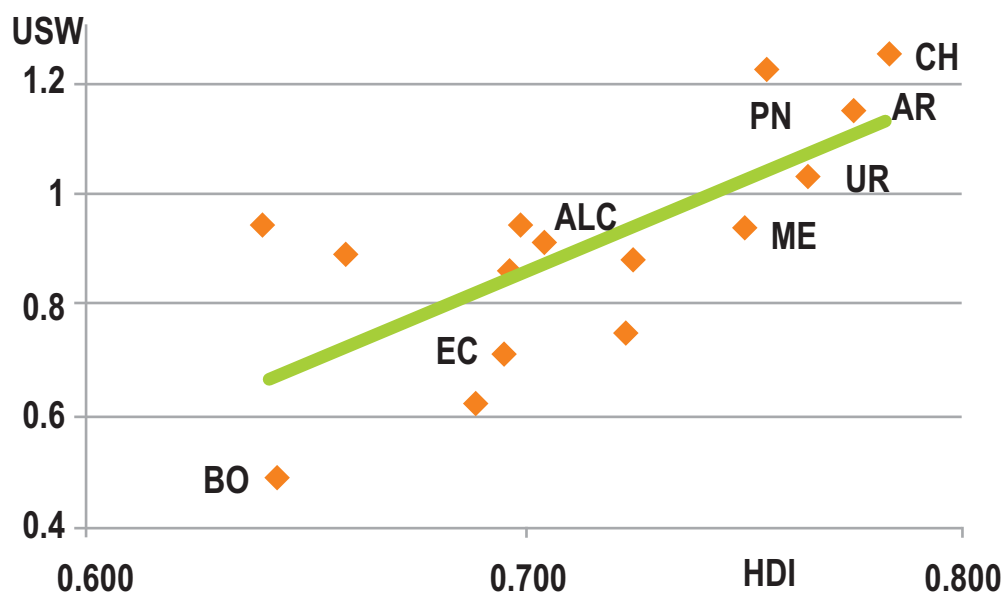
## SOLID WASTE GENERATION IN LAC

Solid waste generation is the most important indicator for the purposes of determining the scale SW management services should have and foreseeing the difficulties that are likely to be encountered (being an especially important parameter on which to base decisions as to the design of collection and final disposal systems). The quantity of SW generated varies among different locations according to a set of factors that influence it, such as economic development, income level, the activity

of the predominant sectors, patterns of consumption, population size, degree of urbanization, and population density, among others.

In this regard, we have already shown the direct proportional relationship between waste generation and per capita GDP in Figure 6, and we can now add the direct relationship between waste generation and HDI, which combines values on economic activity with education and health levels:

FIGURE 17: RELATIONSHIP OF HDI TO PER CAPITA GENERATION OF USW IN LAC



Source: EVAL 2010 software



Table 20 shows the HSW and USW indicators for LAC by country:

TABLE 20: PER CAPITA GENERATION OF HSW  
AND USW IN LAC (KG/INHAB./DAY)

COUNTRY	MICRO		SMALL		MEDIUM		LARGE		MEGA		OVERALL	
	HSW	USW				USW	HSW	USW	HSW	USW	HSW	USW
Argentina	0.66	0.92	0.68	1.06	0.8	1.02	0.78	1.41	..	..	0.77	1.15
Belize	-	-	-	-	-	-	-	-	..	..	-	-
Bolivia	0.27	0.29	0.4	0.43	0.45	0.48	0.51	0.55	..	..	0.46	0.49
Brazil	0.49	0.87	0.54	0.86	0.66	0.85	0.78	1.31	0.91	1	0.67	1
Chile	0.75	1.28	0.76	1.43	0.8	1.21	0.86	1.12	..	..	0.79	1.25
Colombia	0.41	0.48	0.4	0.55	0.56	0.57	0.59	0.66	0.73	0.82	0.54	0.62
Costa Rica	-	1.21	-	0.75	-	0.89	-	1.2	..	..	-	0.88
Dom. Rep.	-	-	0.9	1	0.75	1.01	0.9	1.2	..	..	0.85	1.1
Ecuador	0.41	0.54	0.45	0.66	0.59	0.68	0.73	0.85	..	..	0.62	0.71
El Salvador	0.3	0.48	0.42	0.64	0.58	0.94	0.58	1.74	..	..	0.5	0.89
Guatemala	0.36	-	0.42	0.5	0.52	0.62	0.5	0.62	..	..	0.48	0.61
Guyana	-	-	-	-	-	-	-	-	..	..	-	-
Honduras	0.27	-	0.37	-	0.67	-	0.94	-	..	..	0.61	-
Jamaica	0.6	-	0.64	-	0.83	-	0.95	-	..	..	0.71	-
Mexico	0.32	0.53	0.47	0.78	0.49	0.83	0.75	1.1	0.65	1.34	0.58	0.94
Nicaragua	-	-	0.7	-	0.57	-	1	-	..	..	0.73	-
Panama	0.46	0.54	0.57	1.11	0.59	0.96	0.5	1.6	..	..	0.55	1.22
Paraguay	0.63	0.72	0.63	0.86	0.72	1.02	0.83	1.28	..	..	0.69	0.94
Peru	0.33	0.53	0.41	0.63	0.51	0.67	0.48	0.85	0.43	0.81	0.47	0.75
Uruguay	0.72	0.85	0.67	1.07	0.46	0.81	0.88	1.22	..	..	0.75	1.03
Venezuela	-	0.5	0.77	0.78	0.51	0.75	0.82	1.08	..	..	0.65	0.86
LAC	0.45	0.75	0.53	0.8	0.61	0.84	0.74	1.14	0.73	1.01	0.63	0.93

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available

.. No population of this size

HSW: Household Solid Waste; USW: Urban Solid Waste.



Eval 2010 estimated per capita generation of HSW in LAC at 0.63 kg/inhab./day and USW at 0.93 kg/inhab./day. Per capita indicators for the region imply

daily urban generation of 295,000 tons of HSW and 436,000 tons of USW. The USW estimates are lower than those for per capita USW generation in the United States and various developed countries in Europe, as Table 21 illustrates:

TABLE 21: PER CAPITA USW GENERATION FOR U.S., EUROPEAN COUNTRIES, AND LAC

COUNTRIES / REGION	KG/IN-HAB./DAY
United States	2.08
Switzerland	1.95
Germany	1.59
Spain	1.59
United Kingdom	1.56
Italy	1.51
France	1.48
Sweden	1.42
Latin America and the Caribbean	0.93

Eval 2010 software and information available online from the Organisation for Economic Co-operation and Development (OECD): [http://www.oecd-ilibrary.org/environment/oecd-factbook-2010/municipal-waste\\_factbook-2010-64-en](http://www.oecd-ilibrary.org/environment/oecd-factbook-2010/municipal-waste_factbook-2010-64-en).

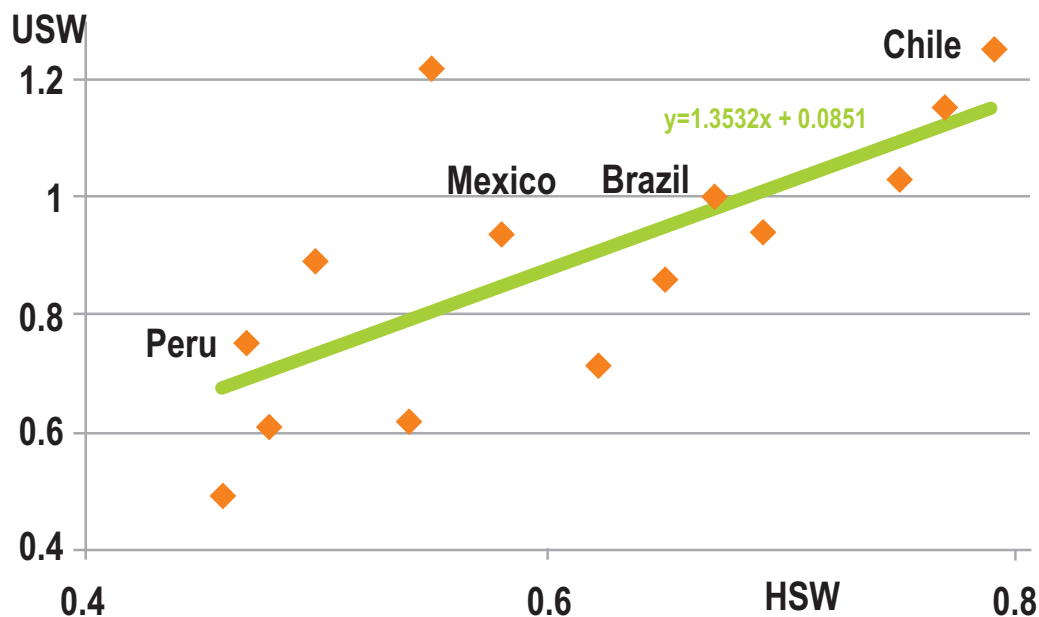
Values based on Eval 2010 data are barely superior to Eval 2002 values for USW generation, and lower for HSW generation. This is curious given that per capita GDP increased substantially during this period.

The indicators for HSW and USW of the different countries range from the estimates for Bolivia (0.46 Kg/inhab./day and 0.49 Kg/inhab./day, respectively) to those for Chile (0.79 kg/inhab./day and 1.25 kg/inhab./day, respectively). In general, the calculated rates of gen-

eration maintain a direct relationship with country indicators on activity, population size, and development.

In Eval 2002, the rate of HSW generation was approximately between 50% and 75% that of USW generation. In Eval 2010, the majority of the values for per capita HSW generation for LAC countries were 60% to 75% of the USW value. When plotting the Eval 2010 HSW and USW generation rates (see Figure 18), we end up with a straight line average, indicating an average relationship between the two rates for the different generation values. According to the straight line average of Eval 2010, the HSW rate in LAC should, theoretically, represent between 67% and 68% of the USW generation rate.

FIGURE 18: PER CAPITA GENERATION OF HSW AND USW IN LAC (KG/INHAB./DAY)



Source: EVAL 2010 software

In EVAL 2010, it was observed that, despite existing regulations in the countries of the region that express a distinction between household solid waste and urban or municipal solid waste, most municipalities do not make this distinction, referring to all waste as one or the other.

Additionally, the great majority of LAC municipalities do not have research specifically on waste generation. In the best of cases, methods are used to measure per capita generation based on the amount of waste in transfer sta-

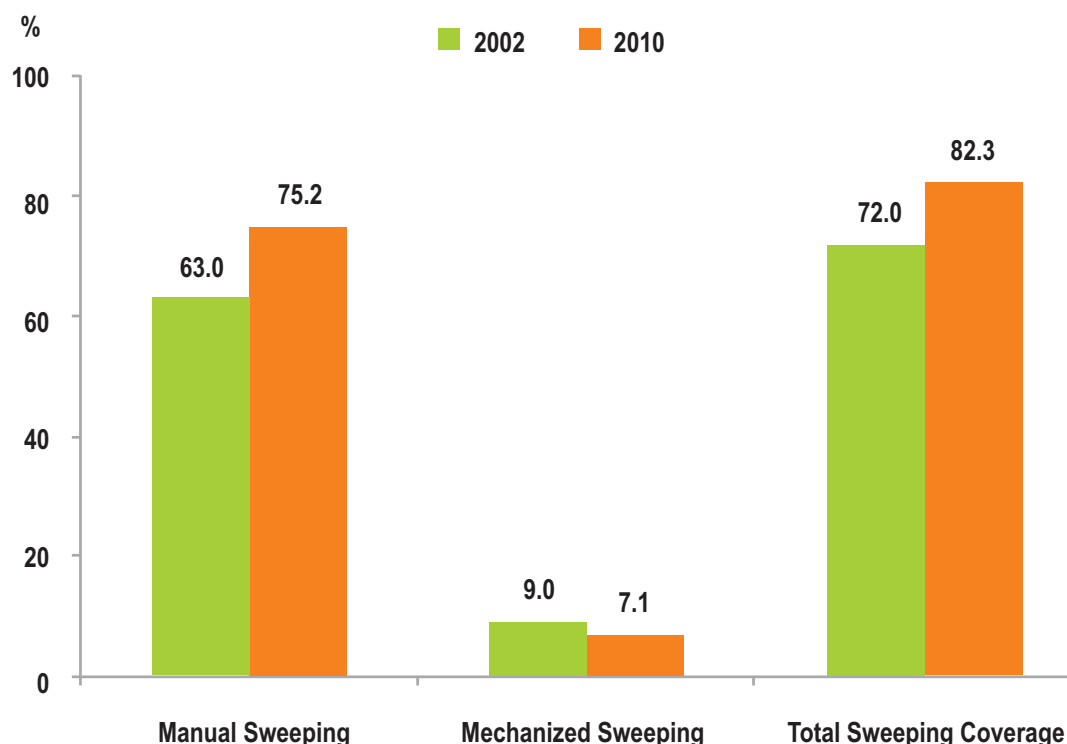
tions or in final disposal sites, neither of which is truly representative, since what is collected is not really what is generated. Further, what is separated out and recovered by waste pickers can amount to 5% of the values weighed or registered in transfer stations and final disposal sites. In any event, micro- and small cities do not generally have the scales needed to do the weighing at final disposal sites, which makes it difficult to calculate even this approximate value of waste generation for these municipalities.

EVAL 2010 estimated that the per capita USW generation rate in Latin America and the Caribbean increased slightly to 0.91 kg/inhab./day, while the per capita HSW generation rate was 0.63 kg/inhab./day.

## PUBLIC AREA AND STREET SWEEPING

A comparison of EVAL 2002 and EVAL 2010 indicators reveals that sweeping services have experienced an increase in coverage in recent years. As shown in Figure 19, manual street sweeping coverage increased from 63% to 75.2% and mechanized sweeping decreased slightly from 9% to 7.1%. The net total result is an increase in sweeping coverage from 72% to 82.3%<sup>34</sup>.

FIGURE 19: TOTAL SWEEPING COVERAGE  
(MANUAL AND MECHANIZED) IN LAC - 2002/2010



Source: EVAL 2010 software

<sup>34</sup> It should be noted that estimates on sweeping coverage for LAC in 2002 did not include data from Brazil. In 2010, Brazil's manual sweeping coverage average was 93.2%, well above the regional average, while its mechanized sweeping coverage average was low (3%); these indicators had a lot of weight in determining the 2010 regional indicators.

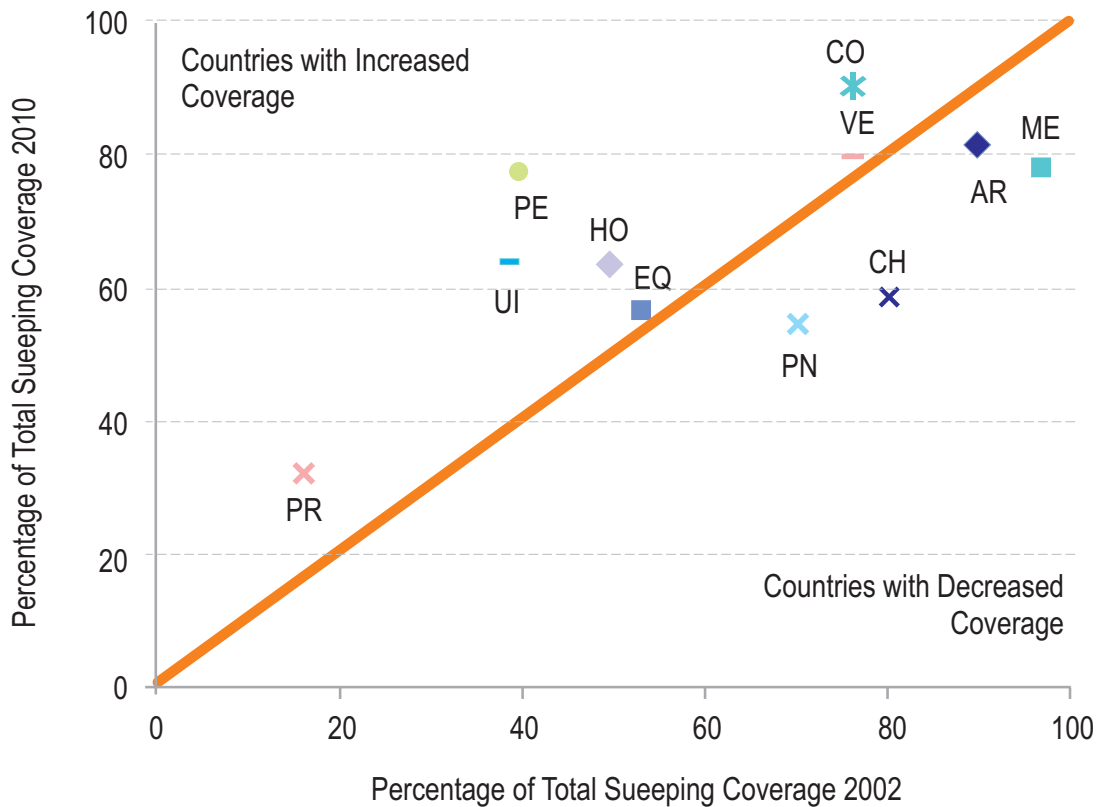
As mentioned in the section on human resources (see Figure 13), manual sweeping is the solid waste management service with the most personnel, at 5.56 employees per 10,000 inhabitants. The increase in coverage is not likely a result of improved efficiency resulting from a better organization of the service, the use of new technologies, or greater productivity on the part of the sweepers. It can be concluded, therefore, that the increase in coverage is due to a greater number of street sweepers, reflected in the majority they represent among the human resources of cleaning services.

Because it requires primary and secondary roadways that are wide enough and paved, mechanized street sweeping is generally used in the large and mega-cities of countries like Mexico, Argentina, Chile, Colombia, and Venezuela, in addition to other cities including, among others: Sao Paulo, Brazil; Lima, Peru; Quito, Ecuador; and Montevideo, Uruguay. In most countries,

mechanized street sweeping is provided by the municipality, although there are exceptional cases, such as Lima, where mechanized street sweeping is provided by a private company in a small part of the municipality. There are also medium, and even small and micro-cities that employ mechanized street sweeping. Among them are: Cananea, Brazil (classified as micro-, one of the country's oldest cities); La Antigua, Guatemala (small); and Tarija, Bolivia (medium), which probably have achieved good results with mechanized sweeping, given that they have been using it for more than ten years.

According to the EVAL 2002 and EVAL 2010 indicators, the majority of the countries in the region have improved coverage. Figure 20 shows this progress by comparing total sweeping coverage for 2002 (x-axis) with total sweeping coverage for 2010 (y-axis). Table 23, found at the end of this section, provides greater detail.

FIGURE 20: TOTAL SWEEPING COVERAGE IN LAC (FOR SELECT COUNTRIES) - 2002/2010



Source: EVAL 2010 software

Returning to the topic of mechanized sweeping in LAC countries, EVAL 2010 gathered information on the number of sweeping vehicles (commonly called mechanized sweepers) in good working order in the locations

where the service is provided. Table 22 shows the processed information for the countries where data was available.

TABLE 22: NUMBER OF MECHANIZED SWEEPERS IN LAC (VEHICLES PER 10,000 INHABITANTS)

COUNTRY	MICRO		SMALL		MEDIUM		LARGE		MEGA		OVERALL	
	NSV	F (%)	NSV	F (%)	NSV	F (%)	NSV	F (%)	NSV	F (%)	NSV	F (%)
Argentina	0.96	100	0.61	100	0.61	87	0.07	85	..	..	0.44	87
Bolivia	-	-	-	-	0.1	100	-	-	..	..	*	*
Brazil	0.81	100	-	-	-	-	0.02	100	-	-	0.16	100
Chile	2.25	100	0.22	100	0.06	99	0.02	100	..	..	0.09	99
Colombia	-	-	-	-	-	-	0.03	67	0.02	100	0.02	78
Ecuador	-	-	-	-	-	-	0.02	100	..	..	*	*
El Salvador	-	-	-	-	-	-	0.16	60	..	..	*	*
Honduras	-	-	-	-	-	-	0.02	100	..	..	*	*
Mexico	-	-	0.53	0	0.06	95	0.07	55	0.13	28	0.18	43
Nicaragua	-	-	-	-	-	-	0.01	100	..	..	*	*
Peru	-	-	-	-	-	-	-	-	0.01	100	*	*
Uruguay	-	-	-	-	-	-	0.01	100	..	..	*	*
Venezuela	-	-	-	-	0.1	-	0.04	86	..	..	0.08	*
LAC	0.88	100	0.51	30	0.2	94	0.04	82	0.03	73	0.17	81

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants ; Mega > 5,000,000 inhabitants

- Information not available

.. No population of this size

NSV: Number of sweeping vehicles; F: Percent of vehicles in good working order (functioning).



On average, for all the municipalities of the region where mechanized sweeping services are provided, there are 0.17 sweeping vehicles per 10,000 inhabitants who receive the service, and 81% of these vehicles are in good working order. Argentina is the country with the most mechanized sweepers per population served, with 0.44 mechanized sweepers per 10,000 inhabitants.

Mexico has the lowest percentage of mechanized sweepers in good working order, with 43% in conditions that do not permit them to provide service. The number of mechanized sweepers per 10,000 inhabitants decreases as the population size increases, underscoring the importance of achieving economies of scale for this service.

**EVAL 2010 estimated that total sweeping coverage for Latin America and the Caribbean increased by 10% to 82.2%. In LAC, there are 5.56 manual sweepers and 0.17 mechanized sweepers per 10,000 inhabitants. Of the total coverage, nearly 91% is swept manually and the remaining 9% mechanically.**

TABLE 23: STREET SWEEPING IN LAC: MANUAL, MECHANIZED, AND TOTAL (%)

COUNTRY	MICRO			SMALL			MEDIUM			LARGE			MEGA			OVERALL		
	MA	ME	TSC	MA	ME	TSC	MA	ME	TSC	MA	ME	TSC	MA	ME	TSC	MA	ME	TSC
Argentina	67.6	12.9	80.6	67	9.3	76.3	62.9	22.6	85.4	60.2	18.1	78.3	..	..	..	62.7	18.9	81.6
Belize	10	0	10	-	-	-	-	-	-	-	-	-	..	..	..	*	*	*
Bolivia	25.8	0	25.8	37	0	37	59.9	4.6	64.5	85.7	0	85.7	..	..	..	65.3	1.9	67.2
Brazil	92.8	4.5	97.3	100	0	100	95.6	0	95.6	97.2	1.9	99.1	70	20	90	93.2	3	96.1
Chile	35.1	0.2	35.3	63.9	0.7	64.6	52.6	2.9	55.4	50	45	95	..	..	..	53.1	5.9	59
Colombia	83.8	0	83.8	72.5	0	72.5	94.1	0	94.1	91.1	8.7	99.7	76.6	23.4	100	84.6	6.3	90.8
Costa Rica	100	0	100	85.6	0	85.6	90.1	0	90.1	100	0	100	..	..	..	89.6	0	89.6
Dom. Rep.	59.5	0	59.5	79.9	0	79.9	66	0	66	73.5	0	73.5	..	..	..	70.4	0	70.4
Ecuador	60.8	0	60.8	39.2	0	39.2	62.6	0	62.6	52.5	5.3	57.8	..	..	..	54.4	2.1	56.5
El Salvador	19.1	0	19.1	40	0	40	23.3	0	23.3	25	5	30	..	..	..	27	0.6	27.6
Guatemala	83.3	0	83.3	18.2	9.8	28	92.7	0	92.7	68	0	68	..	..	..	55.3	4.3	59.6
Guyana	-	-	-	-	-	-	70	0	70	-	-	-	..	..	..	*	*	*
Honduras	74.6	0	74.6	26.4	0	26.4	52.8	0	52.8	87.4	1.2	88.7	..	..	..	62.2	0.3	62.5
Jamaica	-	0	-	-	0	-	-	0	-	-	0	-	..	..	..	-	0	-
Mexico	33.4	0	33.4	63.8	6	69.9	62.6	22.2	84.8	57.2	22.1	79.3	80	20	100	60	17.4	77.4
Nicaragua	-	-	-	65.1	0	65.1	60.2	0	60.2	80	10	90	..	..	..	67.2	2.3	69.5
Panama	61.3	0	61.3	26.8	0	26.8	69.3	0	69.3	50	0	50	..	..	..	54.8	0	54.8
Paraguay	17.8	0	17.8	32.9	0	32.9	32.5	0	32.5	60	0	60	..	..	..	32.5	0	32.5
Peru	59	0.2	59.1	54.2	0	54.2	65	0	65	81.3	0	81.3	99	1	100	77.6	0.3	77.8
Uruguay	10.1	0	10.1	78.6	0	78.6	46.8	0	46.8	95	5	100	..	..	..	61.5	2	63.5
Venezuela	65.5	0	65.5	69.8	0	69.8	68	4.8	72.8	87.1	8.6	95.7	..	..	..	74.4	5.2	79.6
LAC	72.1	2.6	74.7	74.7	2	76.8	73.8	6.9	80.7	78.4	9.5	87.9	78.8	17	95.8	75.2	7.1	82.3

Source: EVAL 2010 software

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available .. No population of this size\* Not enough data to calculate the aggregated variable at country level

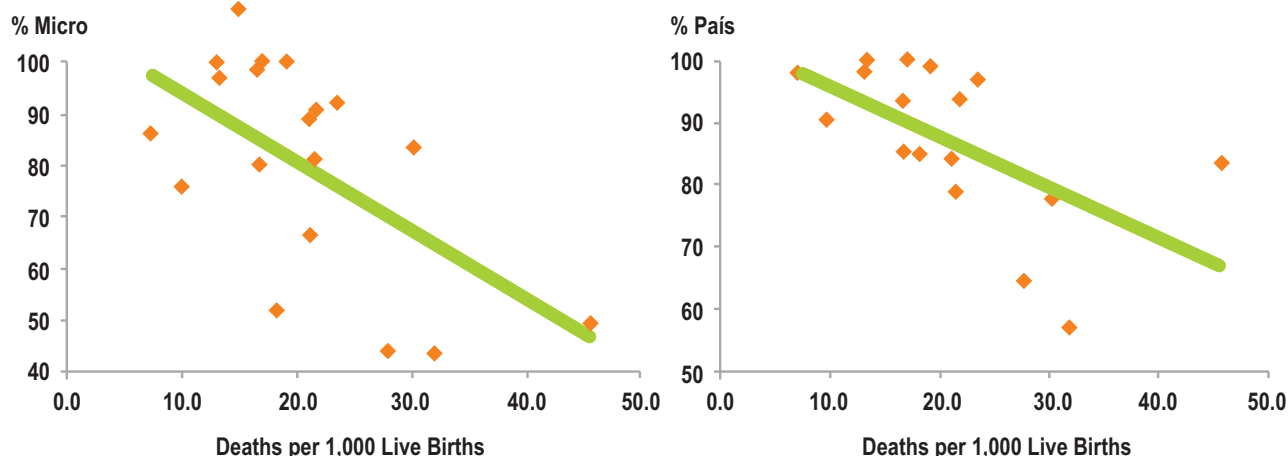
Ma: manual sweeping; Me: mechanized sweeping; TSC: total sweeping coverage.

## COLLECTION AND TRANSPORTATION

Historically, LAC municipalities have prioritized collection and transportation services over all other solid waste management services. Factors that explain why this occurred include the high social visibility that these services afford municipalities, the public intolerance to the accumulation of trash at people's doorsteps, and the

dangerous health effects it can have on the population. Figure 21 shows the relationship between infant mortality in the region and the coverage of trash collection services in micro-municipalities and in countries overall.

FIGURE 21: RELATIONSHIP OF INFANT MORTALITY TO TRASH COLLECTION COVERAGE IN LAC AT THE MICRO MUNICIPALITY AND COUNTRY LEVELS



Source: EVAL 2010 software and CEPAL: Panorama social de América Latina 2009, November 2009

The urban population growth registered in recent years and the consequent increases in population densities are factors that have gradually modified the way services are provided. In many large-sized cities of the region, the practice of depositing trash for collection in unspecified locations, in small designated areas, or in small elevated baskets in front of residences is being replaced with the use of large containers located in strategic locations and at intervals that are short enough for everyone to be able to deposit their trash in them. This has increased the use

of collection vehicles with mechanical or hydraulic lifting mechanisms for the rear or side loading of the trash containers.

Trash collection coverage in the region now reaches 93.4% of the population, a 10% increase with respect to 2002, when 81% of inhabitants received this service. Although the majority of countries have more than 80% coverage, there still exist areas and marginal neighborhoods in large and mega-cities where the service is not provided or is of very low quality.

TABLE 24: TRASH COLLECTION COVERAGE IN LAC (%)

COUNTRY	MICRO	SMALL	MEDIUM	LARGE	MEGA	OVERALL
Argentina	97.2	100	100	99.8	..	99.8
Belize	80	-	90	-	..	85.2
Bolivia	49.3	54	85.5	95.6	..	83.3
Brazil	86.8	96.5	95.7	98.7	100	96
Chile	86.1	94.1	100	100	..	97.8
Colombia	100	94.8	100	100	100	98.9
Costa Rica	75.8	86.8	92.1	100	..	90.4
Ecuador	89	78.2	88.9	81.7	..	84.2
El Salvador	81.1	82.4	74.9	85	..	78.8
Guatemala	83.3	64	83.9	100	..	77.7
Guyana	-	-	90	-	..	*
Honduras	44	48.2	75.9	81.9	..	64.6
Jamaica	73.8	72.5	73.3	75	..	73.9
Mexico	99.4	85.7	88.9	97.3	100	93.2
Nicaragua	-	86.8	95.4	100	..	92.3
Panama	52	55.1	99.3	100	..	84.9
Paraguay	43.6	52.9	58.2	90	..	57
Peru	66.7	77	75.2	82.8	100	84
Dom. Rep.	97.9	95.2	95	100	..	97
Uruguay	100	100	100	95	..	98
Venezuela	100	100	100	100	..	100
LAC	88.2	89.3	92.7	97.4	100	93.4

Source: EVAL 2010 software

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available

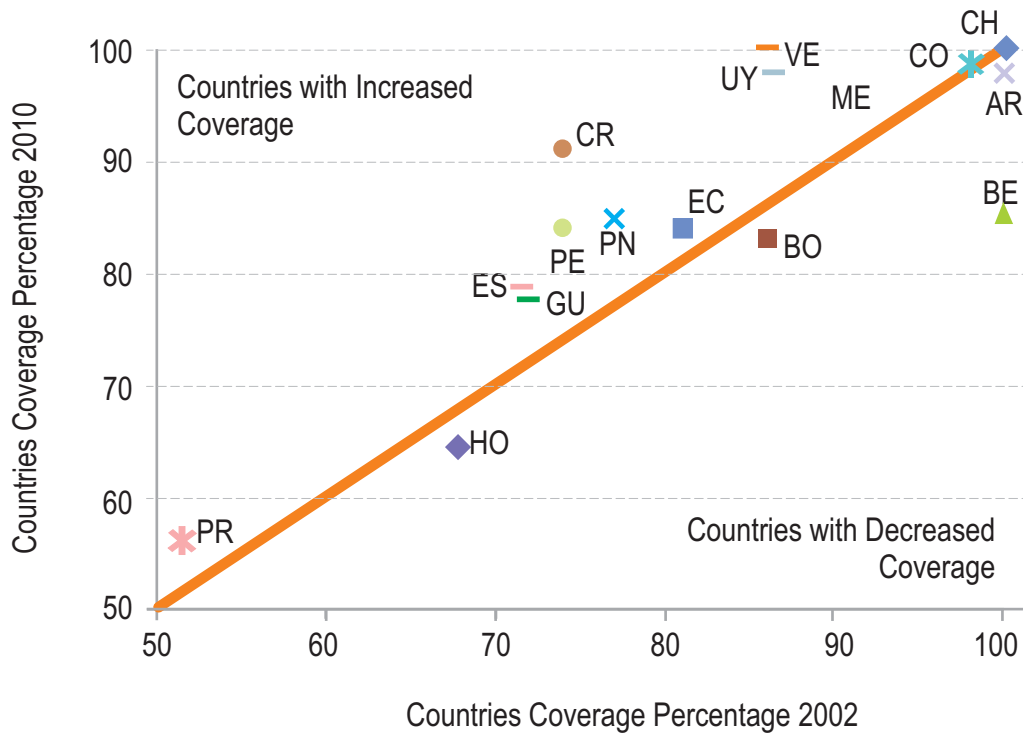
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\* Not enough data to calculate the aggregated variable at country level

With the exception of Paraguay, Honduras, Guatemala, and El Salvador, all LAC countries have more than 80% coverage. Argentina, Brazil, Chile, Colombia, Uruguay, and Venezuela have the highest percentages in the region with nearly universal coverage. For the most part, countries improved their coverage from 2002:

and Venezuela have the highest percentages in the region with nearly universal coverage. For the most part, countries improved their coverage from 2002:

FIGURE 22: PROGRESS OF COLLECTION COVERAGE IN LAC COUNTRIES –2002/2010



Source: EVAL 2010 software

Service coverage is an important factor in assessing collection and transportation services, but the picture is incomplete without an analysis of service quality. For starters, it was observed that the implementation of the container system lacked adequate planning, including the determination and effective communication of the place where users should place their trash. In some cases consideration was also not given to the distance that users must cover to leave the trash in the designated area or to drop it off, and, as a result, trash ends up in inappropriate places. There are also problems with respect to determining the necessary capacity of the containers, their maintenance, and fulfillment of the collection routes they are on.

The regularity of waste collection is another important quality-of-service factor. The estimation of optimal frequency is vitally important for a service to achieve environmental, social, and financial sustainability. Throughout the region, 52.7% of the population receives trash collection service between two and five times a week, while 45.4% receives the service daily and 1.8% once a week. When these percentages are compared with those of EVAL 2002, the marked growth of daily trash collection service stands out. Although daily trash collection leads to higher user satisfaction, there is a need for caution with respect to costs, which can be reduced by providing less frequent service. For this reason, the optimal trash collection frequency should be determined.



TABLE 25: FREQUENCY OF COLLECTION SERVICE IN LAC (%)

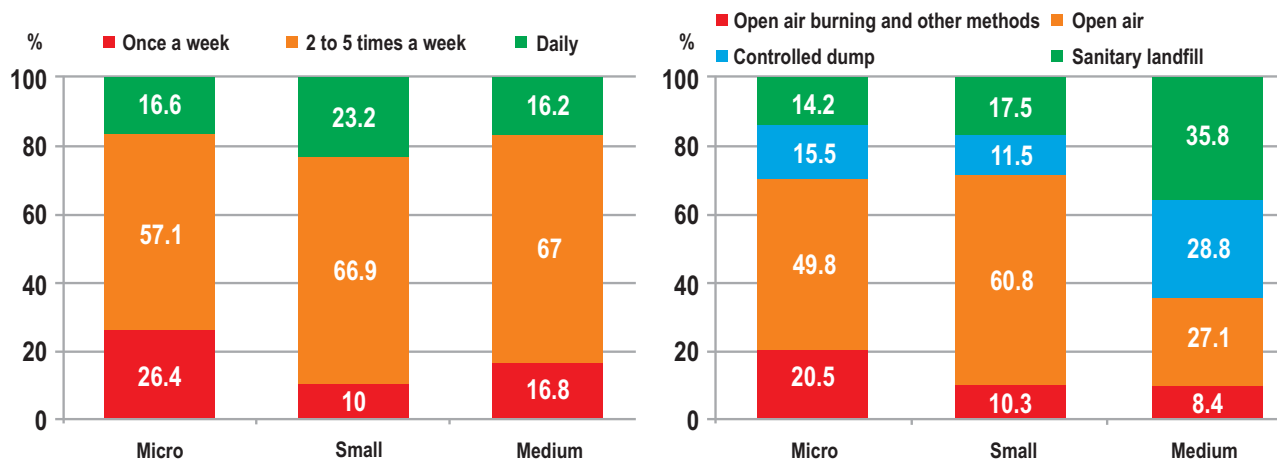
PAÍS	DIARIA	2 A 5 VEZES POR SEMANA	1 VEZ POR SEMANA
Argentina	71,9	27,9	0,2
Belize	0	88	12
Bolivia	5,4	94,6	0
Brasil	44,7	54,5	0,8
Chile	22,3	77,6	0,1
Colômbia	0	98,6	1,4
Costa Rica	0	68,8	31,2
Equador	57,3	42,7	0
El Salvador	20,9	79,1	0
Guatemala	1	86,5	12,5
Guiana	-	-	-
Honduras	5,4	75,7	19
Jamaica	0	35,3	64,7
México	71,6	28,4	0,1
Nicarágua	0	94,2	5,8
Panamá	13,1	79,5	7,4
Paraguai	16,1	79,8	4,1
Peru	55,7	43,5	0,8
Rep. Dominicana	55,2	37,1	7,7
Uruguai	18,6	81,4	0
Venezuela	58,2	41	0,8
ALC	45,4	52,7	1,8

Source: EVAL 2010 software.  
- Information not available

In general, once-a-week collection frequency is characteristic of micro- and small cities due to the scarcity of resources to operate and maintain vehicles. Another important factor is the small quantity of trash generated and the longer distance between residences. When collection frequency is not regularized, it may create anxiety among neighbors who then feel they must burn the

trash in vacant lots or dispose of it in waterways. As can be seen in Figure 23, once-a-week trash collection in the micro-, small, and medium municipalities of LAC coincides with high percentages of open-air trash burning, the use of bodies of water for trash disposal, and the use of trash to feed animals.

FIGURE 23: COLLECTION FREQUENCY AND METHOD OF FINAL DISPOSAL IN LAC



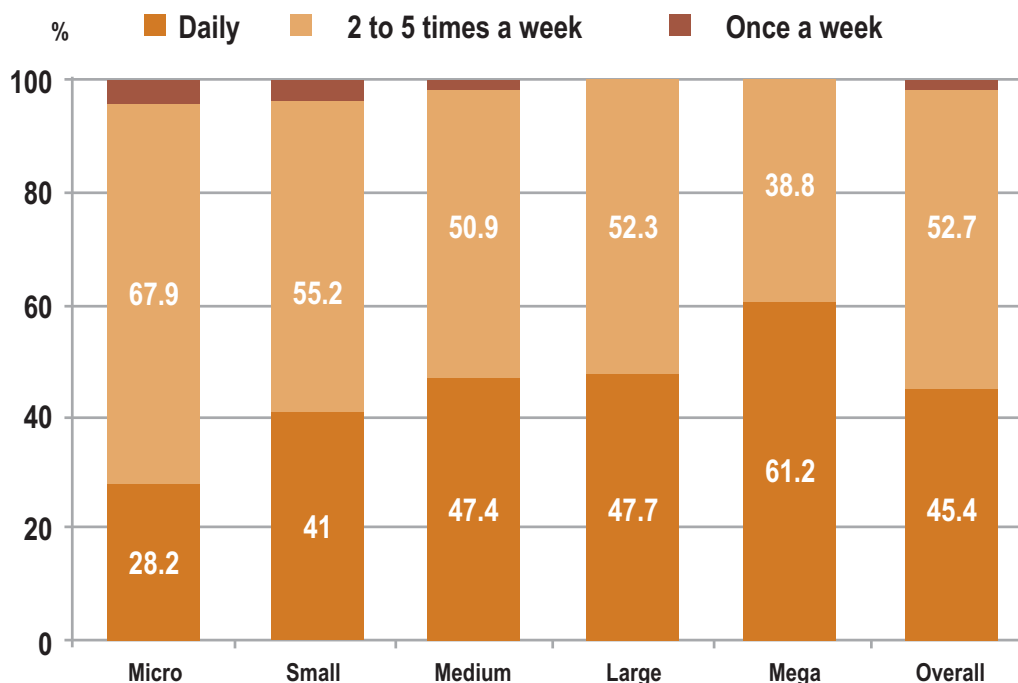
Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants



As population size increases, the frequency of trash collection service increases as well. Figure 24 shows the frequency of collection by population size in LAC:

FIGURE 24: COLLECTION FREQUENCY BY POPULATION SIZE IN LAC



Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

With respect to the collection equipment used, compactors are in the majority, with 57.8% of the collection vehicles equipped with compactors that are rear, side, top, and flatbed loaded. There are, on average, 1.31 collection vehicles per 10,000 inhabitants; this statistic is the result of a preponderance of values that, due to the existence of economies of scale, decrease as population size increases: 3.96 vehicles per 10,000 inhabitants in micro- municipalities, 1.37 in small, 0.95 in medium, 0.95 in large, and 0.87 in mega. Detailed country infor-

mation on the number of vehicles available per 10,000 inhabitants is provided in Table 26, where high levels can be seen for Belize (influenced by the small size of its municipalities), Brazil, El Salvador, and Honduras. The number of vehicles per 10,000 inhabitants is also influenced by the type of vehicle. In small communities, for example, dump trucks and flatbed vehicles are more commonly used than compactors; they serve the needs of fewer users per trip due to their capacity and the amount of time required to unload the trash.

TABLE 26: NUMBER OF COLLECTION VEHICLES PER 10,000 INHABITANTS IN LAC

COUNTRY	MICRO	SMALL	MEDIUM	BIG	MEGA	COUNTRY
Argentina	4,02	1,67	1,29	0,92	..	1,34
Belize	4,47	-	1,84	-	..	3,1
Bolivia	1,12	0,92	0,6	0,56	..	0,65
Brasil	5,41	1,88	1,25	1	0,33	1,77
Chile	1,05	1,21	0,46	0,68	..	0,66
Colombia	3,97	0,99	0,5	0,6	0,51	1,04
Costa Rica	0,75	0,72	0,66	0,69	..	0,69
Ecuador	2,01	0,42	0,49	0,66	..	0,62
El Salvador	3,77	1,47	0,9	2,25	..	1,62
Guatemala	0,56	0,88	0,43	0,73	..	0,69
Guyana	-	-	2	-	..	*
Honduras	3,24	1,19	0,9	1,1	..	1,59
Jamaica	1,5	0,78	0,8	1,07	..	1,27
Mexico	2,11	0,86	0,95	1,16	2,85	1,27
Nicaragua	-	0,76	0,47	0,19	..	0,55
Panama	4,49	1,88	0,47	0,19	..	1,07
Paraguay	1,49	0,63	0,46	0,6	..	0,73
Peru	0,97	0,59	0,4	0,58	0,16	0,39
Dominican Rep.	1,91	1,51	1,07	0,35	..	1,05
Uruguay	2,24	1,61	1,48	0,7	..	1,41
Venezuela	1,7	1,63	1,11	1,08	..	1,2
ALC	3,96	1,37	0,95	0,95	0,87	1,31

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available

..No population of this size

\*Not enough data to calculate the aggregated variable at country level

Additionally, 66% of the fleet is comprised of vehicles that date from less than ten years. Their distribution by population size is curious, with micro-municipalities having a greater percentage of older vehicles than large and mega-municipalities. Although the first have more resources and greater access to credit to purchase new vehicles, the higher percentage of older vehicles in micro-cities is explained by the use of low technology equipment (it is not unusual to see horse-drawn carts, three-wheelers, and forklifts used for trash collection

in these municipalities) and in the higher number of donated vehicles they receive. Generally, micro-, small, and medium municipalities do not have the resources to renew their vehicular fleets, nor are they able to secure loans to replace old vehicles.

Table 27 provides detailed statistics on the percentage of the fleet that dates from less than ten years for each country of the region. The very high 95% in Chile and above-average percentages in Panama, Ecuador, Brazil, and Costa Rica are noteworthy.

TABLE 27: PERCENTAGE OF COLLECTION VEHICLES IN LAC DATING LESS THAN 10 YEARS

COUNTRY	MICRO	SMALL	MEDIUM	LARGE	MEGA	OVERALL
Argentina	15	40	52	73	..	55
Belize	50	-	0	-	..	24
Bolivia	92	72	71	57	..	66
Brazil	77	68	70	72	100	74
Chile	59	82	99	100	..	95
Colombia	54	43	78	62	100	67
Costa Rica	77	85	61	100	..	72
Dominican Rep.	59	62	83	59	..	68
Ecuador	94	48	87	80	..	78
El Salvador	-	83	51	32	..	59
Guatemala	0	69	23	-	..	45
Guyana	-	-	-	-	..	*
Honduras	25	0	39	39	..	25
Jamaica	85	-	85	85	..	85
Mexico	100	30	40	92	40	63
Nicaragua	-	83	100	-	..	89
Panama	71	100	66	100	..	83
Paraguay	48	80	11	65	..	44
Peru	0	57	42	44	72	52
Uruguay	15	37	49	55	..	40
Venezuela	40	47	55	84	..	62
LAC	61	56	60	76	82	66

Source: EVAL 2010 software

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants;

Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available

..No population of this size

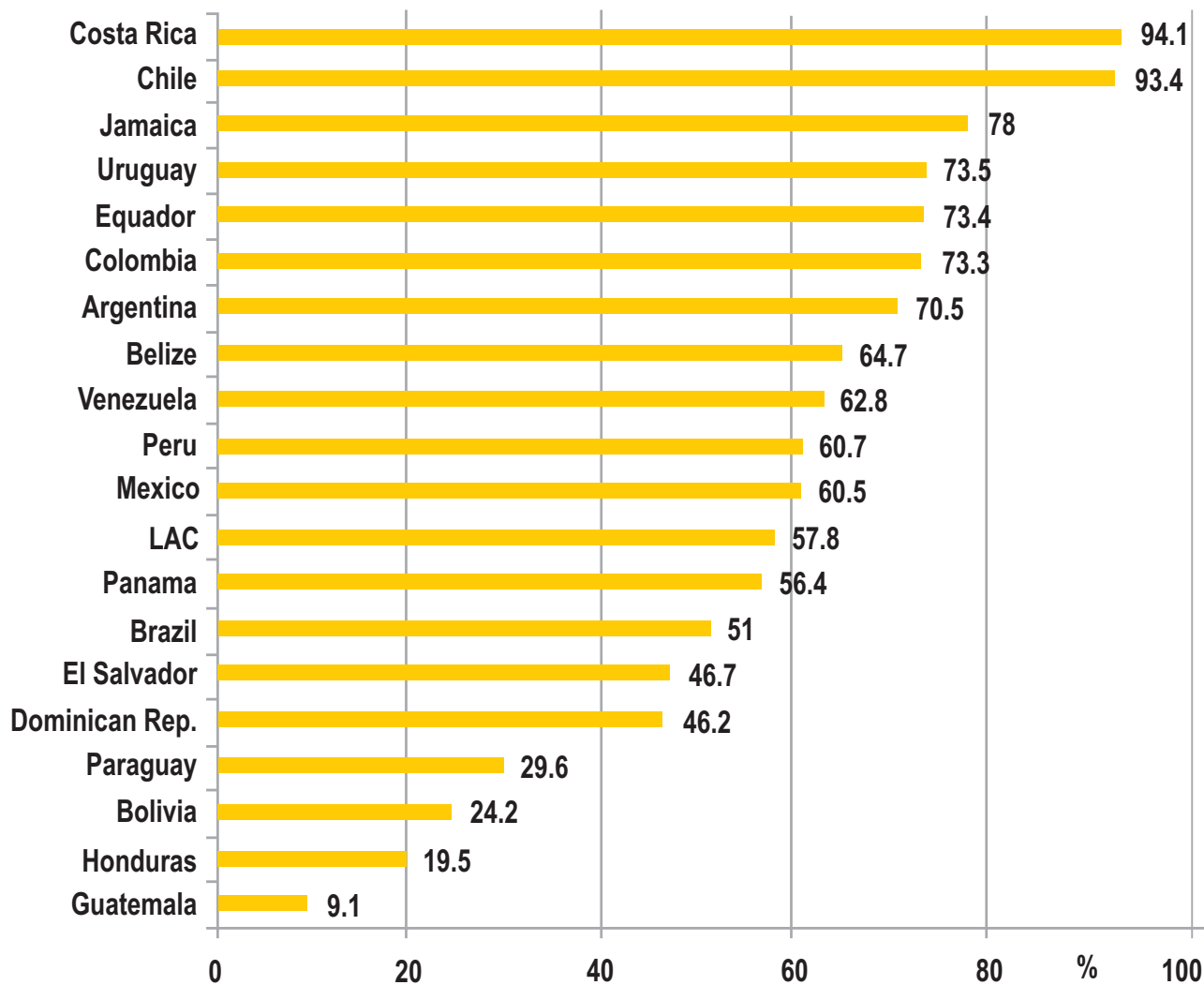
\*Not enough data to calculate the aggregated variable at country level

It should be noted that in LAC collection routes are typically not completely serviced due to problems associated with the availability and proper functioning of vehicles, factors which also contribute to a decrease in the quality of services provided.

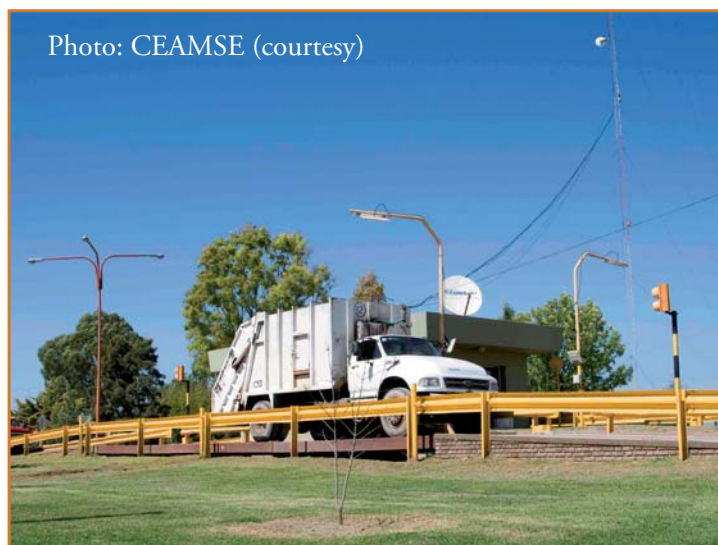
Lastly, as previously mentioned, 57.8% of collection vehicles in LAC are equipped with a trash compactor. Figure 25 provides detailed information in this respect for each country, showing that particularly high percentages are found in Costa Rica (94.1%) and Chile (93.4%), followed by Uruguay, Ecuador, Colombia, and Argentina.



FIGURE 25: PERCENTAGE OF COLLECTION VEHICLES EQUIPPED WITH COMPACTORS IN LAC



Source: EVAL 2010 software



EVAL 2010 estimated that collection coverage in LAC increased by 10% to 93.4%. Coverage is practically universal in six countries of the region: Argentina, Brazil, Chile, Colombia, Uruguay, and Venezuela.

Collection frequency is daily for slightly more than 45% of Latin Americans, while nearly 53% of the population receives this service two to five times a week, and slightly more than 2% receive it weekly. Burning and uncontrolled waste disposal increases as collection frequency decreases.

There are 1.31 collection vehicles per 10,000 inhabitants in LAC, a third of which are dated by more than 10 years.

The percentage of vehicles with compactors is 58%.

## TRANSFER

Waste transfer services reduce the costs of transporting waste to treatment and final disposal sites. Especially in densely populated areas, the distance to these sites incentivizes the use of transfer stations where waste from collection vehicles is transferred to larger transport vehicles. Even though transfer stations provide significant economic benefits, their use in the region is very limited and almost exclusively concentrated in large and megacities.

It should be stressed that the use of transfer stations for small- and medium-sized municipalities that pool their

resources or at a regional level is recommended, since transfer stations often offer significant economic benefits related to the costs of operations, collection, transportation, and final disposal (regionalized). In the case of the public consortium VIRCH-Valdes, for example (see page 68), locales such as Dolavon and Gaiman, with populations less than 5,000, send their waste to a transfer station that is part of the regional structure that has been adopted. It is also possible to find some transfer activity in micro- and small populations, where waste may be manually loaded from one vehicle to a larger one or even from carts to motorized vehicles.

TABLE 28: COVERAGE OF TRANSFER SERVICES FOR COLLECTED WASTE IN LAC (%)

Country	Micro	Small	Medium	Large	Mega	Overall
Argentina	0	7.6	2.8	42	-	16.9
Belize	78.8	-	90	-	-	84.6
Bolivia	0	0	0	0	-	0
Brazil	0	5.5	28.5	82.2	100	41.9
Chile	1.3	0	84.1	100	-	63.3
Colombia	0	0	0	27.9	0	8.2
Costa Rica	0	0	0	0	-	0
Dominican Rep.	0	0	7.4	100	..	33.5
Ecuador	0	13.5	0	53.1	-	23.4
El Salvador	14.5	8.1	0	-	-	4.7
Guatemala	0	19.6	0	0	-	8.5
Guyana	-	-	100	-	-	*
Honduras	12.7	13.7	0	0	-	8
Jamaica	0	0	0	0	0	0
Mexico	-	-	-	-	-	-
Nicaragua	-	-	-	-	-	-
Panama	0	1.4	50	0	-	21.7
Paraguay	0	0	0	0	-	0
Peru	0	0	0	0	100	27.7
Uruguay	0	0	0	0	-	0
Venezuela	0	0	0	21.5	-	6.9
LAC	1	5.2	17.5	53.9	78.2	28.2

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available ..No population of this size

\*Not enough data to calculate the aggregated variable at country level

Transfer service coverage in LAC decreased to 28.2% from the 37.9% registered in EVAL 2002, although the inclusion of new countries like Brazil and Colombia improved the representativeness of the statistic to a large degree. The countries with the highest transfer coverage

in the region are Belize (84.6%), Chile (63.3%), and Brazil (41.9%). It is expected that the development of more efficient management systems will lift this indicator over the next decade.

EVAL 2010 estimated that the coverage of transfer service for collected waste in LAC decreased from 37.9% in 2002 to 28.2% in 2010.

In general, the adoption of regional structures is leading to the greater use of transfer services by municipalities.

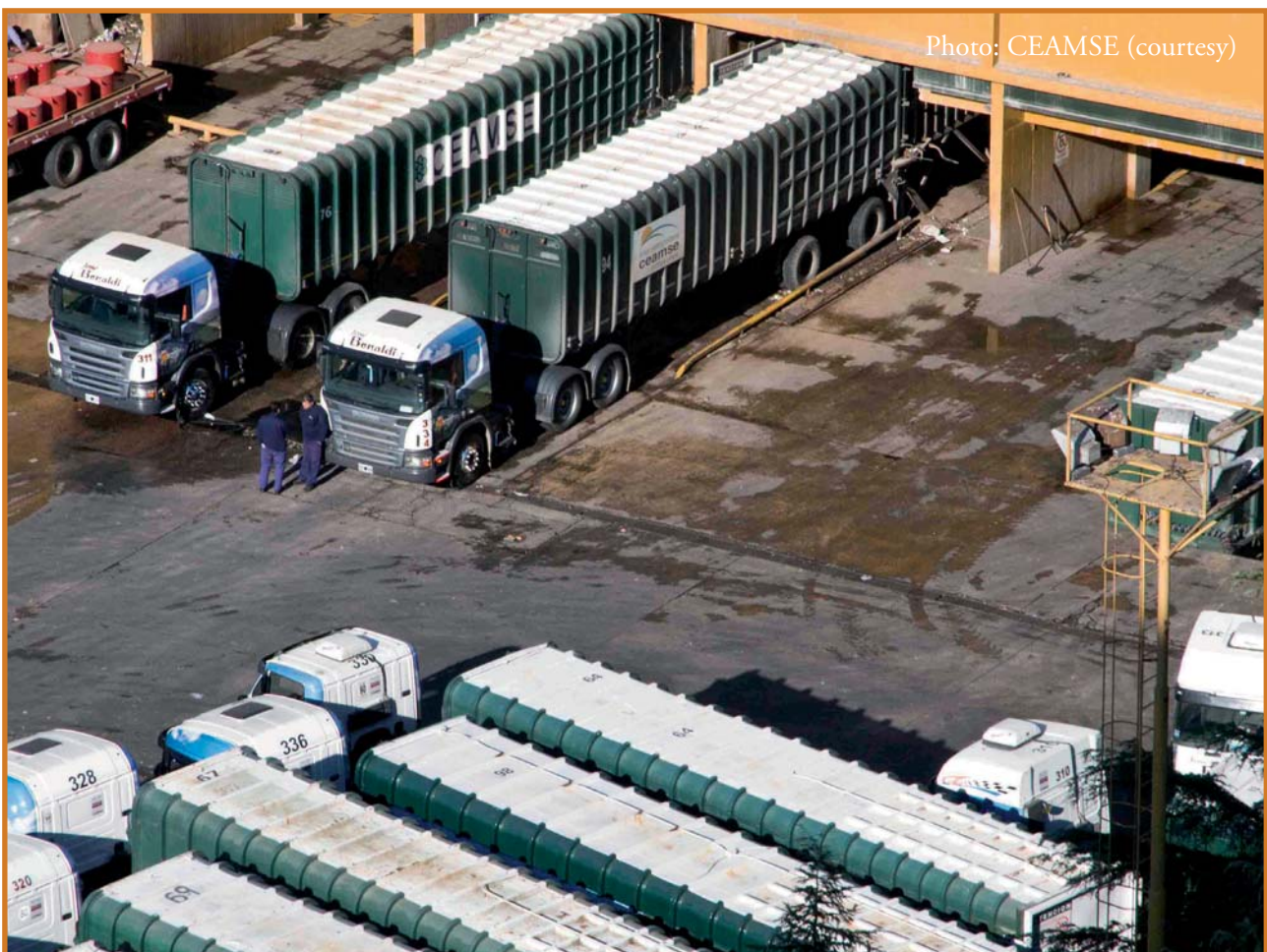


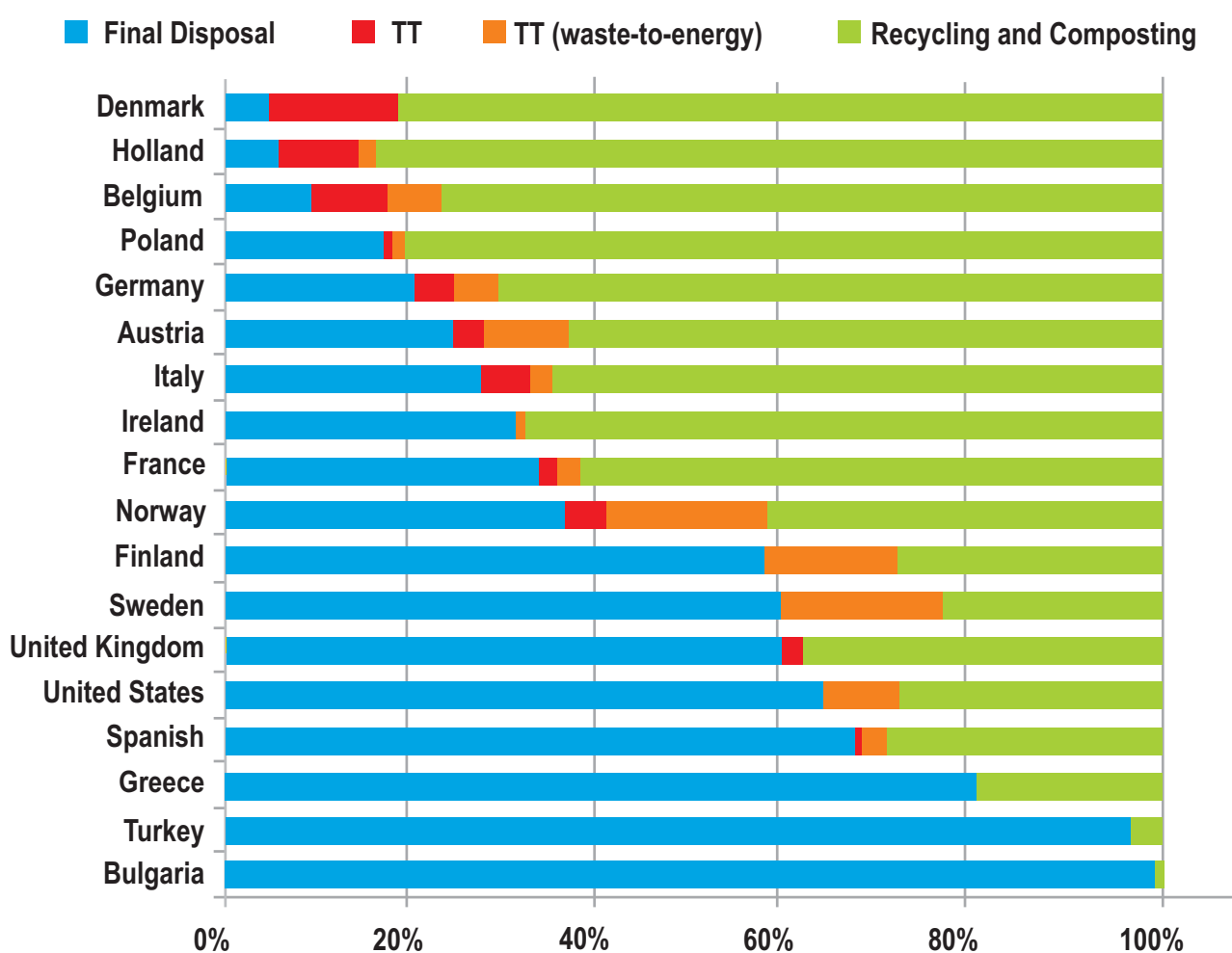
Photo: CEAMSE (courtesy)

## TREATMENT SYSTEMS

The principal alternatives for waste treatment prior to final disposal can be classified as composting, recycling, and thermal treatment, including in some cases tech-

niques to generate energy from waste. Even though these activities are emerging in LAC, they are widely used in developed countries. As can be seen in Figure 26, in 2006, several European countries were already treating a high percentage of their waste, and, in several cases, final disposal was necessary for only a relatively small portion of the waste generated and collected..

FIGURE 26: TREATMENT OF SOLID WASTE IN EUROPE AND THE UNITED STATES –2006



Source: Based on information from EUROSTATS, European Commission: Energy, transport and environment indicators, 2008, and online information from Columbia University's Earth Engineering Center (<http://www.seas.columbia.edu/earth/recycle/>).

Note: U.S. values correspond to 2004.



## RECYCLING

Waste comprised of materials such as paper, cardboard, glass, different types of plastics, wood, and metals, among others, can be separated out and reused through different types of treatment, making it possible to reduce municipal waste and save resources in both the management of solid waste and in the production processes of manufacturing companies.

The separation and recovery of recyclable materials is not practiced on a large scale in the region; there are very few countries that have official sorting plants and employ recycling as a common practice in municipal management systems. The majority have isolated programs where municipalities, NGOs, and organizations of diverse natures encourage citizens to separate out recyclables and turn them in. These efforts are often supported by companies that use the recyclables as raw materials for their production processes. In the region, it is the informal sector that leads the effort to sort and recover recyclable waste. Even in the best of cases, such as the recycling of aluminum cans in Brazil, it is estimated that 50% of the recyclable cans are collected by the “catadores,” while the other half is collected by supermarkets, schools, companies, and philanthropic groups.

It is estimated that only 2.2% of municipal waste is officially recovered and recycled in LAC<sup>35</sup>. Nonetheless, some countries and cities have started to make inroads in this area. Mexico reports that 10% of its urban solid waste is recycled and the Metropolitan Region of Santiago, Chile, has, over the course of the decade, increased its recycling rate from 0% to more than 12%<sup>36 37</sup>.

Other countries have had success in recovering and recycling specific materials from general municipal waste. Paper and cardboard are recovered and recycled in the

majority of countries, with relatively high rates (tons recycled per tons produced) in some: 57% in Colombia (ranking 18th worldwide), 50% in Chile, 44% in Brazil, and 40% in Ecuador<sup>38</sup>. Brazil has achieved high recycling rates for many other materials that are in strong demand by industry, such as: 87% for aluminum cans (making it the leader in countries where recycling is voluntary), 70% for tin cans, 45% for glass bottles, and 51% for PET containers. Even with these high recycling rates, recovered materials represent less than 1% of Brazil’s total waste<sup>39</sup>.

In recent years, HSW has included more electronic waste, also known as e-waste or waste from electrical and electronic devices (WEEE). It is important to note that due to accelerated technological advances these devices are soon made obsolete and promptly become waste. Thus, with their useful life behind them, cell-phones, batteries, monitors, computers, calculators, video game consoles, telecommunications equipment, and other devices are converted into e-waste; as a result, e-waste generation is increasing three times faster than HSW<sup>40</sup>. There are some government initiatives in Chile, Mexico, and Costa Rica, among other countries, that show an emerging interest in e-waste. However, the great speed with which people renew these products, the near total absence of a formal recovery and recycling system, and the existence of an informal sector that uses sorting and recovery methods that, in many cases, are highly dangerous to human health and the environment, demand greater action on the part of authorities and the elevation of this issue to the highest priority.

There are few cities in Latin America where sorting-at-source and recycling are practiced in a formal way. Research in Colombia found that 40 municipalities (3.6% of the total) reported having implemented sorting-at-source programs<sup>41</sup>. According to a recent survey in

35 PAHO, 2005. *Regional Report on the Evaluation of Municipal Solid Waste Management Services for Latin America and the Caribbean*. Washington, DC: Pan American Health Organization.

36 Gutiérrez Avedoy, 2006. *Diagnóstico Básico para la Gestión Integral de Residuos*. Mexico City, Mexico. National Institute of Ecology. Department of the Environment and Natural Resources.

37 CONAMA 2007. *Estadísticas de Reciclaje en la Región Metropolitana*. <http://www.conama.cl/rm/568/article-30025.html>.

38 PAHO, 2005. *Regional Report on the Evaluation of Municipal Solid Waste Management Services for Latin America and the Caribbean*. Washington, DC: PAHO.

39 ABRELPE, 2004. *Panorama dos Solid residue no Brazil*. Sao Paulo, Brazil. Associação Brasileira de Companies de Limpieza Pública e Residuos Especiais.

40 RECYCLA Chile S.A. *Electronic Waste: the garbage of the XXI century*. Santiago, Chile, October 2007. RECYCLA Chile, <http://recycla.cl/en/main/noticia/80>

41 PGN, 2004. *Informe de Seguimiento: Gestión de Residuos Sólidos en Colombia*. Bogota, Colombia. Attorney General of the Nation.



Brazil, it is estimated that 405 municipalities (7.3% of the total) already practice selective collection and that 26 million inhabitants (more than 15% of the urban population) participate in these programs<sup>42</sup>. Curitiba, for example, reported that selective collection is available for all households and that in 2004 a total of 1,770 tons per month of recyclable materials were collected at a cost of US\$76 per ton<sup>43</sup>.

Experience demonstrates that, in order to increase the practice of sort-at-source in households and selective collection—assuming that there exists demand in the market as well as willingness on the part of citizens to pay the additional costs—the first requirement is clear municipal leadership in the planning and implementation process and, second, greater community participation, which, in turn, requires effective and frequent public education campaigns on the Three R's (reduce, reuse, recycle).

In general, the countries of LAC do not have national recycling policies and strategies that address and formalize the existence and development of the sector; if they do have them, they are difficult to implement. On the other hand, the informal recycling of solid waste is a generalized practice; consequently, municipalities of the region do not have reliable statistics on the amount of material recovered or the number of people engaged in this activity. Further discussion on the informal nature of the sector and community participation in the management of solid waste in LAC will be provided in a later section.

## COMPOSTING

In the countries of LAC, despite organic material representing a high percentage of the solid waste generated, the practice of composting is not proportionally developed. In general, the lack of regional guidance

on the application of appropriate technologies and of quality standards for the final product stymies its development. The compost and humus obtained through the controlled decomposition of organic waste reduces the amount of solid waste deposited in sanitary landfills and, thus, the leachate produced, while at the same time providing organic material to prepare soil for agricultural production and to landscape parks and green spaces in cities. This organic material can be of significant benefit to areas of low fertility in the region.

Composting had been practiced in the region for several decades in the past. There are plants that date from more than 60 years ago in Mexico, El Salvador, and Ecuador. Later, starting in the 1970s, more modern plants were installed in some cities of Mexico, Venezuela, and Brazil. Most of them have sorting conveyors to separate out recyclable products and a mechanized system of aerobic biodegradation through piling up and tumbling the waste or through rotary drum anaerobic digesters. Few plants survived, due to operational and financial problems (in general, operational costs had not been evaluated and were substantially higher than what the municipalities could afford). Even in successful projects, such as the large-scale plants of Vila Leopoldina and Sao Mateus in Sao Paulo, an infusion of subsidies were required to continue operations.

Market demand is among the critical points to consider when evaluating composting projects. For that purpose, it is necessary to undertake research to determine the local demand for compost and the quality required to satisfy local users, and to realistically evaluate market prices and the potential to produce compost at a cost that ensures commercial viability of the project. The compost produced should not only meet the quality needs of the market, but should also satisfy public health and environmental standards. Consequently, countries that wish to promote composting should establish appropriate rules and regulations for the production and use of compost.

It is also important to use appropriate technology. Highly-mechanized composting technology for mixed waste is expensive and difficult to operate. Low-cost solutions that consistently produce high quality compost generally require the use of specifically-selected organ-

<sup>42</sup> CEMPRE 2008. *A Evolução da Coleta Seletiva e Reciclagem de Resíduos Sólidos Urbanos no Brasil. Compromisso Empresarial para Reciclagem (CEMPRE)*.

<sup>43</sup> ABRELPE, 2004. *Panorama dos Resíduos Sólidos no Brasil*. Sao Paulo, Brazil. Associação Brasileira de Companias de Limpeza Pública e Resíduos Especiais.

ic waste (for example, garden or green waste, organic waste from food markets, and sorted-at-source household food waste) rather than mixed waste, and of basic pile-tumbling or forced-air technology (which are commonly used by green composting plants in the U.S. and Europe).

In summary, composting should not be seen merely as a solid waste management solution, but also as an economic enterprise that operates in a competitive market, and should, therefore, be driven by conditions of demand and not simply by product production capacity. Fortunately, financing through carbon credits is available for composting projects (by applying the AM0025 methodology for “avoided emissions from organic waste through alternative waste treatment processes” or AMS II for small-scale projects), providing an additional source of funding to help individual projects become commercially viable.

Some of the few examples of currently functioning composting plants are found in the large cities of Mexico, like Guadalajara, Merida, Naucalpan, and Mexico City. Eight plants of different characteristics and capacities operate in Mexico City, one of which is run by the

national government and can process 200 tons per day of organic waste from the floral and vegetable section of the Central Market; the other seven are smaller and located in the boroughs of Alvaro Obregon, Azcapotzalco, Cuajimalpa, Gustavo A. Madero, Miguel Hidalgo, Tlahuac, and Xochimilco. In El Salvador there are pilot projects in some municipalities with less than 5,000 people, and in Argentina the aerated-static-pile method is being used and is lowering the cost of compost production.

The commune La Pintana, located south of Santiago, Chile, provides an example of comprehensive waste management that begins with sorted waste collection and where community education, recycling, energy recovery, and composting all play important roles. The municipal Environmental Management Administration (DIGA) implemented an extensive series of actions, some of which are highlighted in the box. It is worth noting that through the composting and vermicomposting programs, the commune reduced 30 tons per day from its waste load of 150 tons per day—a 20% reduction.



Photo: CEAMSE (courtesy)

## SORT-AT-SOURCE, RECYCLING, COMPOSTING, AND ENERGY RECOVERY IN LA PINTANA, SANTIAGO, CHILE

La Pintana is a commune located south of Santiago, Chile, with a population of approximately 200,000, of which 6% is Mapuche, making it home to the largest Mapuche community in the metropolitan Santiago area. The municipality was established in the latter half of the 1980s with the objective of concentrating low-income populations and groups that were politically problematic for the government of the time. The commune's socio-economic indicators were among the lowest registered in Chile, but over the past few decades they have improved as a Sustainable Development Plan has been implemented; this plan has had notable success in overcoming poverty and in improving the quality of life of the municipality's inhabitants.

This plan includes a sort-at-source program, which asks residents to: a) separate out vegetable waste in a special container provided to them and hand the separated waste to an exclusive vegetable waste collection vehicle (DIGA collects about 30 tons per day of vegetable waste from 17,000 households where 45,000 people live, b) hand paper, cardboard, and metallic waste to the waste pickers that accompany the collection vehicle, and c) drop off glass, plastic bottles, and Tetra Pak containers at designated green points throughout the commune where PET and glass recycling campaigns are run in collaboration with charity organizations. In addition to these selective collection activities, DIGA undertakes a wide series of activities associated with community education, recycling, and both composting and energy recovery.

DIGA operates a composting plant that processes 14 tons per day of pruning and vegetable waste received through the sort-at-source program. As part of these activities, two community pilot projects have been developed to promote home composting; through these programs, individual composters have been installed in 250 homes throughout the commune, reducing the waste collected from these households.

DIGA also operates a vermicomposting plant, making use of an innovative "intensive livestock" model (where the livestock are California red worms) to treat vegetable waste and obtain humus. This activity reduces 16 tons per day of vegetable waste that has been collected through the sort-at-source program. DIGA uses the compost and humus it obtains for an ecological orchard program, with a greenhouse and an organic urban orchard to produce fruits and vegetables for individual consumption.

As part of the sort-at-source program, DIGA also implemented an initiative to separate out cooking oils; residents are given a collection jug that is picked-up once a month. DIGA takes the used oil and transforms it into biodiesel through its own production process. This project received the national innovation award AVONNI 2010 in the environmental category.

Other recycling activities in La Pintana include the construction of gardens (using flower pots made of used tires) and training provided by an urban furniture workshop designed to make



use of trees that have been cut down for various reasons in the commune and the development of micro-enterprises. DIGA also has a mushroom garden built from used tires that receives the waste generated by the urban furniture workshop and that is used to cultivate edible mushrooms (oyster mushrooms).

Various additional activities take place in La Pintana, such as the cultivation of shiitake mushrooms, a display of an energy efficient house, the use of a solar dehydrator and a solar cooker, and classes at the Ruca Verde Community Training Center. There is also a constructed wetland where water from an exterior ditch is treated with plants and aquatic species to purify it so that it may then be used to water public spaces.



## THERMAL TREATMENT

Thermal treatment is not usually practiced in LAC; only Brazil and some Caribbean islands have experience with USW incinerators. According to the National Survey of Basic Sanitation (PNSB), there are 34 of them in all of Brazil, although more than half of these incinerators are in cities with fewer than 50,000 inhabitants that do not have the capacity to equip the incinerators with an adequate emissions control system. Barbados, with private financing, acquired a small incinerator with capacity to burn one ton of waste per day. Other countries with incinerators include Bermuda (which has a waste-to-energy thermal treatment plant that dates from 1994), Martinique (2002), and Saint Barth (2001).

In the rest of Latin America and the Caribbean, the use of waste incinerators is limited to hazardous waste; in some cases, they are used by health services, where emission standards are on par with those of industrialized countries, which is not the case for regional authorities. Some hazardous wastes, such as burnt oil, rags permeated with fuel, and tires, among others, are often used as alternative fuel for the cement kilns of the region, reducing the use of virgin fuel.

In recent years, the use of different waste-to-energy (WtE) incineration technologies has spread throughout the developed world. According to Columbia University's Earth Engineering Center, in 2007, there were nearly 90 active WtE plants in the U.S. and approximately 400 in the countries of Europe combined, which process a combined total of 77 million tons of waste and generate nearly 50 TWh of electricity per year<sup>44</sup>. The growing cost of waste treatment and final disposal, together with rules that incentivize the use of new technologies to reduce contamination, have been the deciding factors that have led to this development. However, in LAC there has not been a large-scale use of WtE thermal treatment technology for USW management; it is in use only in the previously mentioned Caribbean nations, although pre-feasibility studies are underway, especially in Brazil and Chile.

The reasons for the lack of WtE projects have historically been: a) the high level of capital investment needed for technology that is highly complex and requires highly qualified personnel to operate, b) the low calorific value of the waste generated in LAC, which includes a high percentage of wet food waste, is not conducive to the optimal productivity of the technology (it is only plausible to achieve the ideal calorific values of 6 or 7 MJ/Kg in large cities with high levels of commercial and industrial development), and c) the difficulty of supplying a steady amount of combustible waste, with weekly variations not exceeding 20%<sup>45</sup>. Additionally, the monopolistic character of the energy market in various countries of the region creates resistance to the establishment of a sales price that would make these projects economically viable.

Presently, the governments of the region are considering this SW treatment option, given the saturation of the various sanitary landfills used by the large cities of LAC, the high social and political costs of designating additional lots for new adequate final disposal solutions, the availability of new sources of financing to develop alternative energy solutions, and the advances made in WtE thermal treatment technologies in terms of modern techniques that are more efficient and do not contaminate. Decisions should be based on the results of feasibility studies on a case-by-case basis.

<sup>44</sup> The energy measure 50 TWh is equivalent to 50,000,000 MWh.

<sup>45</sup> Rand, T., J. Haukohl and U. Marxen. (2000). *Municipal Solid Waste Incineration: A Decision-Maker's Guide*. Washington, DC: The World Bank.

Waste treatment becomes more feasible when waste is separated out. In LAC, recycling in sorting plants is not currently a formalized practice. Informal recycling, on the other hand, is widely practiced, but the amounts recycled are not known.

Composting, practiced in numerous occasions in LAC, could receive a strong boost from the carbon market.

The practice of SW incineration is practically nonexistent in LAC, but more efficient WtE thermal treatment technologies could make this a viable treatment option in larger cities; the matter should be studied on a case-by-case basis

## FINAL DISPOSAL

Final disposal of USW in LAC continues to be one of the most difficult USW management problems to resolve in the region. Sanitary landfills represent the most widely used method to dispose of solid waste in an economical and environmentally safe manner. Even so, the adequate final disposal of waste in sanitary landfills covers only 54.4% of the population; strictly speaking, the semantic differences of the term among countries could make this an overestimation.

The term “sanitary landfill” with respect to the confinement of municipal solid waste is understood to mean the spacing, placement, and compacting of waste on an impermeable bed and its burying with earth or another inert material on at least a daily basis in order to control the proliferation of vectors and to adequately control gases and leaching so as to avoid environmental contamination and protect the health of the population. A sanitary landfill is the product of an engineering project, with controlled access, weighing, and no waste pickers on site.

The term “controlled dumpsite” has begun to be used assiduously in the last ten years to refer to open air

dumps that are controlled to some extent or to sanitary landfills that have been gradually abandoned over the years and have lost the traits necessary to consider them as such. This causes confusion among the population of the municipality, which, thinking that a dumpsite is a sanitary landfill, does not support this form of final disposal. In LAC, 18.5% of the population is covered by the use of controlled dumpsites.

Open air dumpsites represent one of the most highly contaminating SW management practices; they are detrimental to both the environment and public health. The term refers to sites where waste is dumped indiscriminately, without any care or treatment. In LAC, 23.3% of the population is covered by the use of open air dumpsites. In both controlled and open air dumpsites, it is common to find people (men, women, and children) working in unhealthy conditions as waste pickers, separating out the recyclable materials.

The case of Paraguay is illustrative of this problem. Through pressure from the national legislature (which penalizes the illegal processing of waste), 21 preliminary investigations are underway (administrative criminal proceedings) on municipal dumpsites and 13 on clandestine dumpsites, scrutinizing the actions of public officials in the municipalities where the dumpsites



are located for improper final disposal. In their defense, the officials argue that they lacked the resources to manage improvements of the infrastructure and operations at these sites.

Other inadequate and highly contaminating practices of SW final disposal in LAC include open air burning

(covering 2% of the LAC population), disposal in bodies of water (covering 1.8% of the LAC population), and disposal as animal feed and other practices that are not recommended. All told, the waste of 27.1% of the LAC population is disposed of without any precautions, being burned or used as animal feed.

TABLE 29: FINAL DISPOSAL METHODS IN LAC (% OF POPULATION COVERED)

COUNTRY	SANI-TARY LAND-FILL	CON-TROLLED DUMPSITE	OPEN AIR DUMPSITE	OPEN AIR BURNING	OTHER (IN BOD-IES OF WATER, AS ANIMAL FEED, ETC.)
Argentina	64.7	9.9	24.6	0.8	0
Belize	0	0	85.2	14.8	0
Bolivia	44.7	16.4	10.6	1.9	26.3
Brazil	55	20.2	24.5	0	0.3
Chile	81.5	13.8	4.0	0	0.7
Colombia	81.8	4.1	12.5	1.2	0.3
Costa Rica	67.5	23.5	9.1	0	0
Dominican Rep.	33.7	24.5	31.6	10	0.2
Ecuador	30.2	46.3	20.5	0.8	2.1
El Salvador	78.2	0	13.8	7.3	0.6
Guatemala	15.4	9.6	69.8	0	5.1
Guyana	-	-	-	-	-
Honduras	11.3	59.9	15	13.8	0
Jamaica	0	100	0	0	0
Mexico	65.6	12.1	12.4	5.9	4
Nicaragua	0	19.6	59.3	7.5	13.6
Panama	41.7	16	23.4	4.7	14.2
Paraguay	36.4	40.2	23.4	0	0
Peru	43.5	10.6	45.3	0.6	0
Uruguay	3.8	68.2	18.1	0	9.8
Venezuela	12.9	40.9	45.6	0.5	0
LAC	54.4	18.5	23.3	2	1.8

Source: EVAL 2010 software  
- Information not available

When analyzing the per country data, in addition to the high sanitary landfill coverage in Colombia (81.8%) and Chile (81.5%), it is worth noting the 78.2% coverage attained by El Salvador, which likely reflects the impact of the government decree prohibiting the use of dumpsites by the end of 2007. On the negative side, the use of open air dumpsites is high in Belize (covering 85.2% of the population), Guatemala (69.8%), and Nicaragua (59.3%)<sup>46</sup>. The open air burning of waste and its disposal in bodies of water and as animal feed are

especially troubling in Bolivia, Belize, Nicaragua, Honduras, and Panama.

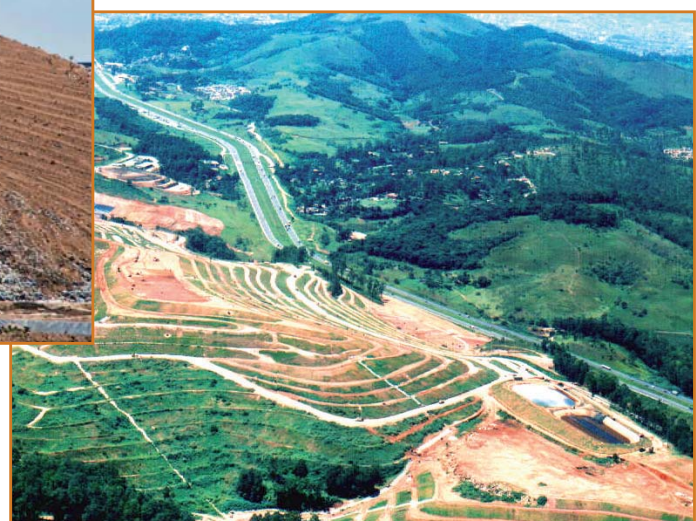
With respect to the population size of the various municipalities, a direct relationship was generally found between number of inhabitants and adequate final waste disposal; at the same time, an inverse relationship was found between population size and final disposal in open air dumpsites. Tables 30 and 31 provide detailed information on sanitary landfill and open air dumpsite coverage by population size.



Photo: Eng. Pilar Tello (courtesy)



Photo: CEAMSE (courtesy)



<sup>46</sup> Currently, an IDB-supported project is being implemented in Belize to provide for the final disposal in a sanitary landfill of the general waste of Belize City, the country's most populous municipality.

TABLE 30: SANITARY LANDFILL COVERAGE BY POPULATION SIZE IN LAC (%)

COUNTRY	MICRO	SMALL	MEDIUM	LARGE	MEGA	OVERALL
Argentina	9.4	24.5	62.7	89.4	..	64.7
Belize	0	-	0	-	..	0
Bolivia	0	0	26	86.2	..	44.7
Brazil	35.2	46.3	45.5	65.3	100	55
Chile	50.7	54.5	90.5	100	..	81.5
Colombia	65.1	56.5	78	100	100	81.8
Costa Rica	0	63.1	69.8	100	..	67.5
Dominican Rep.	0	0	24.6	81.2	..	33.7
Ecuador	15.4	13.5	15.9	53.1	..	30.2
El Salvador	76.9	82.4	74.9	85	..	78.2
Guatemala	0	0	7.8	85	..	15.4
Guyana	-	-	0	-	-	*
Honduras	0	13.7	29.3	0	..	11.3
Jamaica	0	0	0	0	..	0
Mexico	33.6	29.4	76.9	95.6	0	65.6
Nicaragua	-	0	0	0	..	0
Panama	0	0	39.1	100	..	41.7
Paraguay	28.9	28.6	30	100	..	36.4
Peru	0	0	5.4	55.7	100	43.5
Uruguay	0	0	26.8	0	..	3.8
Venezuela	0	0	12	21.5	..	12.9
LAC	33.4	34.4	49.3	73.7	78.3	54.4

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available

..No population of this size

\*Not enough data to calculate the aggregated variable at country level

TABLE 31: OPEN AIR DUMPSITE COVERAGE BY POPULATION SIZE IN LAC (%)

COUNTRY	MICRO	SMALL	MEDIUM	LARGE	MEGA	OVERALL
Argentina	75.4	57.8	25	5.2	..	24.6
Belize	80	-	90	-	..	85.2
Bolivia	50.8	40.2	6.2	0	..	10.6
Brazil	62.8	44.7	15.7	8.3	0	24.5
Chile	1.5	20.7	0	0	..	4.0
Colombia	21.4	36.9	9.6	0	0	12.5
Costa Rica	23.2	25.1	0	0	..	9.1
Dominican Rep.	71.3	69.4	21.9	0	..	31.6
Ecuador	73.4	46.5	23.7	0	..	20.5
El Salvador	11.1	10	17.5	10	..	13.8
Guatemala	100	100	53.4	0	..	69.8
Guyana	-	-	100	-	-	*
Honduras	40.2	19.1	0	0	..	15
Jamaica	0	0	0	0	..	0
Mexico	39.7	40.5	7.2	0.2	0	12.4
Nicaragua	-	75.9	71.1	10	..	59.3
Panama	74.7	47.6	11.5	0	..	23.4
Paraguay	27.8	14.3	33.3	0	..	23.4
Peru	53.5	89.8	84.8	18.5	0	45.3
Uruguay	28.2	27	36.6	0	..	18.1
Venezuela	100	61.3	45.1	35.5	..	45.6
LAC	51.3	46.5	22.2	6.3	-	23.3

Source: EVAL 2010 software.

Micro: ≤15,000 inhabitants; Small: 15,001 – 50,000 inhabitants; Medium: 50,001 – 300,000 inhabitants; Large: 300,001 – 5,000,000 inhabitants; Mega > 5,000,000 inhabitants

- Information not available

..No population of this size

\*Not enough data to calculate the aggregated variable at country level

Comparing estimated values from EVAL 2002 and EVAL 2010 (see Figure 27), a significant increase in sanitary landfill coverage is notable, from 22.6% to 54.4%. This increase can be explained in part by the slight re-conversion of controlled dumpsites (their use decreased from 23.7% to 18.5%), but it seems to be mainly the result of a marked decrease in the use of open air dumpsites, from 45.3% to 23.3%, which leads to the assumption that they are being closed and re-

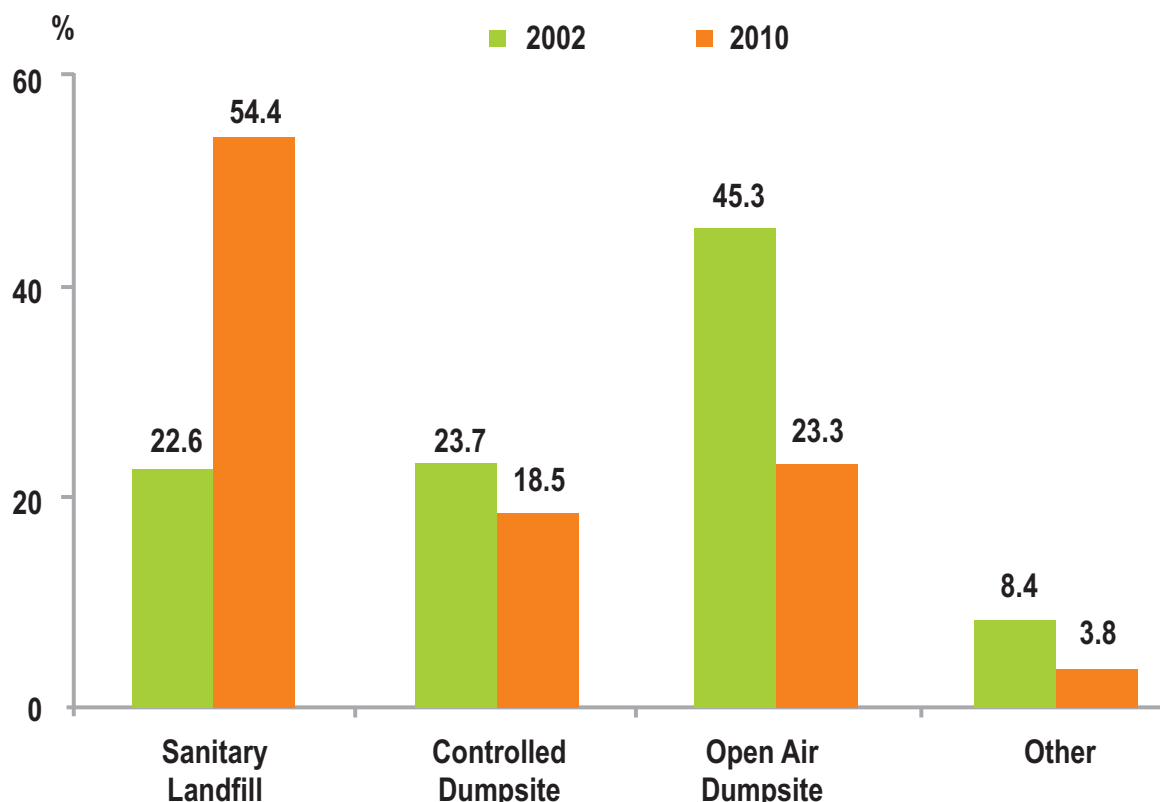
placed with sanitary landfills. To illustrate, huge reductions in the use of open air dumpsites were observed in Colombia (from 54% to 12.5%), Brazil (from 59.6% to 24.5%), and Mexico (from 40% to 12.4%), which explains to a large extent the aggregate values for LAC.

In the case of Colombia, the government successfully launched the “Colombia without Open Air Dumps” plan in 2005, which resulted in a noteworthy reduction in open air dumpsites. In the case of Mexico, although

there was not a specific plan to attack this problem, national and state rulemaking made progress in this area, and various municipalities with large populations showed the political will to tackle the problem, either by constructing new sanitary landfills or improving con-

trolled dumpsites. The cities of Puebla and Queretaro are examples of the latter. The same phenomenon occurred in Brazil in states such as Sao Paulo and cities such as Rio de Janeiro and Porto Alegre.

FIGURE 27: COVERAGE OF FINAL DISPOSAL METHODS IN LAC – 2002/2010



Source: EVAL 2010 software

Beyond the specific reasons previously identified, in general terms, the decrease in the use of dumpsites from 2002 to 2010 and the more than doubling of the population covered by sanitary landfills are noteworthy achievements that were the result of two additional factors. First, the region saw an increase in projects to utilize biogas from landfills due to the availability of financing through carbon certificates. This mechanism provides annual payments for methane emission reductions. This financing is based on results, which means that it becomes available only when projected methane emission reductions are effectively achieved; this is determined by a verifiable monitoring of the project's

performance. Consequently, carbon certificate financing motivates sanitary landfill operators to introduce substantial design and operational improvements aimed at generating and collecting more biogas (such as leachate collection and control systems, better daily and final coverage, improved compacting, and operational monitoring, among others). In simple terms, only a well-designed and operated sanitary landfill can produce methane emission reductions and receive monies through carbon certificates.

The second factor is the already mentioned tendency toward larger regional dumpsites; this option is increas-



ingly chosen because of the significant economy of scale it provides, which reduces the cost per ton of the disposed waste. Additionally, larger dumpsites make it more feasible to efficiently generate and collect biogas, which in turn makes it easier to attract more carbon fi-

nancing at a lower cost. Further, regional sanitary landfills make it much easier to enforce regulations more efficiently, leading to the closure of open air dumpsites and introducing improvements in the supervision of operations and the maintenance of records.

## REGIONAL SANITARY LANDFILLS AND BIOGAS IN MONTERREY, STATE OF NUEVO LEON, MEXICO

As previously mentioned (see page 68), SIMEPRODESO operates three transfer stations and 14 regional sanitary landfills throughout the State of Nuevo Leon, Mexico. One of these, Salinas Victoria, located north of the Monterrey metropolitan area, includes a recycling plant with capacity to process 1,000 tons of mixed waste per day and receives 750 trucks transporting 4,500 tons of waste daily.

In the enclosed area of the Salinas Victoria landfill, SIMEPRODESO and the private company Bioelectric of Monterrey created the company Bioenergy of Nuevo Leon to operate a power plant that generates electricity with biogas captured from the landfill; Bioenergy of Nuevo Leon has been running this operation since September 19, 2003. Following completion of the project's first two phases (Monterrey I and II), the plant's installed capacity is 12.72 Mw; phases three and four will increase this capacity to 17 Mw, making Bioenergy of Nuevo Leon's plant, the third largest in the world in terms of generation capacity.

As of February 2010, nearly 85,000 tons of methane gas emissions have been avoided thanks to the plant's operation, which has generated 409,000 MWh of electricity. The energy generated has been used for public lighting in the City of Monterrey and its greater urban area, including the municipalities of San Nicolas de los Garza, Guadalupe, Apodaca, Santa Catarina, General Escobedo, and San Pedro Garza Garcia, and also to provide power for two subway lines, the Government Palace, Monterrey's Macropiazza, Nuevo Leon's Family Assistance System (DIF), and the water and drainage system of the metropolitan area of the City of Monterrey.



Eval 2010 estimated that the waste of 54.4% of the inhabitants of LAC are disposed of in sanitary landfills, a significant increase from the 22.6% registered in Eval 2002. At the same time, the use of open air dumpsites decreased from 45.3% to 23.37%.

The engines that drove this notable improvement in SW final disposal are new regulations, the political will of governments, carbon market financing, and the adoption of regional final disposal methods.

## SORTING AND RECYCLING BY THE INFORMAL SECTOR

The population segment engaged in informal USW management activities lives in socio-economic conditions of extreme poverty. These conditions are characterized by precarious housing, overcrowding, and the lack of services. As to education, schooling levels are

very low and the dropout rate for children and adolescents is high. It is a sector marked by social exclusion.

Known as “pepenadores” in Mexico, “catadores” in Brazil, “cartoneros” and “cirujas” in Argentina (depending on whether they do the sorting in the streets or at the dumpsites), “cachureros” in Chile, “chamberos” in Ecuador, “cirujas” in the Dominican Republic, “hur-gadores” in El Salvador, and “segregadores” in Peru, throughout the cities of LAC there are a great number of people who collect, sort, and commercialize materials from urban solid waste as their primary means of income.



PAHO estimated the number of people in the informal SW management sector at 500,000 in 2005<sup>47</sup>. EVAL 2010 estimated 8.57 waste pickers per 10,000 inhabitants in LAC, which adds up to slightly more than 400,000 for the entire region, coinciding with the PAHO 2005 estimate. It should be noted that this population is constantly changing and difficult to count. Some estimates place the number at 3.8 million people<sup>48</sup>. Further, the scarcity of information available

in the municipalities made it impossible to gather complete information; therefore, the EVAL 2010 estimate may be considered conservative. Tables 32 and 33 show the EVAL 2010 estimates on the number of waste pickers per 10,000 inhabitants and in total for the different countries of LAC:

<sup>47</sup> PAHO: Report on the Regional Evaluation of Municipal Solid Waste Management Services in Latin America and the Caribbean, 2005.

<sup>48</sup> Medina, Martin: Community-Based Recycling Initiatives, Grassroots Development; 2008.

TABLE 32: NUMBER OF WASTE PICKERS  
PER 10,000 INHABITANTS IN LAC

COUNTRY	GROUPED IN OR- GANIZA- TIONS	(A) AT SORT- ING PLANTS	(B) IN COL- LECTION SERVICES	(C) AT DUMP- SITES	(D) IN OTHER PLACES	SUBTOTAL (A+B+C+D)
Argentina	3.85	1.91	14.68	3.19	0.71	20.49
Belize	-	-	-	11.73	-	11.73
Bolivia	1.87	0	0.57	1.67	4.31	6.55
Brazil	1.77	1.19	0	2.22	1.7	5.11
Chile	0	0	0.39	0.46	-	0.85
Colombia	3.88	5.74	14.51	*	9.73	29.98
Costa Rica	*	0.43	*	*	*	*
Dom. Rep.	*	*	*	7.06	*	7.06
Ecuador	*	1.23	1.42	2.21	*	4.86
El Salvador	*	*	*	-	2.39	*
Guatemala	0	2.12	0.09	0.67	*	2.88
Guyana	-	-	-	*	-	*
Honduras	0.81	0.16	0.35	0.25	0.46	1.22
Jamaica	-	-	-	-	..	-
Mexico	0.93	0.57	0.47	0.42	1.84	3.3
Nicaragua	*	8.03	2.51	1.81	*	12.35
Panama	*	9.77	3.66	9.76	-	23.19
Paraguay	0	1.64	0.44	3.2	2.84	8.12
Peru	0.22	0.11	1.46	0.86	1.8	4.23
Uruguay	0.51	3.3	15.11	2.74	2.99	24.14
Venezuela	0	0	0	2.07	*	2.07
LAC	1.61	1.47	2.74	1.82	2.54	8.57

Source: EVAL 2010 software.

- Information not available

\* Not enough data to calculate the aggregated variable at country level



TABLE 33: TOTAL NUMBER OF WASTE PICKERS IN LAC

COUNTRY	GROUPED IN ORGA- NIZATIONS	(A) AT SORTING PLANTS	(B) IN COLLEC- TION SERVICES	(C) AT DUMP- SITES	(D) IN OTHER PLACES	SUBTOTAL (A+B+C+D)
Argentina	14,465	7,176	55,156	11,985	2,668	76,985
Belize	-	-	-	192	-	192
Bolivia	1,248	-	380	1,115	2,877	4,372
Brazil	29,930	20,123	-	37,540	28,747	86,409
Chile	-	-	595	702	-	1,296
Colombia	13,486	19,951	50,434	*	33,820	104,204
Costa Rica	*	129	*	*	*	*
Dom. Rep.	-	-	-	2,355	-	2,355
Ecuador	*	1,134	1,310	2,038	*	4,482
El Salvador	*	*	*	-	952	*
Guatemala	-	1,508	64	476	*	2,048
Guyana	-	-	-	*	-	*
Honduras	318	63	138	98	181	479
Jamaica	-	-	-	-	-	-
Mexico	8,009	4,908	4,047	3,617	15,845	28,417
Nicaragua	-	2,680	837	604	-	4,121
Panama	*	2,564	960	2,561	-	6,085
Paraguay	-	651	175	1,271	1,128	3,225
Peru	499	250	3,312	1,951	4,084	9,597
Uruguay	159	1,029	4,713	855	933	7,529
Venezuela	-	-	-	5,612	*	5,612
LAC	75,470	68,907	128,439	85,314	119,064	401,725

Source: EVAL 2010 software and information available online from the United Nations Population Division.

- Information not available

\* Not enough data to calculate the aggregated variable at country level

Informal recyclers work under dangerous, unsanitary conditions, exposed to high levels of job insecurity without any kind of occupational safety control or access to social services. Their work shifts are long and their methods of work rudimentary. They do not use any personal protective equipment, working directly with their hands and through intermediaries that set prices and the forms of payment<sup>49</sup>.

In some countries, the waste collected by the informal recyclers in the streets is transported to an informal storage center (this is sometimes someone's house) where they are classified so that they can be later sold to the intermediaries that commercialize recycled materials. The materials that are not commercialized (rejected by the intermediaries) tend to be abandoned in an indiscriminate manner, usually in drainage ditches and public roadways. In general, the involvement of an intermedi-

<sup>49</sup> Terraza, Horacio e Sturzenegger, Germán: *Dinámicas de Organización de los Recicladores Informales, Tres casos de estudio em América Latina*, 2010.



ary that provides storage and/or transportation implies the exploitation of these waste pickers who likely sell the sorted material at prices significantly below the market value. This leads to diverse social, environmental, and management problems. Municipalities have very limited experience in dealing with these problems and finding solutions for them. The formalization of these groups as part of the municipal management system is still an emerging practice.

A similar situation exists at open air dumpsites. In these cases, there exists a greater level of experience in terms of incorporating the informal groups into the comprehensive management system, since the problem was first faced where actions were intended to close dumpsites in order to establish sanitary landfills. Although the examples of success are few, the leading cause of failure, not only from the social perspective but also in the construction of infrastructure itself, has been identified as the lack of a program led by municipal authorities to incorporate the informal groups into the formal system.

Nevertheless, some groups of informal recyclers have managed to leave behind these unfavorable work conditions and, through their own initiative, have formed organizations of recyclers, cooperatives, unions, micro-enterprises, associations or other forms of organizing and formalizing their activities. It is estimated that in Latin America there are 1,000 such organizations disseminated throughout the region, more than in any other region of the world<sup>50</sup>. According to the numbers obtained in EVAL 2010, there are 1.61 waste pickers per 10,000 inhabitants that work under some form of organization, representing slightly less than 20% of total recyclers.

In Colombia, according to the recycling associations, recycling has been practiced for more than 60 years, with approximately 20,000 families subsisting through the recovery and commercialization of recyclable materials. Of these families, 30% are associated with the National Association of Recyclers (ANR) and 70% work independently. Further, EVAL 2010 estimated that there are 100,000 informal urban waste recyclers in Colombia, which makes it the Latin American nation with the greatest number of waste pickers, followed by Bra-

zil and Argentina. In general terms, according to ANR, the recyclers union is characterized by a low capacity to recover, store, and transform recyclables (infrastructure and equipment), which prevents it from adding value and increasing revenues. For this reason, its economic, financial, and organizational conditions are either deficient or nonexistent, which results in low to subhuman living conditions without health and welfare services, and no social and labor guarantees. This forces many to work through intermediaries.

In Brazil, in the late 1980s and early 1990s, associations of catadores such as COOPAMARE in Sao Paulo and ASMARE in Belo Horizonte began receiving the support of social movements, and civil society and religious organizations, which transformed them in strategic partners in the process of dialoguing with municipal governments<sup>51</sup>. More than the relevance they acquired through Brazil's recently-passed Law on Solid Waste, this growing importance was accompanied by significant regulatory changes, the most consequential of which includes passage of Decree 5,940/60, instituting selective collection in federal public organizations (totaling more than 10,000 entities) and delivery of the recyclable materials to organizations of catadores. The passage of Law 11,445/07 is another important positive regulatory development; it exempts catadores, associations, and cooperatives from the national contract licitation process for municipal selective collection programs. There are presently four municipal selective collection programs that involve a considerable number of organized catadores: 450 in Porto Alegre, 700 in Sao Paulo, 380 in Belo Horizonte, and 400 in Londrina. The latter case is described in detail in the box.

50 Terraza, H. and Sturzenegger, G., work cited.

51 Terraza, H. and Sturzenegger, G., work cited.

## INTEGRATION OF INFORMAL RECYCLERS IN LONDRINA, STATE OF PARANA, BRAZIL

Londrina is a city of nearly 500,000 inhabitants located in the State of Parana in southern Brazil. It generates 390 t of solid waste daily, of which 90 t is recycled (23%); this is one of the highest levels of recyclable materials recovery in Latin America. This achievement is accompanied by another; among the highest levels of selective collection coverage (90%) in the region.

These high levels can be attributed mainly to the Recycling Lives program, launched in 2001 with the initial goal of incorporating the catadores of an open air dumpsite that the government wished to close into the municipal plant's formal selective collection and sorting system; an NGO helped the catadores organize. Later, the program was expanded to include catadores who worked the roadways, increasing the collection area and the number of participating associations, which grew from 13 in 2001 to 23 in 2002 and 33 in 2009.

The 400 catadores currently participating in the program (a high percentage of which are women) provide selective collection services in 33 sectors of the city. The municipality segmented the city in these sectors with the objective of dividing the job among the 33 associations participating in the program, thus avoiding competition and guaranteeing access to areas of good recycling production for all of them. In each sector, the catadores are responsible for door-to-door collection of recyclables as well as the sorting of the collected material and its later commercialization. The collection service is monitored by municipal supervisors and by the population through a citizen assistance service (SAC).

The collected material is stored in different parts of the city (Bandeiras), and then it is the responsibility of the regular collection service to transport it to sorting centers (triagem). There are 33 centers, one per organization, that are operated in regular eight-hour shifts and provide workers with the opportunity to earn a salary of US\$231 per month on average. Afterwards, the catadores decide which materials to commercialize themselves and which through CEPEVE (a center where the material is weighed, pressed, and sold). Since 2001, CEPEVE has operated in a municipal warehouse in the outskirts of the city. It is managed by a board comprised of representatives from the 20 participating organizations and possesses two 500 kg scales and eight presses, used to weigh and press the material prior to sale. The sales prices commanded by CEPEVE are significantly higher than those obtained through the independent sale of the material, but the payment period is longer.

It costs the municipality US\$115,000 per month to run this collection, sorting, and recycling program. These costs are incurred through the transportation of recyclables from Bandeiras to triagem, and from there to CEPEVE (in the case of materials that are slated to be commercialized through that organization). This sum represents nearly 30% of the monthly amount the municipality allocates to regular collection services and the operation of a sanitary landfill. Municipal resources for USW management are billed together with the public cleaning fee through the property tax bill (IPTU) and the receipts are deposited in Londrina's urbanization fund (FUL). The estimated cost of selective collection and recycling is about US\$40/ton, which

is less than Brazil's average for regular collection. It should be noted that the reduction of waste destined for final disposal extends the useful life of the sanitary landfill and lessens the number of collection vehicles needed, as well as the costs of transportation and final disposal.

The case of Londrina also owes its success to a contract modality for regular waste collection services by overall costs, which incentivizes the collection company to support the reduction of solid waste generation and recycling, in contrast to the incentives that are present in a contract that pays per ton collected. Presently, the contract modalities for selective collecting by catadores cooperatives specified in Law 11,445/07 opens the possibility for direct payment, which has the potential to significantly increase the income of catadores.



Generally, recyclers with ties to some form of organization tend to have better working conditions. The benefits are derived primarily from greater volumes, higher sales prices, less reliance on intermediaries, and increased possibilities to add value to the materials. Further, once legally constituted, the organizations are able to negotiate contracts with local governments, which facilitates their integration into the formal SW management system, and able to enter into agreements with NGOs and international organizations, which facilitates their access to financing.

The growth of organizations of recyclers and their inclusion in municipal selective collection programs depends to a large extent on a regulatory framework that recognizes them as stakeholders with the ability to assume legal and institutional commitments. It is no coincidence that Brazil and Colombia, two countries with such regulatory frameworks in place, are the most advanced countries in the region with respect to formalizing relationships with this informal sector. It was, in fact, in Bogota, Colombia, where, on March 4, 2008, at the Third Conference of Latin American Recyclers, the following declaration was issued:

## DECLARATION OF THE THIRD CONFERENCE OF LATIN AMERICAN RECYCLERS

In Bogota, between March 1st and 4th of 2008, the delegates of 15 Latin-American countries—Argentina, Chile, Peru, Brazil, Bolivia, Mexico, Puerto Rico, Costa Rica, Guatemala, Ecuador, Paraguay, Venezuela, Nicaragua, Haiti, and Colombia—gathered as members of grass-roots organizations of recyclers, also known as pepenadores, cartoneros, cirujas, clasificadores, buceadores, guajeros, minadores, catadores, thawis, barequeros, and by countless other names, depending on where they work.

In the framework of the Third Latin American Congress of Recyclers, we declare, before the public, our governments, society in general, cooperative agencies, and our own organizations, our commitment to the following:

1. Promote worldwide awareness of the recycling profession and its organizations through the creation of venues for discussion and the development of strategies for an active presence at those venues.
2. Undertake actions and create strategies to raise awareness of the Latin American Network of Recyclers (R.L.O.R.) and certify the work and professional status of recyclers and our organizations.
3. Commit to sharing knowledge with recyclers and their national organizations, its local structures, and the members of different movements.
4. Promote the advancement of recyclers and their organizations in the value chain, so as to gain access to and a share in the revenues generated by the activity.
5. Contribute, in a joint effort from within each one's country, to the global mobilization for the proclamation of an International Day of the Recycler, aimed at raising awareness of both the activity and of the people who perform it.
6. Congress participants demand that public authorities and governments prioritize the involvement of organizations of recyclers in solid waste management systems, creating the conditions required for their effective inclusion through economic, social, and environmental actions.
7. Review laws and public policies to ensure they are formulated to effectively include organizations of recyclers in the decision-making process.

8. The participating organizations commit to raising awareness and to providing both training and professional development for the recycling profession.
9. We commit to promoting contact with the greatest number of recyclers and their organizations throughout the world.
10. Advance the fight for control of the recycling production value chain and its revenues in international, regional, and local committees, through networks and production centers.
11. Strive toward fulfilling the objectives proclaimed in the Second Latin American Congress of Recyclers.

EVAL 2010 estimated that there are 8.57 waste pickers per 10,000 inhabitants in LAC, which totals approximately 400,000 people.

The informal and dangerous labor conditions under which waste pickers operate leads to diverse social, environmental, and management problems. Municipalities have very limited experience in dealing with these problems and finding solutions for them. The formalization of these groups as part of the municipal management system is a valid solution, but one that is still an emerging practice in the region; only 19% of the waste pickers are part of an organization.

The leading cause of failure for projects aimed at closing down open air dumpsites and opening up sanitary landfills has been identified as the lack of a program led by municipal authorities to incorporate informal groups into the formal system.











# CONCLUSIONS, TRENDS AND FUTURE ACTIONS



# CONCLUSIONS, TRENDS AND FUTURE ACTIONS

The information obtained in EVAL 2010 and the progress identified signals that a growing number of LAC governments are aware of the negative impacts of poor SW management on the population and the environment. The progress documented over the past eight years in terms of policies, regulations, and service coverage leads us to this conclusion. Nonetheless, the road to adequate SW management has just begun. Various courses of action need to be strengthened to achieve the common goal of the sector's sustainable development in LAC.

In a well-structured sector, the interaction between the agents involved in the sector and the activities performed should unfold in an economically, environmentally, and socially sustainable manner. In this sense, it is encouraging that LAC governments have begun to include on their national agendas, issues such as the role of national, regional, and municipal entities in the plan-

ning and regulation of services, the reduction and recycling of waste, the need for the formal integration of waste pickers, the adequate final disposal of solid waste, and the relationship between the sector and the process of climate change.

The efforts undertaken by LAC nations to extend service coverage have been significant. Between 2001 and 2008, the LAC population in need of urban cleaning services increased by 15.6% to 63.1 million people. During this period, not only did SW management services incorporate this natural population growth, but also significantly increased their coverage rates. Total street sweeping coverage increased by 10%, from 72% to 82.3% (93 million people), collection service coverage increased from 81% to 93.4% (109 million people), and final disposal coverage through sanitary landfills grew by a factor of nearly 2.5, from 22.5% in 2002 to 54.4% in 2010, which means adequate final disposal





for the waste generated by 225 million people, nearly 164 million people more than in 2002. The percentage of waste transferred decreased between 2002 and 2010, from 37.9% to 28.2%, although the inclusion of new countries like Brazil and Colombia improved the representativeness of the statistic to a large degree. It should be noted that improvements in service coverage are not uniform throughout the region, nor are they in different localities within the same country.

Clearly, one of the determining factors for high levels of adequate final disposal is the implementation of regulations that include stringent requirements with regard to final disposal; these regulations prohibit the use of open air dumpsites, define the specific technical characteristics that an adequate solution should have, and, more importantly, have the support of national and subnational government authorities, who have shown the political will to enforce these regulations. In general, the region has made significant progress in regulating the sector, with the passage of a law on solid waste at the macro-level in seven countries: Argentina, Peru, Paraguay, Mexico, Venezuela, Costa Rica, and Brazil. It should be noted that all these national laws stress the need to implement waste valorization, sort-at-source, and recycling programs, and to find the means to attain the financial sustainability of services. The concept of the production/consumption cycle of materials is also starting to manifest itself in some laws that include shared responsibility for waste. At present, it is important to increase enforcement mechanisms for these regulations.

Improvements in regulations for the sector are likely the result of the establishment of policies and the formulation of plans for the sector that have developed in recent years; there has been a tendency toward official standardization in this regard, with most LAC countries placing the authority for SW management under their national environment ministry, with subnational governments responsible for the planning of concrete and applicable solutions. Although awareness of the need for planning has been a key to the progress made, the actual development of adequate solid waste management plans at the regional and municipal levels has lagged far behind in some countries, which undermines efforts to coordinate the activities of the actors involved

and to foster cooperation toward common goals. In cases where the guidance of a national or regional plan was missing, the municipalities took it upon themselves to develop comprehensive solid waste management plans. Even so, less than 20% of LAC municipalities have adequate plans. The lack of reliable information impedes the adequate planning of solid waste management, as well as the actual management of solid waste.

In a related matter, the growing practice of regional organization for provision of final disposal services has led to a marked improvement in final disposal indicators. The trend toward a greater use of regional sanitary landfills is driven by the significant economy of scale it provides municipalities, reducing the cost per ton of the waste deposited. This solution is particularly important in the design of waste management systems in medium, small, and micro- municipalities, where increases in service coverage have not yet improved significantly.

To a lesser degree, another factor that explains the significant progress made in final disposal is the spread of carbon finance mechanisms, such as the CDM; Brazil and Mexico, for example, are the countries ranked third and fourth in the world in terms of the number of approved CDM projects. Beyond the growing awareness on the part of the population and governments of the impacts of climate change and the vulnerability of the planet, availability of these resources have been one of the major incentives, for both the public and the private sectors, to improve the final disposal of solid waste in order to avoid the methane gas emissions from inadequate disposal sites; methane gas emissions represent the sector's most significant contribution to global greenhouse gas emissions. Of the CDM projects registered in LAC, 25% are municipal solid waste management and disposal projects.

One factor that is still pending and that could help improve the sector's indicators, in general, is the development of a regulatory framework for services. The absence of a regulator or an institution at the national level to guide municipalities in the formulation of service contracts contributes to a lack of correlation between the service desired and the amount paid for it. The greatest need is in the economic-financial aspects of service provision, where there is neither a designated

regulator nor an adequate legal framework for one to perform that function.

As occurs in the provision of other public services, governments should regulate the sector's fees and rates, considering the economic-financial sustainability of providers that are to deliver service of a predetermined quality, actual and projected investment, operational costs and earnings, fair remuneration for contractors, and the population's ability to pay. When necessary, a progressive subsidy system should be implemented. It is especially important to improve the areas of cost accountability, budget determination, and information management, as well as to introduce improvements in the area of cost recovery. Colombia and Chile are the only two countries in the region that can be cited as examples of the successful regulation of services.

Unit costs for services have increased significantly over the past eight years, due in large part to appreciation of the Brazilian real and other currencies in the region during this period. At the same time, the costs of fuel, labor, and other elements continued to rise and the technology used to provide services was modernized, leading to service quality improvements in some cases. From EVAL 2002 to EVAL 2010, the per ton unit cost of collecting, transferring, and disposing of solid waste increased nearly 42%, from US\$47/ton to almost US\$67/ton.

Additionally, billing for solid waste management services is not a widespread practice in the region; only about 65% of municipalities bill for the service. In the face of increased costs, the failure to bill, and the absence of regulation in terms of the sector's fees and rates, makes the recovery of costs difficult to achieve, and, therefore, other municipal funds are used to pay service costs. In 2002, it was estimated that, on average, cost recovery was less than 47%. Considering the information obtained by EVAL 2010 with respect to the amounts billed for services, unit costs, waste generation, and service coverage, it is estimated that, on average, cost recovery rose to 51.6%, which clearly makes it impossible to achieve the financial sustainability of services.

An option to improve the financial sustainability of services could be the generalized use of joint payment systems with other public service providers. This approach

makes use of payment system structures that are already in place and have a proven track record, thereby providing several benefits, including economies of scale and a higher bill payment percentage. Only 22% of municipalities bill 28% of the LAC population for services through the payment systems of other public services such as electricity, water, and sanitation.

Current levels of economic and demographic growth, as well as the increase in urbanization, make the related increase in solid waste generation unsustainable. Despite the special pressure this places on the metropolitan areas of major cities in the region and of medium and large cities, the population in general and its representatives have yet to demonstrate awareness of this situation. LAC should redouble its efforts to minimize the amounts of solid waste generated, collected, transferred, and disposed of. The region should not only strive for the financial sustainability of services, as previously mentioned, but also for their environmental and social sustainability.

Over the long-term, it is necessary for the region to develop a management model that shifts away from the present day basic concept of waste. Solid waste management should be based on a rational and sustainable materials cycle, where the waste generated is viewed as an environmental resource. This vision implies the acceptance of a high level of shared responsibility between the state, the private sector, and the population; in some cases, none of the three parties are willing to assume responsibility in the short term. The most important responsibility is the economic responsibility and how it is shared between the parties. Although this issue is not currently on regional agendas, it is imperative for discussions based on a realistic analysis to begin immediately. In the case of multilateral organizations, the IDB favors sources of financing that are specifically for the development of innovative practices that support this vision based on the principles of the 3 R's and the generation of energy from waste when it is economically and environmentally viable. The debate on the long-term responsibility of the product manufacturer in the generation of waste is perhaps the matter in this regard that needs to be most urgently addressed and resolved. The new vision proposed for the sector will not only result in benefits for the environment in general,

but should also be viewed specifically as a measure to mitigate climate change, in as much as the use of virgin prime materials will be reduced and fossil fuels substituted for with energy recovered from waste streams.

Although per capita waste generation has remained at similar levels during the period, without a direct correlation with the economic growth experienced by the region, it is difficult to imagine that this is the result of a growing awareness on the part of the population of the need to reduce and minimize waste. Campaigns in this respect should be strengthened and widened to include the re-use of waste, its recycling, and the importance of sort-at-source collection.

The formalized separation and recovery of recyclable materials is not practiced on a large scale in the region; there are few countries that have formal sorting and recycling plants as part of the infrastructure in their comprehensive SW management system. Functioning selective collection programs are also rare. In general, these are informal activities in the region that are undertaken with the labor of waste pickers.

Waste pickers work in precarious, unsanitary conditions and are one of the most vulnerable social groups. The decrease in poverty and increase in employment that the region experienced since 2002 have not had an impact to a large degree on the number of waste pickers. This can be due to the fact that there has not been sufficient progress made in addressing the issue of income inequality in most countries of the region, as indicated by the fact that LAC remains the most unequal region in the world income-wise, implying that the situation in terms of income for the lower population strata has not largely changed. This can also be due in part to a strong historical element: the crises suffered in the region in the early years of this decade. The know-how obtained as an waste picker at that time and the gradual advances in the improvement of working conditions and the commercialization of waste products may serve to induce some workers to continue in that line of work.

Nonetheless, during the past decade, there has been growing awareness at the municipal level of the need to begin to formalize the work of the informal sector in LAC by incorporating these workers into a comprehen-

sive waste management system, giving them the role of selective collection, sorting, and recycling, thereby recognizing the work they are already doing and providing them a safety framework that makes it possible for them to improve their quality of life. The social sustainability of the services depends on this to a large degree.

Considering the results of EVAL 2002 and EVAL 2010, and the documented advances in terms of policies, regulations, and service coverage, the following future courses of action are deemed necessary for the sector's development in the region:

- At the municipal level, we stress the following courses of action: (i) strengthen all levels of local government management and performance, (ii) modernize administrative and financial systems, (iii) improve the sector's information systems, (iv) create incentives to improve public performance with respect to the environment for activities related to solid waste management, (v) encourage a culture of payment for services, (vi) improve the planning of comprehensive solid waste management, (vii) ensure adherence to rules and standards for public health and environmental quality in all phases of service, and (viii) promote training and education in areas of specialized solid waste management.
- At the national level, the following courses of action are necessary: (i) consolidate solid waste management as a sector and institutionalize it, with national goals and programs, (ii) provide institutional organization for the sector to enable better coordination between solid waste management institutions, (iii) strengthen the aforementioned financial sustainability of services, making it possible to recover costs, (iv) engage the participation of private initiatives and civil society by associating the community with the public solid waste management entities, (v) promote the economic valorization of the sector in terms of job creation, the exchange of goods and services, the construction of infrastructure, the reduction of risks, and the development of micro-enterprises, and (vi) strengthen the abilities of municipalities and create market incentives.

All of the above elements are part of a systematic vision change toward which the region should be guided. Implementing it will take decades, but, in the economic conditions are given to commence the change process. It is essential that political decisions support the process.

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