

Latin American cities are under increasing pressure from rapid urbanisation, while current impacts and potential threats from climate change are further exposing municipal vulnerabilities. City planners are responding to these twin pressures with innovations in climate-related policies and are making big strides in terms of climate change mitigation and adaptation.



CITY-LEVEL CLIMATE CHANGE ADAPTATION AND MITIGATION

SUMMARY

In Latin America, 80% of the region's approximately 590 million inhabitants lives in cities. Between 2000 and 2010, the total estimated cost of damages from extreme climate events in the region exceeded US\$40 billion, affecting some 40 million people. Looking forward, Latin American cities must brace for the impacts of more frequent, severe, and even unprecedented climate risks by boosting the resilience of their infrastructure and systems through adaptation programmes. Yet, just as cities are vulnerable to climate change, they are also contributing to it: urban areas are responsible for approximately 75% of global greenhouse gas emissions (GHGs), primarily from transport and buildings. In an effort to abate climate variability and extreme events, many Latin American cities are working to decouple economic development from the rampant GHGs emissions that fuel climate change, while benefitting from more intelligently managed cities, efficient economies, and healthier populations.

These risks and opportunities are not limited to Latin America. The geographic locations of many cities in developing regions are particularly susceptible to the risks of climate change. Of equal consequence are the high levels of urbanisation in the developing world that are increasing the vulnerability of local populations to climate impacts. This Guide presents a selection of examples of what is being done to increase climate mitigation and resilience in Latin American cities. These examples show that mitigation can provide benefits well beyond stabilising global climate change, and in fact compliment adaptation efforts by helping establish a stable microclimate, increase economic and energy efficiency, and improve living conditions. Readers in the developing world will find these examples useful in their own endeavours as they contribute to the sustainable development of cities in their own countries.



Cities account for the majority of worldwide greenhouse gas emissions (75%) and municipal leaders have authority over many of the sectors that produce these emissions (75% on average), making widespread urban-level mitigation measures a superb opportunity to tackle global climate change, while simultaneously improving local quality of life.

Municipal leaders in Latin America are working to capture these opportunities through city-level actions and commitments, as participants in networks of similarly climate-concerned cities, as signatories of inter-municipal agreements, and as partners with international NGOs.

Even if the world quickly transitions to a low-carbon economy, our societies will still face the impacts of climate change set in motion from past decades of emissions, however the costs of future adaptation measures are dramatically reduced by current mitigation initiatives. This perspective is reflected in the comprehensive municipal climate action plans of Quito, Rio de Janeiro and Mexico City.



THE IMPACTS OF CLIMATE CHANGE ON URBAN AREAS

Climate-related disruptions pose serious threats to the sustained operations and growth of cities, as well as to the lives of their inhabitants. According to the International Panel on Climate Change (IPCC) Fourth Assessment Report, by the end of the century, Latin America is projected to warm by an average of between 1 and 4°C. Like most developing regions of the world, the associated physical impacts of climate change in Latin America are expected to be severe, though not as acute as in, say, Southeast Asia and East Africa. Figure 1 shows aggregated physical climate impacts including extreme weather, sea-level rise, and agricultural productivity loss.¹

Figure 1: Direct Risks of Extreme Weather



Source: Wheeler, D. 2011. <u>Mapping the Impacts of Climate Change</u>. Center for Global Development, online publication.

In Latin America, 80% of the region's population currently lives in cities; a figure expected to increase to 89% by 2050. Amidst mounting pressure from urban growth, the capacity of city infrastructure will be increasingly put to the test at a time when it is also facing climate-related impacts. Dominant infrastructure risks include disruption of energy transmission and distribution, paralysis of transportation, contamination of clean water supplies and treatment facilities, uncontrolled dispersion of refuse and pollutants, and the spread of waterborne diseases.

For many cities, climate change will drive warmer air and surface temperatures, strengthening the urban heat-island effect and increasing energy demand for air-conditioning. The rapid loss of glacial mass decreases water security for communities that depend on glacial melt – an effect already felt by urban centres throughout Latin America including the capital cities Bogota, La Paz, Lima and Quito. In other areas, increased frequency of flooding is expected to affect cities such as Buenos Aires and Rio de Janeiro (as well as Dhaka, Lagos, Kolkata and Mumbai). The damage has already proven quite costly, exceeding US\$40 billion in Latin America alone between 2000 and 2010, and affecting some 40 million people.²

Even in the absence of climate-related risks, rapid urbanisation applies mounting pressure on existing infrastructure: dense housing developments result in widespread use of concrete and asphalt, reducing flood mitigation services; immigration and poverty can overwhelm city planning and support systems, leading to slums and other marginalised communities; poor waste management can provoke the spread of disease, pollution, and atmospheric heat; increased transport for commuting produces further carbon emissions and air pollution; unrelenting use of aging infrastructure can create unreliable routes for the transport of vital commodities like food, fuel, and water.

MITIGATION AND ADAPTATION: WHY ADDRESS BOTH?

So should cities in developing countries mitigate to avoid climate change or adapt to its impacts? The answer is that both are required to optimise potential outcomes for current and future generations. Mitigation is vital to curb the future impacts of climate change, and has in fact given rise to a new generation of development paradigms, such as the green economy, that propose a range of affordable and implementable strategies to decouple economic growth from GHG emissions, as well as providing a range of important co-benefits.³

Yet, even if the world magically ceased to emit GHGs tomorrow and for the rest of time, our societies would still face the impacts of climate change set in motion from the past several decades of emissions. Thus, adaptation to the risks of climate change is also necessary to reduce the potential costs of climate-related disasters, with a disproportionately high level of impacts and vulnerability

² UNEP. 2012. Graphic <u>Details of Climate Change for Latin America and the Caribbean</u>. UNEP, online publication.
³ For more on the Green Economy in Latin America, read the <u>ELLA Guide: Pursuing a Green Economy: Growth Alongside Environmental Sustainability in Latin America.</u>



¹Wheeler, D. 2011. <u>Quantifying Vulnerability to Climate Change: Implications for Adaptation Assistance</u> - Working Paper 240. The Center for Global Development, Washington, DC.

falling on developing countries. That being said, the shortterm costs of adapting to climate change (i.e. to a 2°C rise in average temperatures) are perceived to be much lower than mitigation efforts, whereas long-term adaptation without mitigation (i.e. a 4+°C rise) would be exorbitantly expensive, if not impossible.⁴ Thus, when looking at the longterm, the incentive to mitigate today in order to avoid even costlier, extreme adaptation in the future is a safe bet (Box 1).

Box 1: Complementary Strategies: Linkages between Mitigation and Adaptation

According to the IPCC Fourth Assessment Report, adaptation measures can affect the cost of mitigation in two ways. Firstly, more adaptation strategies can lower mitigation costs because policymakers choose to move to another point on the same mitigation cost curve; adaptation does not alter the marginal productivity of mitigation, it merely induces a shift along the cost curve. Second, adaptation can act as a technical substitute to mitigation or complement shifts of the mitigation cost curve. For example, flood defences change land use and therefore costs and prices in that area, which ultimately impacts mitigation costs. Whether adaptation causes a shift along the mitigation cost curve or a shift of the entire curve itself, the costs and benefits become a modelling question to determine the magnitude of the shift and new cost curve.

Source: IPCC. 2007. *Fourth Assessment Report*. IPCC, Geneva.

CITY-LEVEL CLIMATE ACTION

Over the last 15 years, international efforts within the United Nations Framework Convention on Climate Change (UNFCCC) have consistently fallen short of what the global scientific community recommends as an appropriate global response to mitigate GHGs and adapt to a changing and uncertain climate. UNFCCC inaction thus far is a mixture of international political gridlock, perceptions of high and unequal economic costs, and technological constraints. As a result of the intensifying climate impacts felt in cities coupled with the current international climate change impasse, new initiatives in Latin America are homing in on climate mitigation and adaptation at the city level as a more effective model for driving through programmes that can achieve immediate and direct impacts, as well as complement longer-term objectives.

If humanity is to respond successfully to the challenges of global climate change, cities have a big role to play in piloting and scaling-up mitigation and adaptation initiatives. Think about it: cities account for up to 80% of world energy use, they are home to the majority of the world's population, and they drive the development of large-scale infrastructure.⁵ Furthermore, the top-five sectors with the highest economic mitigation potentials in 2030 are expected to be buildings, industry, energy supply, transport and waste. All of these sectors are predominantly concentrated in and around cities.⁶

Secondly, cities operate on a scale small enough to leverage a narrower scope of work and a concentrated administrative effort relevant to broad policy implementation. Yet cities and their programmes are also large enough to attract national and international financial support to develop solutions and establish themselves as leaders well beyond their city limits by demonstrating the viability of their climate-related programmes.

Lastly, the global population living within cities is set to increase by 73% by 2050.⁷ Cities are therefore increasingly important sites of climate change action given current and future rates of urbanisation in developing countries (Figure 2).



Figure 2: The Developing World Drives Urbanisation

⁴ Simonis, U. E. 2013. Climate Change: Mitigation and Adaptation at Urban Level. In: The Baltic Course. Internet magazine.

⁶ Simonis, 2013, see n4 above.

⁷ UN Department of Economic and Social Affairs. 2011. *World Urbanization Prospects: 2011 Revision*, UN, New York.



Source: UN. 2011, see n7 above.

⁵ Bicknell, J. et al. 2009. Adapting Cities to Climate Change: Understanding and Addressing the Development Challenges. Earthscan, London.

No wonder international organisations like <u>UNEP</u>, the <u>Clinton</u> <u>Global Initiative</u>, the <u>Carbon Disclosure Project</u> and the <u>World</u> <u>Wildlife Fund</u>, among many others, are dedicating additional resources to climate-related efforts in cities. New institutions are also being developed to coordinate municipal efforts, such as the <u>World Mayors Council on Climate Change</u>. With over 80 mayors currently working in local governments, this Council represents a geographically diverse network of city leaders committed to climate change mitigation and adaptation.⁸

Mitigation efforts within cities refer to municipal measures that reduce urban GHGs. It begs the question: how much can one city really do to tackle global climate change? Alone, in terms of absolute terms, one city cannot achieve much. In 2012, for example, Mexico City emitted 24.5 million tonnes of CO₂ equivalent GHG^{,9} that same year, global CO₂ emissions totalled approximately 35 billion tonnes.¹⁰ Which leads to another question: what then is a city's incentive to mitigate at all if its mitigation efforts are but a drop in the bucket with respect to global emissions? Generally speaking, incentives to mitigate at the city-level occur when national directives require compliance, cost-saving opportunities are available through efficiency gains, quality of life can be improved, and/ or when city leadership wants to establish itself as a firstmover on climate action and solutions. As this Guide will show, intelligently managed cities are not only good for their local populations, by increasing efficiency and reducing pollution, they also create solutions for other urban centres to replicate, which can lead to massive collective gains in GHG mitigation.

Adaptation at the city level, on the other hand, has incentives that are relatively straightforward compared to mitigation. Climate change is predicted to cause more frequent droughts and floods, water insecurity, heat waves, forest fires and sealevel rise. Dominant risks in cities include disruption of energy generation and transmission, paralysis of transportation, contamination of clean water supplies and treatment facilities, uncontrolled dispersion of trash and pollutants and the spread of waterborne diseases. Many cities will be vulnerable to these impacts, especially in the developing regions of the world. Since city leaders and administrators are responsible for ensuring the wellbeing of their urban dwellers, they must plan appropriately for adequate disaster response, early warning systems and strategic risk management; strategies and planning that will become ever more important as climate change impacts bear down on cities.

LATIN AMERICAN MUNICIPAL MITIGATION STRATEGIES

Mitigation addresses the root causes of climate change by attempting to reduce GHG emissions and avoid the worstcase scenarios of climate modelling. There can be many co-benefits that result from mitigation, such as increased efficiency and energy security, as well as improved quality of life for city dwellers. Mitigation efforts often employ new technologies, renewable sources of energy, infrastructure and equipment retrofits, and behavioural change. The following section provides examples of key mitigation efforts in Latin America, particularly in the areas of GHG inventories, short-lived climate pollutants, green transport, waste management, energy conservation and green buildings.

1. Manage What You Measure: City-Level Greenhouse Gas Inventories

A critical step to implementing effective GHG mitigation efforts is to benchmark current emissions and set future reduction targets. Inventories require that city managers have an indepth understanding of the current quantity, composition, and sources of city-level emissions. Figure 3 shows city members of an initiative called the Global Protocol for Community-Scale Greenhouse Gas Emissions (GPC) Pilot Project 2013.

Thanks to a partnership between the World Resource Institute and the World Business Council for Sustainable Development, cities are able to use a tool called the GHG protocol – an international accounting tool – to measure and manage their mitigation policies. In June 2013, at a GPC seminar in Brazil, 200 Brazilian city officials (from Sao Paulo, Rio de Janeiro, Belo Horizonte and Piracicaba) shared their cities' experiences with the implementation of GHG inventories. The number of attendees demonstrates the potential of city-level mitigation efforts to disseminate to a scale well beyond any single city.¹¹ The attendees also identified key conditions that facilitate GHG inventory implementation, which are covered in the section 'Enabling Factors' below. In general, once inventories are completed, city planners can assess their mitigation options and set appropriate reduction targets.

¹⁰ Olivier, J. G. J., Janssens-Maenhout, G., Peters, J. A. H. W. 2012. <u>Trends in Global CO2 Emissions</u>. European Commission Joint Research Centre, The Hague.
¹¹ Fong, W. 2013. <u>6 Lessons Brazilian Cities Learned from Greenhouse Gas Inventories</u>. WRI, Washington, DC.



⁸ A full list of members can be found on the <u>World Mayors Council on Climate Change website</u>.

⁹ Carbonn. 2012. <u>Cities Climate Registry Data</u>. Carbonn, online registry.





Figure 4: GHG Inventory Examples from Latin American Cities



Source: Carbonn. 2012. <u>Cities Climate Registry Data</u>. Carbonn, online registry.

The GHG inventory examples in Figure 4 are similar to regional indices for cities. For example, on average, Latin American cities generate a majority of emissions by burning fossil fuels for transport (38%), producing electricity (21%), and industry (17%). Once GHG inventories are in place, city leaders are able to use the information to make reduction targets appropriate for their city and its composition of emissions (Figure 5).

Figure 5	: Examples	of City-level	GHG Mitigation	Commitments
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City	Country	First GHG Inventory	Reduction (Baseline)	Total Annual Emissions (M tonnes)
Buenos Aires	Argentina	2000	20% by 2025 (2008)	10.8 in 2010
Mexico City	Mexico	2010	15% by 2012 (2008)	24.5 in 2012
Belo Horizonte	Brazil	2010	20% by 2030 (2007)	3.1 in 2010
Sao Paulo	Brazil	2003	30% by 2012 (2005)	14.8 in 2003

Source: Carbonn. 2012. *Cities Climate Registry Data*. Carbonn, online registry.

¹² UN Habitat. 2012. Estado de las Ciudades de America Latina y El Caribe 2012. Regional Office for Latin America and the Caribbean (ROLAC), Rio de Janeiro.



2. Short-lived Climate Pollutants (SLCPs): City-level Mitigation with Local Benefits

Short-lived Climate Pollutants – such as sulphur, smog, ozone, and black carbon (soot) - behave precisely as the name suggests. SLCPs originate from transportation, commercial, residential, and industrial sectors. They are a relatively new topic in mainstream climate change mitigation, cutting across many sectors with immediate benefits for local communities in addition to global climate mitigation. Although SLCPs are only in the atmosphere for a short period of time, compared to CO₂, they significantly alter local and global climate.¹³ SLCPs have global warming potentials (GWP) that are tens, hundreds, even thousands of times more potent than CO₂, depending on the type of gas.¹⁴ Beyond affecting the climate, SLCPs also damage the respiratory health of city inhabitants, reduce yields of nearby agricultural production, and decrease water security by increasing the melt rate of glaciers.¹⁵ In short, the mitigation of SLCPs presents an opportunity to align incentives between municipal, national, and international efforts to tackle climate change, since actors at all levels are poised to benefit. Yet, despite national efforts to address these pollutants, Latin America still has work to do.

Based on the negative impacts of SLCPs, particularly with respect to human health, most Latin American countries have already enacted national air quality regulations (Figure 6). However, many of these countries are still exceeding the recommended levels of the very pollutants they are attempting to regulate (Figure 7). Since these shortcomings are not for lack of relevant policies, the fundamental problem is that Latin American countries with existing policies need to make them more stringent and enforceable in order to close the lid on excessive SLCP emissions.

Figure 6: Regional Air Quality Standards

SLCF Standards in Latin America	# of Countries
PM2.5 (fine particles)	8
PM10 (large particles)	16
Ozone (8-hour)	13
SO ₂ (24-hour)	16
NO ₂ (annual)	15

Source: Maxwell, A. 2013. *Air Quality in Latin America: High Levels of Pollution Require Strong Government Action*. Natural Resources Defense Council, New York.

-¹³ Ramanathan, V., Victor, D. 2010. <u>*To Fight Climate Change, Clear the Air*. New York Times, reprint.</u>

¹⁴ United States Environmental Protection Agency. 2011. *Global Warming Potentials of ODS Substitutes*. US EPA, online publication.

¹⁵ CEDHA, CEMDA, CEDARENA, ILSA, Instituto de Energia e Meio Ambiente, Earth Justice, FIMA, AIDA. 2011. <u>Reducing Emissions of Short Lived Climate Forcers</u> (<u>SLCP) Soot and Smog in Latin America: A Civil Society Perspective</u>. Paper prepared for the Technical Workshop on Science and Policy of Short-Lived Climate Forcers.

¹⁶ The Climate and Clean Air Coalition. 2012. Inter-Governmental Consultation on Near-term Climate Protection and Clean Air Benefits for Latin America and the <u>Caribbean</u>. CCAC, Bogota.



Figure 7: Air Quality Shortcomings in Latin America

People breathing polluted air in Latin America	100 million
Countries exceeding the WHO recommended level of large particles (PM10) in the region	16
Countries exceeding the WHO recommended level of fine particles (PM2.5) in the region	11
Countries exceeding the WHO recommended level of nitrogen dioxide (NO ₂) in the region	13

Source: Maxwell, A. 2013. *Air Quality in Latin America: High Levels of Pollution Require Strong Government Action*. Natural Resources Defense Council, New York.

Around the legislative void of effective national SLFP policies, climate-focused organisations are devoting increasing attention and resources to addressing SLCP emissions from cities in developing regions. For example, the Clinton Climate Initiative (CGI) started a new partnership with the C40 Cities <u>Climate Leadership Group</u> (C40) to tackle this problem by working at the municipal level. The C40 network connects 40 megacities and other partner cities that are working to mitigate GHG emissions and climate risks, both locally and globally. Of the forty global cities involved, Latin America accounts for seven, along with an additional two innovator cities (Figure 8). Interestingly, C40 studies claim that mayors actually have direct control over 75% of urban emissions within their cities. As mentioned earlier, urban areas account for approximately 75% of global GHG emissions. As urbanisation in the developing world increases, this share is set to rise even more. Therefore, given cities' high share of global GHG emissions, coupled with the ability of municipal leaders to reduce them, if widespread urban-level mitigation measures were achieved they could dramatically reign in global climate change.¹⁷

Figure 8: C40 Cities





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Santiago, the capital of Chile, plagued by decades of poor air quality, offers an example of precisely the SLCP opportunities that CGI and C40 are working to capture. In 2005, through municipal decree, Santiago implemented the Diesel Particle Filter (DPF) programme. The programme was designed to reduce particulate matter (black carbon) emissions from public transport by modernising the city's 6,300 bus fleet. The decree requires all new buses to be equipped with postcombustion particle filters and 100% of all buses (new and used) by 2018. As of 2011, 32% of the municipal bus fleet had DPF technology. The direct benefits of this project are twofold. First, DPF buses emit 97% less particulate matter, including fine particles - the most harmful to human health. The total associated health costs from particulate matter (mortality, bronchitis, hospital admissions, asthma attacks, restricted activity days and work days lost) between 2000 and 2005 are estimated at US\$150.1 million. Second, the GWP of black carbon is up to 1,600 times higher than carbon dioxide. Because black carbon constitutes roughly 75% of pre-2005 bus particulate matter, the annual emissions reduction of the DPF programme in 2018 will be 136,000 tonnes of CO₂ equivalent. 18

In many ways, actions to reduce SLCPs are the low-hanging fruit of GHG mitigation because they also provide direct local health and climate benefits to the cities themselves. In contrast, mitigation of CO_2 helps stabilise the global climate, but does not present immediate local benefits (on the microclimate, health or agricultural productivity, for example), which is precisely why international climate agreements prove so allusive.

3. Greening Urban Transport Systems

America and the Carribean (ROLAC), Rio de Janeiro.

Transport accounts for 38% of GHG emissions from Latin American cities.¹⁹ For the past 15 years, improving air quality and reducing traffic congestion in urban areas in Latin America have been indirectly motivating mitigation efforts, helping with city-dweller health and transport efficiency, respectively. However, it was not until recently that a strong connection between transport, local climate, and air quality emerged as a direct driver of GHG mitigation efforts, in part thanks to a deeper understanding of SLCPs. Bus rapid transit (BRT) systems are gaining popularity in Latin American cities including Bogota (Colombia), Curitaba (Brazil) and Santiago (Chile). These cities have been particularly successful in promoting mass transit systems that have produced significant reductions in GHG emissions and are relieving pressure on city infrastructure.

In addition and complementary to BRT, policies to promote bicycle use have had emerged as a particular success in Bogota. Over the past 15 years, the <u>Ciclorutas de Bogotá</u> programme has evolved into one of the most extensive and comprehensive networks of cycle paths (303km) in the world. Also in Bogota, a high-capacity BRT system called the <u>TransMilenio</u> spans 87 km, and has been closely emulated by many other highly congested cities since opening in 2000. In 2012, a jointly managed pilot project between Bogota, C40, and the Clinton Global Initiative deployed 50 electric taxis.

In Argentina, the capital city Buenos Aires recently launched a new initiative, the Bicycle Buenos Aires Programme, offering no-interest loans for the purchase of bicycles, and has built partnerships with bicycle retailers and services providers. All information required by residents to participate is provided through a website. The city also offers a free bicycle programme, *EcoBici*, with more than 1,000 bikes available from 28 docking stations, accounting for 4,200 trips a day (Figure 9). A report from the <u>World Resources Institute</u> claims that the city's cycle lanes and bike-share programme increased cycling from 0.4% of all trips in 2007 to 2.5% in 2013.

Figure 9: EcoBici Routes in Buenos Aires



Source: EcoBici Website.

¹⁸ The Swiss Agency for Development and Cooperation (SDC) and the Chilean Environmental Ministry (MMA). 2011. <u>The Santiago de Chile Diesel Particle Filter</u> <u>Program for Buses of Public Urban Transport</u>. SDC, Santiago.
¹⁹ UN Habitat. 2012. <u>Estado de las Ciudades de America Latina y El Caribe 2012 (The State of Latin American and Caribbean Cities 2012)</u>. Regional Office for Latin



Although specific mitigation statistics are not available for Buenos Aires, bicycle programmes such as these surely reduce car use and GHG emissions, thereby improving air quality and the health of city inhabitants. The city of Bogota in Colombia launched a similar programme in 2000, which has since evolved into a network of 300km bike-only paths, plus another 44km of mixed-use roads. With 83,000 bikers using these paths daily, the programme is a shining success that has reduced approximately 36,800 tonnes of CO_2 . For more information on how the region's cities have been greening their urban transport systems see the <u>ELLA Brief:</u> <u>Capitalising on Public Transport: Reducing GHG Emissions</u> in Latin American Cities.

4. New Partnerships to Manage Waste and Mitigate Methane Emissions

Methane gas – a GHG with a global warming potential (GWP) 25 times more powerful than CO₂ – is emitted from coalmines, natural gas wells, livestock, rice paddies, and landfills.²⁰ This section focuses on the latter since it is most relevant to the urban context. Methane is produced from landfills when organic material solid waste (MSW) undertakes anaerobic decomposition (i.e. without air). Globally, in 2010, the methane emitted from landfills accounted for 1.5% of manmade GHG emissions. 2020 forecasts predict that number will rise to 3%; 2050 forecasts, even higher yet to 6%. Broadly speaking, assuming urbanisation and consumption trends continue to rise, city officials have two options: divert biodegradable material from landfills (i.e. avoidance) and/or gas capture to create electricity, also known as waste-to-energy (WTE).²¹ The most common approach in Latin America is WTE, which will be discussed shortly. First, a bit more on the waste produced by developing regions.

On average, urban dwellers in Latin America produce 1kg of solid waste per day, an amount that is expected to increase,²² but is still below the world average of 1.2 kg per capita per day. However, per capita daily waste is higher in Latin American cities than other developing regions (see Figures 10 and 11). Furthermore, only 23% of Latin American urban population's waste is safely disposed of. From the perspective of a city administrator, waste is primarily a public health and infrastructural concern, but can also represent significant GHG reduction opportunities. Some cities, such as Santiago in Chile, are beginning to address this challenge with recycling programmes, while others need to invest more in collection, discharge, recycling and reuse. The most common solution to methane gas emissions from Latin American landfills, however, is WTE projects.

Kg/Capita/Day City Africa Bamako, Mali 0.70 Lusaka, Zambia 0.55 Mashi, Tanzania 0.93 0.60 Nairobi, Kenya Asia 0.74 Bengaluru, India 0.50 Delhi, India Dhaka, Bangladesh 0.46 Ghorahi. Nepal 0.46 0.78 Kunming, China Latin America Belo Horizonte, Brazil 1.45 Canete, Peru 0.67 1.15 Managua, Nicaragua

Figure 10: Daily Waste in Developing Regions

Source: UN Habitat. 2010, see below n21.

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City	Domestic (kg/capita/yr)	Total (kg/capita/yr)	Total Municipal Solid Waste Disposal (ton/yr)	Methane Emissions from landfills (ton/yr)
Bogota	267	442	1,792,211	25,200
Buenos Aires	281	606	5,300,000	168,240
Lima	246	310	2,164,893	60,000
México	210	438	6,518,900	176,000
Santiago	462	949	2,578,697	25,200
Sao Paulo	380	726	5,235,195	168,240

Figure 11: Analysis of Municipal Waste in Latin America

Source: Ricardo, J., Rehner, J., Samaniego, J. 2010. *Regional Panorama: Latin America Megacities and Sustainability*. ECLAC, Santiago.

²² Jordan, R. *et al.* 2010. *Regional Panorama, Latin America: Megacities and Sustainability*. Economic Commission for Latin America and the Caribbean (ECLAC), New York.



²⁰ Ramanathan and Victor. 2010, see above n13.

²¹ UN Habitat. 2010. *Solid Waste Management In the World's Cities.* Earthscan, London/Washington, DC.

To date, in Latin America, over 99 WTE landfill projects have been launched and financed through the United Nations Clean Development Mechanism (CDM), which uses market principles to put a price on GHGs (i.e. carbon credits). From 2007 to 2012, Latin American WTE projects reduced 19 million tonnes of CO₂ using the CDM, nearly two times the total GHG emissions of Buenos Aires in 2010 (see Figure 5). In the 1990s Monterrey became the first city in Mexico and all of Latin America to build a WTE landfill. Thanks to a World Bank supported pilot project, international financing via the Global Environmental Facility and carbon credits paid at US\$4.99 per tonne of carbon, the project exhibited an internal rate of return of 27.6%, thereby attracting private and public investment within Mexico. The Monterrey WTE system treats 19 million tonnes of waste, reduces 4 million tonnes of CO₂ equivalent, and generates 16 MW (or US\$2.5 million worth) of energy annually. The success of Monterrey's flagship effort led to a proliferation of WTE landfill projects in Mexico. The sweet spot for WTE is cities with 100,000 or more inhabitants. From 2006 to 2012, 22 new landfills pursued carbon financing in Mexico, with eight of them deploying WTE systems. Leveraging CDM financing, World Bank project development funds, and publicprivate partnerships are some of the key enabling factors behind how Monterrey and many other Mexican cities turned trash into gold. For more information on waste-to-energy projects in Latin America see ELLA Brief: Turning Waste into Resources: Latin America's Waste-to-Energy Landfills.

5. Energy Conservation and Green Buildings

The city of Belo Horizonte recently unveiled Brazil's first solar powered stadium in advance of the 2014 World Cup. The city's Mineirão stadium, originally built in 1965, has been retrofitted with a 1.4MW solar array on its rooftop. Belo Horizonte has had a long tradition of utilising solar energy, installing solar water heaters since the 1990s. The initiative was part of the Brazilian Energy Conservation Programme (Programa Brasileiro de Conservação de Energia) that generates enough warm water to supply showers, conserving 24% of residential energy consumption in the city. Given that the residential sector accounts for 26% of Brazil's national energy consumption, solar heaters present an example of how both energy consumption and GHG emissions can be significantly reduced.

Belo Horizonte's Municipal Committee on Climate Change and Eco-efficiency decided to draft a bill in 2010 for the installation of solar water heating systems throughout the city by offering tax breaks. The law was passed in 2011 and requires all new private buildings that use hot water to include a solar water heating system. This initiative has the potential to reduce the annual energy demanded for heating water by at least 51%. Local inhabitants were eager to adopt the solar water heating systems, as they provide annual energy savings of between 30% and 60% depending on the size of the solar units.²³

In Latin America, buildings consume 21% of treated water and 42% of electricity while producing 25% of CO₂ emissions and 65% of waste. Green buildings are defined as structures that are environmentally responsible and resource-efficient over their full lifecycles. By transitioning to green buildings, the sector could reduce energy consumption by up to 50%, water use by 40%, carbon dioxide emissions by 39%, and solid waste by 70%. In Latin America (and the world) the most successful international labelling initiative for the promotion of high-end commercial and residential green buildings is the Leadership in Energy and Environmental Design (LEED) Certification System, administered by the World Green Building Council. The Council is a non-profit organisation comprised of real estate professionals that support cost-efficient and energysaving green buildings worldwide. The group has grown quickly, and local councils have been established in five Latin American countries over the last eight years: Mexico (2005), Brazil (2007), Argentina (2009), Colombia (2009) and Peru (2011). In contrast, only two countries in Sub-Saharan Africa and South Asia have set up local LEED councils: India in 2001 and South Africa in 2008. In 2007, there were only two LEEDcertified buildings in all of Latin America, one of which was in Mexico. Mexico now has over 15 certified LEED buildings, with several more in the pipeline. Mexico has the second most LEED certified buildings, after Brazil.

Whereas LEED promotes and certifies high-end green buildings, the International Finance Corporation's Excellence in Design for Greater Efficiencies (EDGE) aims to rapidly scale-up green building construction in emerging markets by helping to "democratise" the green building market. Basically, EDGE extends green building gains beyond niche, top-tier, LEED clients to the mass market.

The World Green Building Council and the International Finance Corporation announced the programme in July 2013, with pilot projects operating in Brazil, China, India, Mexico, and South Africa, and another 20 countries to be selected for

²³ Belo Horizonte Solar Energy Draft Bill (available in Portuguese only).



2014. To learn more about the growth of the green building sector in Latin America, read the <u>ELLA Brief: Green Building</u> in Latin America.

CITY-LEVEL CLIMATE ADAPTATION IN LATIN AMERICA

Adaptation strategies seek to lower the risks presented by the various consequences of climatic change. Adaptation measures may be planned in advance or created spontaneously in response to a local event. They include large-scale infrastructure changes – such as building defences to protect against sea-level rise or improving the porosity of road surfaces. City adaptation programmes can also promote behavioural shifts such as more effective use of water and disaster preparedness.

In 2012 the World Bank carried out a survey on climate adaptation in Latin American and Caribbean cities. In total, 226 cities across 20 countries participated. Although the results are slightly skewed by disproportionate countrylevel responses (i.e. 24% were from Honduras) and citysize representation (i.e. 88% of the cities were smaller than 500,000 people), the survey provides insightful information (Figures 12 and 13). For example, 78% of participants classified climate adaptation as an urgent policy measure.²⁴ It should be noted that small cities that are rapidly growing present an opportunity to implement city planning and development with climate change in mind. Much like how mobile telephones allowed developing countries to leapfrog the development of landline infrastructure, large-scale public works and municipal systems can and should account for potential climate change impacts to avoid unnecessary and costly iterations. It is interesting to note that adaptation research (with 26% of respondents) is the standout adaptation activity being carried out at city-level, which runs in parallel to GHG inventories for mitigation efforts since both start by assessing the problem, risks, costs, and potential benefits, thereby facilitating informed policy and construction decisions amidst the uncertainties of climate change.

Figure 12: Adaptation Activities in Latin America, by % of Respondents



Source: Fraser and Lima. 2012, see n24 above.

Climate Change Impacts	Drivers of Vulnerability	Consequences of Inaction	Potential Actions for Adaptation
Frequent, severe heat waves	Heat Island Effect; Insufficient cooling system; Informal settlement	Increased Airpollution; Heat Induced Illness/Death	Green infrastructure, including more municipal vegetation and green building investments; Retrofit existing bus fleet with white roofs; Public relations campaign to encourage citizens to hydrate to avoid heat stroke
	Undiversified energy portfolio, poor infrastructure	Blackouts because of high demand	Investment in clean energy and energy effeciency
Frequent, intensified cyclones	Rapid urbanization creates informal settlements marginal lands with no drainage	Increased flooding and landslides	Development and enforcement of sound, climate-sensitve land use planning; Early warning systems
		Contaminated or stagnant water with disease bourne illness	Improved waste management to prevent leakage/contamination; regular drain clearance to prevent clogs; and public health engagement and risk prevention for flood-specific diseases
	Low to no adequate transportation infrastructure	Blocked emergency routes during flooding, slowing evacuation; constrained commercial activity	Investment in pathways, roads, and public transport options for informal settlements; green infrastructure; relocation of bus/train storage yards out of flood prone areas to reduce loss of equipment
	Insufficient storm water infrastructure, worsened by deforestation and other losses of ecosystem services	Increased runoff and flooding	Regular drain clearance to prevent clogs; improved ecosystem management to leverage natural storm water function (e.g. contour planting, terracing and afforestation).
Sea-level Rise	High population density and commercial activity along coasts and river deltas	Loss of property/infrastructure before end of useful life	Relocation of facilities out of flood-prone areas; sea-walls to stop coastal flooding
Intensified Drought	Existing water scarcity across various needs (drinking, energy, agriculture)	Water scarcity and competition worsen	Ensure resilient utility water supply; reclaimed water; demand management and effeciency programmes
	Local food shortages or high prices driven by local or global impacts	Increased competition, with possible famine	Public awareness campaign to increase municipal competency about food supply; urban agriculture; city-level food storage infrastructure

Figure 13: Classification of Potential Adapation Responses to Climate Change Impacts

²⁴ Fraser, A., Lima, D. B. 2012. *Survey Results Report: Regional Technical Assistance Initiative on Climate Adaptation*. World Bank, Washington, DC.



A global survey released by ICLEI - Local Governments for Sustainability on urban climate adaptation indicates that Latin American cities, compared to other regions, are making noteworthy progress. 95% of Latin American cities are engaged in adaptation planning, well above the global average of 68% and more than any other developing region. Africa follows with 80% of cities engaging adaptation measures, trailed by Asia at 67%. In Latin America, 45% of countries in the region have completed risk and vulnerability assessments, and 75% have formed some type of group to support adaptation planning, such as a commission, task force, or advisory group.

The three examples of city-level climate action plans below are considered the most comprehensive and effective in Latin America, as they address both adaptation and mitigation. Quito was one of the first cities in Latin America to make adaptation central to its development strategy when much of the region – and the world – was focused on mitigation. After severe flooding and many casualties, Rio de Janeiro implemented a strong technical response complemented by a low-cost information network to increase the preparedness of city officials and residents. Finally, Mexico City provides a shining example for other urban centres, having surpassed the targets set out in its Climate Action Plan.

1. Quito Climate Change Strategy

Quito, Ecuador is a steep-sloped city in the Andean mountains with 2.1 million inhabitants. Due to an increasing incidence of mudslides and flooding in the city around the turn of the century, as well as the decline of the local Artisana glacier,²⁵ over 670,000 people now live in high-risk areas, and overall, 43.5% of its inhabitants live below the national poverty line. Given the city's considerable climate vulnerability, Quito was one of the first movers in Latin America with respect to municipal climate adaptation.

As early as 1993, the city's municipal law was reformed to create authorities responsible for adaptation, with a scope of work that included creating environmentally protected areas, managing appropriate land use, and coordinating territorial management. Hillside management was put in place in 1997, along with glacier monitoring the following year. The latter contributed significantly to catalysing strong partnerships

and reducing stakeholder pushback (i.e. the city's powerful water company) on upcoming adaptation policies. In 2000, through participatory management reforms, the coordination of climate change adaptation was decentralised to include NGOs and community groups.

In 2007, the former city mayor Paco Monyaco worked with city council members, local businesses, research groups, and various community groups to submit a draft climate action plan, which was approved as policy by the council in 2009 and followed up with an implementation proposal in 2010. Finally, Quito's Climate Action Plan for 2012-2016 was approved and includes a total of 28 mitigation and adaptation projects.²⁶

The city's adaptation efforts aim to reduce municipal vulnerability by 20% via the following actions:

1. Conservation of ecosystem services (e.g. reforestation and afforestation)

2. Water security (e.g. education campaign on local aquifer and water consumption)

3. Public health (e.g. water consumption and sanitation, household relocation)

4. Infrastructure (e.g. electricity generation, green roofs, energy efficiency)

5. Climate risk management (e.g. early warning systems, forest fire modelling, hydrological analysis, and vulnerability studies)

In addition to adaptation programmes, the climate plan also includes a mitigation goal of 15% reduction of 2011 government emissions by 2016.²⁷ Mitigation initiatives include Bici-Q (Quito's bike-share programme), Government Buildings Renewable Energy Interventions, and even an emissions reduction scheme for the private sector.²⁸ For more information on Quito's climate change strategy see the ELLA Brief: City-Level Climate Change Adaptation Strategies: The Case of Quito, Ecuador.

2. Rio de Janeiro's Climate Change Action Plan

Rio de Janeiro in Brazil is another city that has both climate adaptation and mitigation policies in place for its 6 million people. The programme targets three key areas in particular:²⁹

²⁹ Municipal Government of Rio de Janeiro. 2010. *Rio Sustainable: Climate Change Action Plan. Municipal Government of Rio de Janeiro, Rio de Janeiro*.



²⁵ Gallucci, M. 2013. *6 of the World's Most Extensive Climate Adaptation Plans*. InsideClimate News, online publication. ²⁶ Carbonn. 2013. <u>City Climate Report: Metropolitan District of Quito</u>. Carbonn, online publication.

²⁷ Ibid. ²⁸ Cáceres, N. 2012. <u>El Plan de Acción Climático de Quito: Construyendo Resiliencia (Quito's Climate Action Plan: Building Resilience)</u>. Quito's Environmental Secretary, Quito.

- 1. Climate vulnerability mapping
- 2. Emergency risk management programme
- 3. Educational activities (private, government and civil society)

These adaptation efforts, along with a recently installed operation centre with 80 screens and 1,000 cameras, have proven effective at reducing damage from various types of climate shocks, especially heavy rainfall. Much like Quito, Rio is located on steep slopes, many of which are covered with informal neighbourhoods (*favelas*) that are highly vulnerable to mudslides and floods, which are projected to increase in frequency and severity due to climate change (Figures 14 and 15). In April 2010, Rio recorded its heaviest rainfall on record, 305mm in 24 hours, claiming 67 lives. As a result of this disaster, the city's early warning system (EWS) was improved such that on the 5th March 2013, when 86.2mm of rain fell in one hour, 45 sirens were sounded in 24 communities, thousands of people evacuated their homes, and zero fatalities were recorded. In this case, it took a severe disaster to occur before adaptive measures were sufficiently

Figure 14: Risk Map for Favela Formiga, Rio de Janeiro



Source: Provided by the Civil Defence of Rio de Janeiro.

Figure 15: Informal Settlement (Favela) in Rio de Janeiro



Source: Author's own

improved.

In total, 117 communities in Rio have been designated as vulnerable to high-precipitation events. Given the number and locations of many of these communities, the city had to develop a low-cost strategy to raise public awareness about disaster risk management to maximise the impact of the EWS. This was achieved with a mixture of actions. First, local health assistants who make monthly household visits have been tasked with disseminating information about the EWS direct to families. In addition, these community health workers collect details on inhabitants with special needs (due to their age or a disability) so that they receive special assistance in the event of an emergency evacuation. The mapping system facilitates targeting efforts to evacuate the most vulnerable inhabitants first. For more information on Rio's EWS system, see the ELLA Brief: Rio de Janeiro City's Early Warning System for Heavy Rain.

As for mitigation, Rio de Janeiro set reduction targets of 8% by 2012, 16% by 2016, and 20% by 2020, using its 2005 emissions as a benchmark. These targets and the monitoring of the city's climate-related actions are formalised under the ISO-certified Rio de Janeiro Low Carbon City Development Programme, which many claim to be the new business model for city-level climate change mitigation. Municipal initiatives already underway include:

- Transportation since this sector is responsible for 45% of the city's annual GHG emissions, developing a four-lane BRT system and doubling the city's network of bike paths presents substantial GHG reduction opportunities with the co-benefits of improved air quality and decreased traffic congestion
- Urban forestry with the largest urban forest in the world (19,000 ha) the city aims to reforest 1,300 ha of degraded land to increase carbon sequestration with an adaptation co-benefit from ecosystems services, reducing flooding and mudslides
- Carbon market city-level emission reductions may either be counted toward the GHG reduction goals or sold on international market as carbon offsets

Upcoming efforts include increasing recycling, as well as energy efficiency in buildings and streetlights. The important role of partnerships in the Rio experience cannot be overstated. The Low Carbon Development Plan was a joint effort between Rio and the World Bank's Climate Change



Practice Group and <u>Carbon Finance-Assist Program</u>. Similarly, Rio's urban forestry initiative receives support from the U.S. Forest Services and local NGOs.³⁰

3. Mexico City's Climate Action Plan

The international environmental community frequently recognises Mexico's national-level climate-related initiatives, many of which are attributed to the efforts of former President Felipe Calderón. However, the country's capital, Mexico City, has a lot to brag about as well. Mexico City's Climate Action Plan, 2008-2012³¹ is the country's first policy planning instrument for climate change. Not only did the municipality meet the plan's adaptation goals, it also surpassed its mitigation targets.

Adaptation efforts focused on forestry, agriculture, health, poverty and biodiversity, and involved three broad actions from the municipal government: i) analysis of principal threats and vulnerabilities locally; ii) mainstreaming of adaptation considerations into existing municipal institutions; andlastly, iii) implementation of prioritised adaptation measures. The approximate cost of these efforts is estimated at nearly US\$300 million over five years (Figure 16).

The city's total emission reduction target was 7 million tonnes of CO_2 equivalent from 2008 to 2012 to be achieved via measures in the transportation, waste, forestry, energy and water sectors. The city surpassed its goal, achieving a total reduction of 7.7 million tonnes by 2012, with transportation accounting for well over half of the reductions (Figure 17).

Adaptation Measures				
Flood Early Warning System	10.0			
Urban ravines	62.5			
Protection/restoration of native crops	13.5			
Forest fire detection	25.1			
Epidemiological monitoring	0.5			
Vulnerable community programme	6.4			
Soil/Water conservation	40.5			
Agricultural soil/water development	18.9			
Agricultural monitoring and organic farming	23.4			
Smallholder farmer pilot 1: soil restoration	41.4			
Smallholder farmer pilot 2: native species	9.3			
Aztec knowledge integration	18.2			
Education and Outreach				
Efficient household resource consumption	0.6			
Strengthening water conservation	5.4			
Educational outreach for climate change	9.0			
Educational outreach on residual solids management	5.7			
Educational outreach on adaptation measures	15.7			
Total	305.9			

Figure 16: Proposed Budget for 2008-2012 (US\$ million)

Source: Municipal Government of Mexico City. 2008. <u>Mexico City's Climate Action Plan, 2008-2012</u>. Municipal Government of Mexico City, Mexico City.

Figure 17: Mexico City's GHG Reduction Measures, 2008-2012

Sector	Mitigation of $\rm CO_2e$ (millions of tonnes)	Share of total reductions
Transportation	4.8	62.0%
Waste management	1.2	15.3%
Carbon sequestration	0.9	11.6%
Energy effeciency	0.8	10.8%
Watermanagement	0.046	0.1%
Total	7.7	100%

Source: C40 Cities. 2012. Mexico City Meets, Exceeds Climate Action Program Goals. C40 Cities, Online publication.

³⁰ World Bank. 2012. <u>*City of Rio and World Bank Launch Ground-Breaking Program for Low Carbon City Development</u>. World Bank, online publication. ³¹ Municipal Government of Mexico City. 2008. <u><i>Mexico City's Climate Action Plan, 2008–2012*</u>. Municipal Government of Mexico City, Mexico City. (available in Spanish only).</u>



CONTEXTUAL SUPPORTING CITY-LEVEL FACTORS **CLIMATE INITIATIVES**

At the city level, there is a strong nexus between the conditions that enable mitigation and adaptation. First and foremost, city planners, administrators, and policymakers need to understand their respective city's vulnerabilities to climate shocks, as well as their own contribution to climate change (i.e. GHG emission sources). Therefore, processes of mitigation and adaptation must starts with research. Since cities are on the frontline of climate change, support for action typically comes in the wake of climate disasters. This leads to the next vital factor: political will.

Without political will among the urban populace and their elected officials, it is nearly impossible to make the proper investments. Highlighting the local benefits of climate policy in public outreach, awareness, and preparedness facilitates the approval process to secure and/or allocate adequate investment, both for the public and politicians (Figure 18).

Cities in countries with progressive national leaders can tap into funding streams, with additional support through grants and partnerships with international NGOs, development banks, multilateral organisations, and international carbon markets to help make these transitions when local resources are limited.

- Cities account for a majority of worldwide GHG emissions (75%) and mayors have authority over much of their respective cities' emissions (75% on average), making widespread urban-level mitigation measures a superb opportunity to tackle global climate change.
- Latin American municipal leaders are working to capture this opportunity through city-level actions and commitments, as participants in networks of similarly climateconcerned cities, as signatories of inter-municipal agreements, and as partners with international NGOs.
- The most successful municipal initiatives for climate change mitigation reduce emissions while simultaneously improving the quality of life of urban inhabitants and/or increasing costsaving opportunities. Latin American experience shows that waste-to-energy projects improve waste management processes, support energy supplies, and

reduce GHG emissions from landfills. Energy efficiency, particularly in commercial and residential buildings, reduces energy consumption, utility bills, and GHG emissions. Modernised private and public transport systems and regulations (e.g. bus rapid transit, bike paths, particle filters, electric taxis, etc.) reduce traffic congestion, air pollution (including GHGs), and the associated health risks.

Successful municipal mitigation efforts in Latin America also promote national and regional uptake of similar programmes by proving viability and mainstreaming best practices. This is demonstrated by Monterrey's flagship waste-toenergy project, which proliferated across Mexico shortly thereafter; and, similarly, with Curitiba's bus rapid transit system, which spread across to other major cities across the region.

Successful adaptation policies in Latin America start with an assessment and mapping of climate risks and identifying vulnerable communities and infrastructure. Low-cost outreach and education can be achieved by leveraging existing institutional capacity and responsibilities of civil servants, as was the case in Rio de Janeiro.

Mitigation and adaptation are both necessary and complimentary. Even if mitigation efforts are wildly successful and the world quickly transitions to a low-carbon economy, our societies would still face the impacts of climate change set in motion from past decades of emissions. However, the costs of future adaptation measures are dramatically reduced by current mitigation initiatives. This perspective is reflected in the comprehensive municipal climate action plans of Quito, Rio de Janeiro, and Mexico City.

Figure 18: Barriers to Implementing Effective Climate Change Adaptation in Latin America



Source: Fraser and Lima. 2012, see n24 above.

Lastly, even when funds are low, the case can be made for many of the top climate policy priorities, as they actually save money in short and long-run when considering potential co-benefits and the damage from inaction.

LESSONS LEARNED





CONCLUSION

By exploring examples of municipal-level climate change mitigation and adaptation in cities throughout Latin America, this Guide aims to provide readers with a range of best practices and considerations for helping to enact or improve their own municipal climaterelated measures. Leading municipal climate strategies have and will continue to extend beyond their city limits, driving national policies and promoting green economies in the name of healthy urban populations with climate-resilient futures, domestically and internationally. Acting as beacons, lessons from climate-resilient cities can undoubtedly help other developing regions navigate the challenges and uncertainties of climate change, capitalising on the local benefits enjoyed by intelligently managed cities.

KNOWLEDGE PARTNERS

Below is a sample of some of the most influential organisations researching and working on city adaptation and mitigation in Latin America. For additional information about these and other organisations, read the ELLA Spotlight on Organisations.

The Carbon Cities Climate Registry (cCCR) is an internationally recognised greenhouse gas emissions reporting platform for local governments, managed by ICLEI. It has developed a global mechanism that encourages local governments to regularly and publicly report on their greenhouse gas reduction commitments, GHG emissions inventories and climate mitigation/adaptation actions and enables cities to publicly register their greenhouse gas reduction commitments, report performance and showcase actions. Sixty-eight Latin American cities participate in the registry.

The <u>C40 Cities – Climate Leadership Group</u> is a joint venture between megacities with an interest in taking action in relation to GHG emissions. The C40 focuses on implementing meaningful and sustainable climate-related actions locally that will help address climate change globally. To do this, the organisation works with city governments to fulfil their needs in changing their emissions profile. Curitiba, Rio de Janeiro and Sao Paulo are three participating cities from Latin America.

The Carbon Disclosure Project (CDP) is an international, notfor-profit organisation that collects climate change data from organisations in some 60 countries worldwide, providing indices for companies and cities to measure, disclose, manage and share vital environmental information. It holds the largest collection globally of primary climate change, water and forest-risk information and shares these insights with business, investors and policymakers. Headquartered in London, the CDP has offices in New York, Berlin, Brussels, Sydney, Stockholm, Milan, Sao Paulo, New Delhi, Beijing and Tokyo.

The <u>Global Methane Initiative (GMI)</u> is a multilateral partnership that aims to reduce global methane emissions and to advance the abatement, recovery and use of methane as a valuable clean energy source. GMI achieves this by creating an international network of partner governments, private sector members, development banks, universities and non-governmental organisations, in order to build capacity, develop strategies and markets, and remove barriers to project development for methane reduction in partner countries. The initiative has been very active in Latin America, with experiences documented in Argentina, Brazil, Chile, Colombia, Dominican Republic, Ecuador, Mexico, Nicaragua and Peru.

The <u>Global Partnership on Waste Management (GPWM) –</u> <u>UNEP</u> supports the development of work plans to facilitate the implementation of integrated waste management at national and local levels. The partnership has compiled waste management databases, country needs assessment analysis, and sub-sector specific waste management guidelines. GPWM has also put together countrywide waste management profiles for a number of Latin American countries, such as Argentina, Barbados, Brazil, Chile, Colombia, Costa Rica, Guatemala, Honduras, Jamaica, Mexico, Paraguay, Saint Lucia, Trinidad and Tobago.

The International Council for Local Environmental Initiatives (ICLEI) is the world's leading association of cities and local governments dedicated to sustainable development. It brings together more than 1,000 cities and towns in 84 countries. ICLEI promotes local action for global sustainability and supports cities to become sustainable, resilient, resource efficient, biodiverse and low-carbon, to build smart infrastructure and to develop an inclusive, green urban economy. Key pillars of ICLEI's approach are capacity building and training, consultancy and knowledge exchange among its members.

The Urban Climate Change Research Network (UCCRN) brings together individuals and institutions dedicated to urban climate change. With a diverse steering group from developing and developed regions, UCCRN benefits from climate policy leaders from the Latin American cities of Buenos Aires, Curitiba, Quito, Rio de Janeiro and Tijuana. Its key aim is to promote a better understanding and exchange between researchers, practitioners and policymakers.



RECOMMENDED READING

The following is a selection of some of the key publications related to city-level adaptation and mitigation in Latin America. For more information about these and other publications, see the <u>ELLA Spotlight on Publications</u>.

Cadena, A. *et al.* 2011. *Building Globally Competitive Cities:* <u>The Key to Latin American Growth</u>. McKinsey Global Institute, Washington, DC.

Carbon Disclosure Project (CDP). 2012. <u>Measurement for</u> <u>Management: Cities Global Report</u>. CDP, London.

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Carmin, J., Nadkarni, N., Rhie, C. 2012. <u>Progress and Challenges In</u> <u>Urban Climate Adaptation Planning: Results of a Global Survey</u>. MIT, Cambridge, MA.

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Hardoy, J., Pandiella, G. 2011. <u>Urban Poverty and Vulnerability</u> to <u>Climate Change in Latin America</u>. In: *Environment and Urbanization* 23: 123-155.

LEARN MORE FROM THE ELLA BRIEFS

These four ELLA Briefs provide analysis of some the most successful cases of city-level adaptation and mitigation Latin America.

<u>City-Level Climate Change Adaptation Strategies: The Case of</u> <u>Quito, Ecuador</u>

The City of Quito is successfully mainstreaming innovative adaptation practices into development planning under a participative management platform. So how has it been possible to push forward these reforms?

Turning Waste into Resources: Latin America's Waste-to-Energy Landfills

Waste management is typically viewed as a resource intensive activity. Yet some urban areas in Latin America have managed to turn this idea on its head by converting waste into energy and profit.

<u>Capitalising on Public Transport: Reducing GHG Emissions in</u> <u>Latin American Cities</u>

Energy efficient modes of transport – like Bus Rapid Transit (BRT) systems, bicycles and electric taxis – are providing an effective means for reducing urban greenhouse gas emissions in Latin American cities.

Rio de Janeiro City's Early Warning System for Heavy Rain

The city of Rio de Janeiro has developed a highly efficient early warning system (EWS) in just three years. The measures employed are innovative and inclusive, and are constantly being amplified and improved upon.

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To learn more about city-level adaptation and mitigation in practice in Latin America, read the rest of the <u>ELLA knowledge materials</u> on this theme. To learn more about other ELLA development issues, browse other <u>ELLA Themes</u>.

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