

SOME CASE STUDIES

BOX 1.3 MEXICO CITY: ENVIRONMENTAL DEGRADATION AND VULNERABILITY

The water management system of Mexico City has developed features which do not allow it to cope with floods and droughts. It is overexploiting not only its water resources by between 19.1 and 22.2 cubic metres per second, but also the water of two providing basins (Lerma and Cutzamala). According to projections where no consideration is given to global warming, between 2005 and 2030 the population of Mexico City will increase by 17.5 per cent, while between 2007 and 2030 available water will diminish by 11.2 per cent. The situation might get worse if, as expected, climate change brings lower precipitation to this area. Those water users who already face recurrent shortages during the dry season, or when droughts hit Mexico City, will be especially affected. For example, 81.2 per cent of people affected by droughts during 1980 to 2006 live in Netzahualcoyotl, one of the poorer municipalities of the city.

This overexploitation of water resources creates two sources of vulnerability: first, problems of water availability (scarcity) that make water users (especially poor sectors already facing scarcity) vulnerable to the changes in the availability of water that are expected from climate change. Second, groundwater levels are continuously falling, which historically has caused subsidence (and continues to do so in some areas), thus undermining the foundations of buildings and urban infrastructure and increasing the vulnerability of these areas and the populations within them to such hazards as heavy earthquakes and rains.

Source: Romero Lankao, 2010

BOX 2.4 UN-HABITAT'S CITIES AND CLIMATE CHANGE INITIATIVE

Launched in 2008, the Cities and Climate Change Initiative (CCCI) seeks to promote collaboration between local governments and their associations and partners on climate change-related topics, enhance policy dialogue between local and national governments on addressing climate change, support local governments in addressing climate change impacts while reducing greenhouse gas (GHG) emissions, and foster awareness, education and capacity-building for the implementation of climate change policies and strategies.

CCCI initially helped four pilot cities in Asia, Africa and Latin America to carry out climate change assessments. These cities already are at risk of natural disasters. In Esmeraldas (Ecuador), for example, more than half the population live in areas at risk of floods or landslides, while in 2006 two typhoons hit Sorsogon City (the Philippines), destroying some 10,000 homes. Climate change will only exacerbate those vulnerabilities in the 21st century. CCCI currently plans to help those cities deepen their assessments in priority areas, develop climate change strategies and action plans, mainstream findings into ongoing planning processes, and build capacity. At the same time, CCCI has been expanding to include five new cities in Africa in 2009 (Bobo Dioulasso, Burkina Faso; Mombasa, Kenya; Walvis Bay, Namibia; Kigali, Rwanda; and Saint Louis, Senegal) and nine new cities in Asia and the Pacific in 2010 (Batticaloa and Negombo, Sri Lanka; Kathmandu, Nepal; Ulaanbaatar, Mongolia; Pekalongan, Indonesia; Port Moresby, Papua New Guinea; Lami City, Fiji; Apia, Western Samoa; and Port Vila, Vanuatu).

CCCI also is developing capacity-building tools to help cities access carbon finance or to develop climate change plans, drawing on local experiences. Finally, CCCI is taking lessons that it has captured through its local-level work, and disseminating and applying them globally. For example, the recent experiences of Negombo (Sri Lanka) in determining a baseline for its GHG emissions are helping to inform the next iteration of the International Standard for Determining Greenhouse Gas Emissions for Cities (see Box 2.5).

Source: UN-Habitat, 2009b

BOX 3.3 CONTRIBUTION TO GHG EMISSIONS, SÃO PAULO, BRAZIL

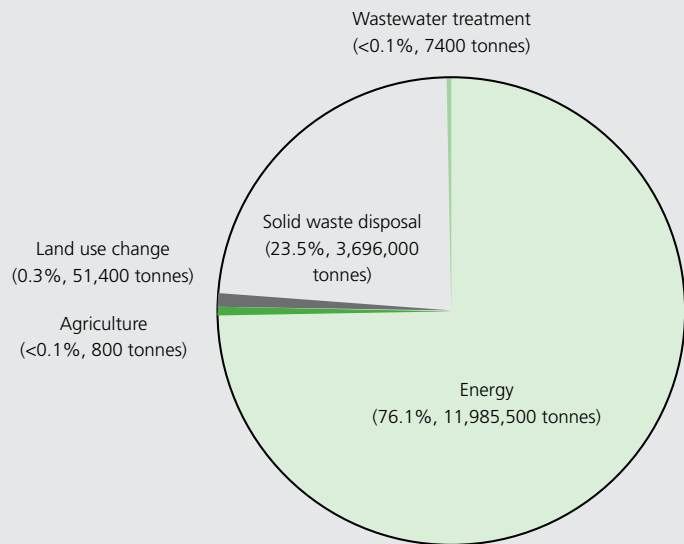
The São Paulo Metropolitan Region has a population of 18 million and is the largest urban area in Brazil. The city is a major driving force for the national economy, with a gross domestic product (GDP) of US\$83 billion in 2003. The service industry is the main driver, accounting for 62.5 per cent of GDP. This is followed by the industrial sector, which accounts for 20.6 per cent. A comprehensive greenhouse gas (GHG) emissions inventory was conducted in 2005. It shows that energy use accounts for more than three-quarters of the city's emissions (see figure below). Approximately two-thirds of this was associated with diesel and gasoline, and 11 per cent with electricity generation. However, the contribution of urban transportation to GHG emissions is still relatively low as a result

of the mandatory blend of ethanol (23 per cent) and gasoline (77 per cent) used in most of the private fleet. Similarly, the contribution of the electricity generation sector is low as the city relies heavily on hydroelectric generation. Solid waste disposal accounted for almost one quarter of the city's emissions, or 3.7 million tonnes of CO₂eq. However, Clean Development Mechanism (CDM) projects at the Bandeirantes and São João landfills will prevent the generation of 11 million tonnes of CO₂eq by 2012 – almost removing the contribution of solid waste to the city's emissions.

Per capita emissions from the city are low, at about 1.5 tonnes CO₂eq per year (in 2003), compared to a national average for Brazil of 8.2 tonnes (1994 figure). Despite this, the growing importance of reducing global GHG emissions means that cities in middle-income countries will increasingly need to identify their emissions reduction potential and act on this.

It is important to note that although the city of São Paulo accounts for 6.8 per cent of the population of Brazil, its GHG emissions are relatively small. This is because Brazil is a large emitter of GHGs from agriculture, land-use change and forestry. In the case of deforestation, due to high rates, emissions account for 63.1 per cent of total national emissions of CO₂ and methane. The agriculture sector as a whole is responsible for 16.5 per cent of the same gases, mainly because of the size of the national herd. In the case of the extremely urbanized city of São Paulo, these emissions are insignificant.

Sources: Dubeux and La Rovere, 2010; La Rovere et al, 2005; Ministério da Ciência e Tecnologia, 2004



BOX 4.1 INCREASED INCIDENCE OF FLASH FLOODING IN MEXICO CITY

The greater metropolitan area of Mexico City is one of the largest and most densely populated urban settlements in the world, containing an estimated 19.5 million residents at a population density of 3584 persons per square kilometre in 2010. The city and its residents have become increasingly vulnerable to flooding and related impacts of climate change over the past century. Annual rainfall in Mexico City increased from 600mm during the early 20th century to over 900mm towards the end of the century. Likewise, the annual incidence of flash flooding has increased from one to two annual floods, to six to seven annual floods over the same time period. On 2 August 2006, for example, a rainfall of 50.4mm in only 36 minutes caused severe flooding in the southern and western parts of the city. The incidence of flash flooding is expected to continue to rise due to climate change-related increases in the frequency of heavy precipitation.

Higher precipitation is associated with an increased frequency of flash flooding, which encompasses a wide range of conditions that threaten life and property, including submerged roads, overflowing rivers and mud- or rock-slides. Flooding damage including injury, death, property loss and water contamination are exacerbated by the infrastructure and development patterns in Mexico City. Informal settlements are often located in areas prone to flooding and landslides and, thus, particularly vulnerable. Inadequate drainage in these areas results in the accumulation of trash and debris that poses serious hazards to human health when flooding occurs. Poorly maintained and aging water drainage and sanitation systems throughout the city worsen the impacts of heavy rains and flash flooding, and make it more difficult for communities to recover.

Source: Ibarrarán, 2011

BOX 4.5 ECONOMIC IMPACTS OF HURRICANE KATRINA, US

The city of New Orleans is located on vulnerable lands at the mouth of the Mississippi River on the Gulf of Mexico. Due to its proximity to the Mississippi and the gulf, the area has strategic economic importance for the petrochemical industry, as well as international trade. New Orleans's longstanding infrastructure and population centres have become increasingly at risk from climate events; coastal defences and other land areas are subsiding as a result of groundwater withdrawal, man-made changes to the flow of the Mississippi River prevents silting and the build-up of new land, and the below sea-level elevation of much of the city requires continuous pumping of water.

In 2005, Hurricane Katrina caused extensive damage to physical infrastructure and the economies of the gulf coast region. The economic losses were in the hundreds of billions of US dollars. An estimated 1.75 million property claims were filed, totalling more than US\$40 billion. Over 250,000 claims were filed as a result of flood damage, which would have bankrupted the National Flood Insurance Program were it not given the right to borrow an additional US\$20.8 billion.

In the Gulf of Mexico, over 2100 oil and natural gas platforms and 15,000 miles (24,140km) of pipeline were affected. A total of 115 platforms were lost, with 52 suffering heavy damage; 90 per cent of total Gulf of Mexico oil production and 80 per cent of natural gas were idled, with lost production equalling over 28 per cent of annual production. The damage to the petrochemical corridor, which produces half of the US supply of gasoline, caused disruptions in economic markets worldwide, resulting in the largest spike in oil and gas prices since the Organization of the Petroleum Exporting Countries (OPEC) embargo of 1973. In the first two months following Hurricane Katrina, over 390,000 people lost their jobs, with over half coming from low-wage earning jobs. As of 2006, only 10 per cent of businesses in New Orleans had returned and reopened.

Before Hurricanes Katrina and Rita, which also happened in 2005, the port of New Orleans was the fourth largest port in the world in terms of transported tonnage. However, as a result of the damage from hurricanes, port operations were halted for a period of time, which forced a realignment of shipping destinations and functions that, because of the high cost of realignment, could become permanent.

Sources: Petterson et al, 2006; Wilbanks et al, 2007

BOX 4.7 IMPACTS OF CLIMATE CHANGE UPON THE INSURANCE INDUSTRY

- In 1992, Hurricane Andrew hit southern Florida (US) and resulted in over US\$45 billion in damage (2005 dollars). In the aftermath, 12 insurance companies dissolved.^a
- The average annual damage from hurricanes in the US is estimated to increase by US\$8 billion (2005 dollars) due to intensification, assuming a scenario in which CO₂ levels double.^b
- By the 2080s, a severe hurricane season in the US would increase annual insured damage by 75 per cent, while in Japan, insured damage would increase by 65 per cent.^c
- Insured damage in Europe are estimated to increase by 5 per cent as a result of extreme storms, with the costs of a 100-year storm doubling from US\$25 billion to US\$50 billion by the 2080s.^c
- Miami (US) has over US\$900 billion of capital stock at risk from severe coastal storms, and London (UK) has at least US\$220 billion of assets located on a floodplain.^d
- The gross regional product of the New York City region (US) is estimated to be nearly US\$1 trillion annually and losses from a single large event could be in the range of 0.5 to 25 per cent, or as much as US\$250 billion.^e
- The full macroeconomic costs of Hurricane Katrina of 2005 are estimated at US\$130 billion, while the gross state product for Louisiana (US) in the same year was US\$168 billion.^f
- In Russia, insurance costs along the Lena River have increased during recent years as a result of more frequent and severe flooding.^g
- By 2100, flooding could cause over US\$94 billion in property damage in metropolitan Boston (US) if no adaptive actions are taken, with homeowners on 100-year and 500-year floodplains sustaining an average of US\$7000 to US\$18,000 in flood damage per household.^h

Sources: a Wilbanks et al, 2007, p369; b Nordhaus, 2006; c Hunt and Watkiss, 2007, p21; d Stern, 2006, p14; e Jacob et al, 2000; f Stern, 2006, p11; g Perelet et al, 2007; h Kirshen et al, 2006

BOX 5.17 DISTRIBUTION OF RESOURCES FOR CLIMATE CHANGE MITIGATION IN MEXICO CITY

In 2008 the City of Mexico presented the Climate Change Action Programme, which introduced a number of measures in the fields of energy, transport, water, waste, climate change adaptation and environmental education. Some 60 per cent of the total budget (of some 61 billion pesos) was invested in transport measures and an additional 36 per cent in infrastructure. Only 4 per cent of the budget was invested in measures for the built environment. However, while the measures in the transport and urban infrastructure sectors were expected to reduce carbon emissions by 2.1 million tonnes of CO₂eq (47 per cent of projected emission reductions) and 1.9 million tonnes of CO₂eq (42 per cent), respectively, built environment measures were projected to reduce the city's carbon emission by 0.5 million tonnes of CO₂eq (10 per cent), suggesting that the built environment measures are the most effective in reducing carbon emissions.

The analysis in the figure brings a new dimension into the discussion – namely, the disparity of efficiency of different measures in terms of reducing CO₂eq per million of pesos invested. Issues such as the 'rebound effect' that may cancel the energy efficiency gains of built environment programmes (e.g. 'efficient lighting in homes') need to be taken into consideration. Furthermore, the costs and reduction potential of each measure will be different in each city. Overall, the Mexico City approach, which targets a wide range of measures in different sectors, is likely to bring the best results.

Source: Ciudad de Mexico, 2008; see also Johnson et al, 2009

