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Urban poverty and vulnerability to climate change in Latin America

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ABSTRACT This paper considers who within the urban population of Latin America is most at risk from the likely impacts of climate change over the next few decades. It also considers how this risk is linked to poverty and to the inadequacies in city and municipal governments. It discusses those who live or work in locations most at risk (including those lacking the needed infrastructure); those who lack knowledge and capacity to adapt; those whose homes and neighbourhoods face the greatest risks when impacts occur; and those who are least able to cope with the impacts (for instance, from injury, death and loss of property and income). Adaptation to climate change cannot eliminate many of the extreme weather risks, so it needs to limit their impacts through good disaster preparedness and post-disaster response. This paper also discusses the measures currently underway that address the vulnerability of urban populations to extreme weather, and how these measures can contribute to building resilience to the impacts of climate change.

KEYWORDS adaptation / climate change / climate variability / Latin America / risks / urban poverty / vulnerability

I. INTRODUCTION

In Latin America, climate change and variability come to people's attention as extreme weather events such as floods, droughts, extreme temperatures, heavy rains and storms. These events are perceived as unusual and extraordinary and over subsequent days, the media is full of press releases detailing how many people were killed, injured or displaced. Authorities and experts comment on the status of the situation, its causes and what should be done to prevent future disasters. However, a few days later everything is forgotten, although those who have been displaced or whose homes have been damaged continue to struggle with the situation. Much the same happens with the general coverage and information around disasters not caused by extreme weather. Many factors contribute to this kind of thinking. Some are related to old paradigms, which see disasters as occasional "natural" extreme events rather than as caused by the lack of attention to risk reduction prior to the extreme event. Others have to do with the lack of rigorous data collection and analysis of the impact of disasters at country, regional and local level, so the information needed to justify actions and guide decisions on disaster prevention is not there. But much of it has to do with the long-evident incapacity of governments to address risk and to integrate development with the reduction

of vulnerability. In the city, hazards and vulnerability combine and reinforce each other, increasing risk levels.

Much urban expansion in Latin America has taken place over floodplains or up mountain slopes, or in other zones ill-suited to settlement such as areas prone to flooding or affected by seasonal storms, sea surges or other weather-related risks. Low-income groups mostly occupy these dangerous sites. Usually, these areas were left vacant (and low-income households allowed to build on them) only because of the environmental conditions that make them so vulnerable and because of their lack of infrastructure and services. In most cases, the poor have no formal tenure of the land and face not only environmental risks but also the risk of eviction. Left with no alternative, low-income groups inhabit overcrowded houses in neighbourhoods with high population densities, although in many cases informal settlements have been developed with layouts that include provision for road networks that would allow service installation and neighbourhood regularization in the future. In these neighbourhoods, houses are usually built with inadequate materials, making them damp and cold in the winter and very hot in the summer.⁽¹⁾ Meanwhile, within local governments, there is generally an institutional incapacity to address this issue or to control pollution and protect natural resources; and also a lack of accountability to citizens in their jurisdiction and little or no scope for citizen participation.

The lack of attention to the risks faced by large sections of the urban population from extreme weather puts many people at high risk from the likely impacts of climate change, including storms, flooding, landslides, heat waves and drought, and overloaded water, drainage and energy supply systems. High levels of risk are particularly evident for those who inhabit dangerous sites and lack the resources and options to modify their vulnerability. Many urban inhabitants who lack safe and sufficient freshwater provision may face additional problems as climate change contributes to constraints on freshwater supplies. Thus, climate change contributes another level of stress to already vulnerable cities and populations, adding to the inadequacies in water and sanitation coverage, poor solid and liquid waste collection and treatment, pollution, poverty and unemployment, lack of participation and inadequate governance structures (including corruption). There are so many problems that there is an urgent need to address them in an integrated way.

Three-quarters of Latin America's population live in urban areas, a much higher proportion than in Asia and Africa.⁽²⁾ In many countries in the region, a high proportion of the urban population lives in one or two very large cities. National economies, employment patterns and government capacities are also very dependent on these large cities, which makes them extremely vulnerable. Any disruption can easily affect the whole country in terms of production, service provision, functioning of government institutions and the national economy. However, the growth of very large cities has been less than anticipated, with higher growth rates concentrating in mid-size or small cities and urban centres or in the periphery of metropolitan regions.

Latin American urban centres have developed within a great range of environments: from sea level to more than 3,000 metres above sea level,⁽³⁾ and in a variety of geographic and topographic locations. Although some have made considerable improvements regarding environmental risk management, these are the exceptions. In general, city governments

1. See Hardoy, Jorge, Diana Mitlin and David Satterthwaite (2001), *Environmental Problems in an Urbanizing World*, Earthscan Publications, London, 448 pages.

2. McGranahan, Gordon, Deborah Balk and Bridget Anderson (2007), "Cambio climático y asentamientos humanos en zonas costeras de baja altitud en América Latina y el Caribe", *Medio Ambiente y Urbanización* No 67, pages 5–24, IIED–AL, Buenos Aires.

3. Canziani, Osvaldo, Sandra Diaz, Eduardo Calvo, Max Campos, Rodolfo Carcavallo, Carlos C Cerri, Carlos Gay–García, Luis J Mata and Andrés Saizar (2000), *Impactos Regionales del Cambio Climático. Evaluaciones de la Vulnerabilidad. Capítulo 6: América Latina*, Informe Especial, Grupo Intergubernamental de Expertos sobre el Cambio Climático (IPCC), WMO, UNEP.

4. UN–Habitat (2003), *Water and Sanitation in the World's Cities: Local Action for Global Goals*, Earthscan, London, 320 pages.

5. Comisión Económica para América Latina y el Caribe (CEPAL) (2007), *Panorama Social de América Latina 2007*, CEPAL, Santiago de Chile.

6. Secretaría de Medio Ambiente y Recursos Naturales, Programa de las Naciones Unidas para el Medio Ambiente (2006), *El Cambio Climático en América Latina y el Caribe*, PNUMA–SEMARNAT, Mexico City.

7. Awuor, Cynthia B, Victor A Orindi and Andrew Adwerah (2008), "Climate change and coastal cities: the case of Mombasa, Kenya", *Environment and Urbanization* Vol 20, No 1, April, pages 231–242.

8. See <http://www.em-dat.net/>.

9. Examples of the scale of this undercount can be seen in the records of DesInventar, which is a data collection system and methodology created in 1994 by Red de Estudios Sociales en Prevención de Desastres en América Latina (LA RED) – the Network of Social Studies in the Prevention of Disasters in Latin America. It keeps track of disasters of different scale and impact in 17 countries in the region. Records come from the media, national databases, government organizations, etc.

10. Hardoy, Jorge (1995), "Urban research in Latin America", in Richard Stren (editor), *Urban Research in the Developing World, Volume Three: Latin America*, Centre for Urban Community Studies, University of Toronto in collaboration with El Colegio de Mexico, Mexico City, the Instituto Universitario de Pesquisas do Rio de Janeiro (IUPERJ) and the Centre for Social Studies in Education (SUR), Santiago de Chile, University of Toronto Press, pages 19–41.

11. See reference 10, page 35.

have not implemented the controls and governance mechanisms that are essential to keeping environmental problems in check.⁽⁴⁾

A significant proportion of the region's population remains very poor. Estimates for 2006 indicated that 36.5 per cent of the region's population was living in poverty (194 million people) with 13.4 per cent in extreme poverty (71 million people) – although there has been a general trend towards poverty reduction up to 2008 (unlike the 1990s). By 2006, the number of people living in poverty in urban areas was nearly twice that in rural areas while the number in extreme poverty was similar (35 million in urban areas, 36 million in rural areas).⁽⁵⁾

Most national governments have been unable to reduce absolute poverty levels or the very high disparities in income distribution, which have increased particularly since the 1970s. Within Latin America, the wealthiest 10 per cent of the population has between 40 and 47 per cent of a nation's income while the poorest 20 per cent only has 2–4 per cent.⁽⁶⁾

The population that has been most affected by extreme weather events in the past provides a basis for identifying those most likely to be at risk from such events in the future.⁽⁷⁾ But the available data on this are very limited. Although the combination of hazards and vulnerability generates environmental risks that are part of everyday life for large sections of the urban population, the number of deaths, serious injuries and loss of assets from these is not known. There are some data on the number of deaths and injuries for events registered as disasters, but this is known to be a small proportion of all those killed or injured by floods and storms, in part because the criteria for what constitutes a "disaster" means that "small" disasters go unregistered in official records. When flood deaths are recorded only for events in which at least 10 people died and/or at least 100 were reported as affected,⁽⁸⁾ the number of deaths from floods is likely to be greatly underestimated.⁽⁹⁾ Without adequate adaptation measures, climate change is likely to mean that the impact and frequency of small and not so small extreme weather disasters will increase.

The availability and quality of data on the impacts of extreme weather or other hazards is a problem throughout the region. Data from different sources exist – for instance, from each government agency, hospital, health and education centre or private firm – but are difficult to obtain and to compare because institutions manage their data in different ways and use different time frames and geographic scales. This makes it difficult to build an accurate picture of impacts. For example, in Argentina there is no agreed estimate of the population living in informal settlements. In 1995, researchers were already pointing to the limitations in the information needed to address risks – for instance, regarding tenancy, quality of housing and infrastructure, access to basic services – and to the lack of studies or particular methodologies to study environmental conditions in low-income neighbourhoods and poor consolidated urban areas.⁽¹⁰⁾ Also of concern then (as now) is that official data such as censuses are so aggregated that they are of little use to local level action programmes. NGOs may gather data in informal settlements where they work and there are insights from numerous micro-level studies;⁽¹¹⁾ but in general, there is little information on the different groups within the poor and on their different needs and priorities, and little of the kind of data needed to guide actions in ways that address root problems. Besides, situations change and it is difficult to keep track of these changes. Community mapping is interesting as it may provide a local perception of problems and an information base

that can be updated and combined with local government data and perceptions, providing a much more accurate picture of reality at the local and micro-local level.

II. VULNERABILITY AND ADAPTATION IN URBAN AREAS

a. Introduction

Adaptations undertaken at community level, making use of traditional knowledge to reduce the effects of climate-related disasters can be translated or improved in the face of climate variability and change. However, most of these examples are rural and include mechanisms for coping with droughts and floods. The agricultural sector has autonomously been adapting to climate variability, using different seed varieties and technologies, adjusting times of sowing and harvesting and moving spatially. But there is little evidence of adaptation in urban areas – perhaps not surprisingly in a context where national and local governments have never shown much interest in addressing vulnerability and managing risks.

The next section looks at six aspects of vulnerability:

- Who lives or works in the locations most exposed to hazards related to the direct or indirect impacts of climate change (e.g. on sites at risk of flooding or landslides)?
- Who lives or works in locations lacking the infrastructure that reduces risk (e.g. from serious floods, where settlements lack drains)?
- Who lacks knowledge, capacity and opportunities to take immediate short-term measures to limit impacts (e.g. to move family members and assets before a flood hits)?
- Whose homes and neighbourhoods face greatest risks when impacts occur (e.g. homes of poorer quality, which provide less protection for inhabitants and their possessions/physical assets and hence there is more loss, often including death and serious injury)?
- Who is least able to cope with impacts (illness, injury, death, loss of property, loss of income, lack of insurance or relation to government to get compensation)?
- Who is least able to adapt to avoid impacts (e.g. by building better homes, getting government to install needed infrastructure and provide needed disaster preparedness, moving to a safer place)?

It must be recognized that adaptation cannot eliminate all risks from extreme events, so a critical part of adaptation lies in the resources, institutions and networks needed for rapid and effective immediate post-disaster response and for rebuilding homes and livelihoods.

Owing to the lack of local level data, it has been difficult to find local case studies that illustrate all six of the above aspects. It is also difficult to separate processes and aspects of vulnerability when in reality these categories overlap and reinforce each other. For example, most of those who live or work in floodplains without the infrastructure to reduce risks are also poor, and lack both the power to press for needed flood controls, suitable land, insurance to protect their properties (houses and possessions), and health. Any case study can easily be relevant to several of the six aspects but there may not be the data to illustrate each aspect. In addition, any of the adaptation measures implemented (autonomously or led by government) will have to compete with many other pressing needs.

b. Six aspects of vulnerability

Who lives or works in the locations most exposed to hazards related to the direct or indirect impacts of climate change?

In urban areas, when the land available for housing is scarce and/or unaffordable for low-income groups, the choices for location are limited. Individuals and households make choices that reflect priorities and trade-offs – for instance, with regard to location/accessibility, availability, type of ownership (private or state owned), security (i.e. the likelihood of eviction), possibilities of service provision and regularization, and cost. In some cases, land is occupied by organizations of dwellers who select a piece of land and prepare an urban plan with plots and streets. Once settled, they struggle for services, negotiate for regularization and, where natural and environmental conditions generate risks, they demand solutions from government.

In most Latin American cities, there are concentrations of low-income households on land sites at high risk from extreme weather.⁽¹²⁾ For example, an estimated 1.1 million people live in the *favelas* of Rio de Janeiro that sprawl over the slopes of the Tijuca mountain range. Housing conditions here have improved over time, with better quality building materials and public services such as electricity, water and sewerage. In many places, however, the paving of sidewalks has increased runoff in the rainy season to the point where water is ankle or knee-deep between houses. Water runs down from the mountain through cemented or quasi-natural watercourses, flooding lowlands. The accumulation of uncollected wastes also blocks drains and surface runoff. More intense or prolonged rains will increase risks in the area.⁽¹³⁾

The city of Santa Fe in Argentina (with a population of 489,595 in 2001⁽¹⁴⁾) has increasingly expanded onto the Río Salado floodplain. To defend itself from floods, it had to create embankments and dykes. A flood in 2003 displaced 139,886 persons (1/3 of the city population) and 27,928 households were affected.⁽¹⁵⁾ Official statistics indicate there were 23 deaths, although local sources suggest there were at least 100 more than this. There were also 180 cases of leptospirosis and 200 cases of hepatitis. Economic losses were estimated at approximately US\$ 1 billion: US\$ 752,000,000 from losses in agriculture – cattle production, industry and commerce; US\$ 180,000,000 from infrastructure and US\$ 91,000,000 in the social sector.⁽¹⁶⁾ Actual losses were much larger than this but were hard to measure (for example, work and school days lost and the impossibility of carrying out informal activities to generate income). Among the factors contributing to the flood were increased and more intense rainfall and deforestation and land use changes around the city – but the flood caught the city authorities completely unprepared, even though the Instituto Nacional del Agua (INA) was monitoring water flows and had informed city and provincial government.⁽¹⁷⁾ More floods in 2006–2007 also caught the government unprepared: there were several deaths, tens of thousands of people had to be evacuated, highways and roads were flooded and bridges brought down. Again, one-third of the city became a shallow lake – the same part of the city that was hit by the 2003 flood (see below for how the lack of infrastructure and preparedness plans contributed to this). City authorities recognized that in the last 50 years there had been no official urban land policies and people had settled where and how they could, prioritizing

12. See reference 1.

13. De Sherbinin, Alex, Andrew Schiller and Alex Pulsipher (2007), "The vulnerability of global cities to climate hazards", *Environment and Urbanization* Vol 19, No 1, April, pages 39–64.

14. Instituto Nacional de Estadísticas y Censos (INDEC) (2001), *Censo Nacional de Población y Vivienda*, INDEC, Buenos Aires.

15. Natenzon, Claudia (2006), "Inundaciones catastróficas, vulnerabilidad social y adaptación en un caso argentino actual. Cambio climático, elevación del nivel medio del mar y sus implicancias", Paper submitted to EMF Workshop IX: Climate Change Impact and Integrated Assessment, July 28–August 7, Snowmass, Colorado.

16. CEPAL (2003), cited in Natenzon (2006), see reference 15.

17. Asociación Civil Canoa, accessible at <http://www.canoa.org.ar/DDHH02.html>.

proximity to work places or social networks. But the lack of policies is also a way of doing politics.⁽¹⁸⁾

Buenos Aires has had a significant increase in annual rainfall over recent decades, and increasing numbers of intense rainfall events (for example, more than 100 millimetres in 24 hours).⁽¹⁹⁾ According to Deslinventar, between 1990 and 1998, 24 flood events occurred, affecting neighbourhoods of different income levels.⁽²⁰⁾ Other data indicate that between 1985 and January 2003, 35 flood events affected the metropolitan region.⁽²¹⁾ The areas most at risk are the low-lying lands of the lower basins of the rivers Reconquista and Matanza-Riachuelo and these lands have high concentrations of informal settlements.⁽²²⁾ No thorough studies have looked at flood events from the perspective of those most affected; but the location of informal settlements within the metropolitan area historically has been on disadvantaged lands, including low-lying coastal lands.

Quito, in Ecuador, is another city where hazards and vulnerability combine to create risk. The city is at the foot of the Pichincha volcano, on very steep slopes. Its population has increased four-fold over the last 30 years or so and a combination of problems (economic crisis, debt, population growing far faster than government can keep up, a lack of planning) has led to legal and illegal occupation of slopes. The costs of providing services and infrastructure to these areas are very high, especially for illegal settlements. The lack of sewers and drainage systems increases the risk of floods, while the lack of proper waste collection systems results in waste accumulation in ravines and gorges, which clogs natural water flow and generates floods and landslides.⁽²³⁾

The metropolitan district of Caracas has suffered from recurrent disasters. Much of the city is built on slopes, with many gorges that lead to the main city river, the Guaire. In 1993, 41.5 per cent of the population lived in low-income neighbourhoods and, while the general population increased 300 per cent between 1950 and 1990, the population in low-income neighbourhoods (*zonas de ranchos*) increased by 878 per cent, resulting in far higher population densities.⁽²⁴⁾ As the city has expanded, land has become more impermeable, increasing water runoff. Without planning, low-income neighbourhoods have occupied unstable land and gorges and, together with waste accumulation, they act as barriers to water runoff.⁽²⁵⁾ In December 1999, Venezuela experienced a one in 100-year rainfall with massive landslides and floods that killed hundreds of people. The rainfall was unusual in its intensity, the time of year and in that it was not produced by either a hurricane or a tropical cyclone. The death toll among people settled on slopes and on low-lying lands was very high.⁽²⁶⁾ Eight states were affected but especially Vargas. The area is heavily urbanized, with high population densities on a narrow strip between the mountains and the sea, and crossed by 37 rivers and 42 canyons. Rapid urban growth led to the occupation of slopes with no controls (the rich occupying floodplains and areas near river banks while poor households settled on slopes and near ravines).⁽²⁷⁾ The metropolitan area of Caracas occupies a valley measuring approximately 30 kilometres east to west and five kilometres north to south. Although it is a relatively small area, co-ordination between different administrative units (municipalities) has proved difficult. Several efforts are underway but there are difficulties in translating a theoretical model of risk management into practice.⁽²⁸⁾

Intense rains in January 2006 affected several areas in Bolivia, including the city of Viacha, where the Río Pallina overflowed – a result of heavy

18. Asociación Civil Canoa, accessible at <http://www.canoa.org.ar/PrPe-Recons.html>.

19. See *Atlas Ambiental de Buenos Aires*, accessible at <http://www.atlasdebuenosaires.gov.ar>; also Rebagliati, Ricardo (2003), "Plan director de ordenamiento hidráulico y proyecto ejecutivo para el arroyo Maldonado del gobierno de la ciudad de Buenos Aires", *Contactar, Ciudades Saludables* No 11, accessible at www.revistacontactar.com.ar/plan_director_nro11.htm.

20. Herzer, Hilda and Nora Clichevsky (2001), "Perspectiva histórica: las inundaciones en Buenos Aires", in Alcira Kreimer et al. (editors), *Inundaciones en el Area Metropolitana de Buenos Aires*, World Bank, Washington DC; also see reference 4.

21. See reference 19, Rebagliati (2003).

22. See Re, Mariano and Ángel Menéndez (2007), "Impacto del cambio climático en las costas del río de la Plata", in *Revista Internacional de Desastres Naturales, Accidentes e Infraestructura Civil* Vol 7, No 1, April, Universidad de Puerto Rico, Recinto Universitario de Mayagüez, Puerto Rico, www.uprm.edu/civil/revistadesastres/Vol7Num1/2%20Re%20y%20Menendez.pdf; also Frers, Cristian (2007), "El cambio climático global y su influencia sobre la República Argentina. Impacto del cambio climático en la ciudad de Buenos Aires", accessible at http://www.internatura.org/estudios/informes/el_cambio_climatico.html; and Czubaj, Fabiola (2007), "Conclusiones del panel intergubernamental de las Naciones Unidas. Expertos advierten sobre los efectos del cambio climático en la Argentina", *La Nación*, Sección Ciencia y Salud, 11 April, page 16.

23. Zeballos Moreno, Othon (1996), "Ocupación de laderas: incremento del riesgo por degradación ambiental urbana en Quito, Ecuador", in

M A Fernández (editor), *Ciudades en Riesgo, Degradación Ambiental, Riesgos Urbanos y Desastres en América Latina*, LA RED, Lima; also UN-Habitat (2003), *Water and Sanitation in the World Cities: Local Action for Global Goals*, Earthscan Publications, London, page 154.

24. Cilento Sarli, Alfredo (2007), "La vulnerabilidad urbana de Caracas", accessible at <http://168.96.200.17/ar/libros/venezuela/rvecs/3.2002/sarli.doc>.

25. See reference 24.

26. Mata, J L and Carlos Nobre (2006), "Impacts, vulnerability and adaptation to climate change in Latin America", Background Paper presented at Regional Workshop on Latin American Adaptation, UNFCCC, 18–20 April, Lima, Peru.

27. See reference 4, page 149.

28. Jiménez, Virginia (2006), "Taller vivencial de intercambio de experiencias municipales en reducción de riesgos", Report within the framework of Proyecto RLA/51467 Fortalecimiento Regional y Reducción de Riesgos en Ciudades Mayores de la Comunidad Andina, 9–12 November, Caracas, Venezuela.

29. "Rehabilitación urbana en Viacha, La Paz, Bolivia", accessed 4 December 2007 at <http://www.hic-net.org/document.asp?PID=238>.

30. UNDP–DIPECHO (2007), "Proyecto regional de reducción de riesgos en capitales Andinas. Documento país: Bolivia", Mimeo, Brussels.

31. Mejía, Fanny Y (2000), "Construyendo una ciudad mas saludable y sostenible ambientalmente. Estrategia municipal para la superación de condiciones de vulnerabilidad del distrito central, capital de Honduras", Seminar on El Impacto de los Desastres Naturales en Areas Urbanas y en la Salud Publica Urbana en Centro America y el Caribe, ASIES, Guatemala.

32. Segunda Comunicación Nacional de la República Argentina a la Conferencia de

rains combined with the dumping of city waste into the watercourse and a lack of cleaning and maintenance of the area. Settlements on the periphery of Viacha have expanded spontaneously and regularization and basic services come after residents have settled; most houses do not have approved plans or legal tenure. Those most affected by the rains were low-income groups, with the disaster occurring at the same time as an economic and political crisis, making it very difficult to implement the needed actions in time. Residents recall former floods in 1985 and 1995, when sewage overflowed onto the streets and damp crept into house foundations, but none were as heavy as the 2006 floods. Demands on local government have been constant.⁽²⁹⁾ In Bolivia, 51 per cent of the urban population is poor. Migration from rural areas is an important part of the demographic and physical expansion of cities such as La Paz, Santa Cruz, Trinidad and Cochabamba, and in all of these there are risks of floods, hailstorms, droughts and landslides, with low-income groups settled in peri-urban areas being at particular risk. In January 2007, during floods in Cochabamba, 60 houses collapsed.⁽³⁰⁾

During Hurricane Mitch, 30 per cent of the central district of Honduras, including the cities of Tegucigalpa and Comayagua, was destroyed. Most damage was concentrated around the four rivers that cross these cities. Obsolete and inadequate city infrastructure, especially water, sanitation and drainage, a lack of zoning codes, the concentration of services and infrastructure in only a few centres, a lack of official prevention and mitigation strategies, together with inappropriate management of the river basins all combined to create the levels of vulnerability seen in Honduras' capital;⁽³¹⁾ 78 per cent of Tegucigalpa's drinking water supply pipelines were destroyed.

Who lives or works in locations lacking the infrastructure that reduces risk?

Many of the urban neighbourhoods most at risk from extreme weather are made even more vulnerable by the lack of infrastructure and services, and often by physical changes to the site or its surrounds. The metropolitan region of Buenos Aires has a large deficit in the infrastructure needed to keep risks to a minimum, including provision for water, sanitation and drainage – although with large disparities between the wealthier and the low-income municipalities in the quality and extent of provision. Buenos Aires has an old drainage system, planned for half the current population and designed to work in the context of open spaces and vacant land that no longer exist. In 2001, record levels of precipitation caused large parts of the urban infrastructure to collapse, a situation that has now become recurrent.⁽³²⁾

The devastating floods experienced by Santa Fe described above were due in part to incomplete or unmaintained infrastructure. Infrastructure may also generate a false sense of security, leading to a disregard of important non-structural measures. In Santa Fe, where land use has not been regulated, nobody enforced recommendations for avoiding the occupation of low areas. A member of a local foundation complained that local authorities favour the settlement of at-risk areas by bringing piped water and electricity to the neighbourhoods, "where they have their loyal voters".⁽³³⁾ Infrastructure to defend certain city areas was supposed to be in place shortly after 1998 but was never completed because of a lack of

resources; and the construction of road infrastructure, such as the highway connecting the city with Rosario, created barriers to water runoff. Five years previously, studies had pointed to the need to double the size of the highway's bridges. The pumps and drainage systems installed to evacuate water in protected areas did not work because of vandalism and lack of maintenance.⁽³⁴⁾

The city of Pergamino in the Pampas of Argentina also faces more frequent floods due to a combination of increased rainfall since the 1970s, land use changes without a proper urban plan, and the lack of drainage systems and proper waste disposal.⁽³⁵⁾

Besides the fact that basic services and infrastructure such as water and sanitation and proper waste collection and disposal decrease health risks, when they are in place, excess water drains more easily, cesspits do not overflow and wastes do not clog drains and channels. In Latin America, sanitation has improved; however in 2004, 125 million people (14 per cent of the urban population) still lacked a basic sanitation system⁽³⁶⁾ and a significantly higher proportion lacked good quality provision for sanitation and drainage.⁽³⁷⁾

Who lacks knowledge, capacity and opportunities to take immediate short-term measures to limit impacts?

The devastation caused in so many low-income settlements by extreme weather is not necessarily a matter of a lack of knowledge or capacities by their residents, although this may be the case for some new migrants. For residents of informal settlements, there are often risks associated with moving away from their homes because of an approaching storm or likelihood of a flood, even when advised to do so – for instance, losing valuables to looters, uncertainty about provisioning for their needs in the places they move to and the worry of not being allowed back if the settlement is damaged. There are also uncertainties about what the weather forecast actually implies for each home and household, so decisions are made in the context of stress and considerable uncertainty.

This uncertainty is not necessarily removed by official mechanisms to inform the population on how to prepare and react in cases of disaster. In the case of the floods in Santa Fe, the accuracy of the information was doubtful. In addition, the lack of appropriate information and official evacuation mechanisms stopped many from evacuating promptly. The sense of insecurity for those living in informal settlements and the knowledge that looting usually accompanies flooding made many stay to protect their homes and assets. There is no official information regarding the post-disaster situation in Santa Fe, although different newspapers mentioned that many were not able to return to their houses, or that government agencies intended to move them to other city areas far away from social and family networks, work and schools.

A case study of 15 disaster-prone "slum" communities in El Salvador also shows the difficulties of getting appropriate risk-reduction action at neighbourhood level. Households recognized the serious risk of flooding and landslides and took measures to lower risks. But various factors limited the effectiveness of community-wide measures, including the individualistic nature of households' investments, the lack of representative community organizations and the lack of support from government agencies, with most residents viewing local and national governments as unhelpful or even as a hindrance to their efforts.⁽³⁸⁾

las Partes de la Convención Marco de las Naciones Unidas sobre el Cambio Climático (CMNUCC) (2007), Secretaría de Medio Ambiente y Desarrollo Sustentable, Jefatura de Gabinete, Buenos Aires.

33. Valente, Marcela (2007), "Cambio climático. Inundación Santa Fe: aguas violentas, desidia humana", Buenos Aires, April 2, (IPS), <http://www.proteger.org.ar/doc621.html>.

34. See reference 15.

35. Herzer, Hilda et al. (2001), "Grandes inundaciones en la ciudad de Pergamino: extraordinarias, pero recurrentes, análisis de un proceso de vulnerabilidad progresiva", *Realidad Económica* No 175, pages 92–116.

36. "Noticias de Latinoamérica", *Boletín de Agua y Saneamiento* No 20, July 2007.

37. See reference 4.

38. Wamsler, Christine (2007), "Bridging the gaps: stakeholder-based strategies for risk reduction and financing for the urban poor", *Environment and Urbanization* Vol 19, No 1, April, pages 115–142.

In the case of a low-income community (EL Zanjon) on the banks of the Matanza Riachuelo River in Buenos Aires, the lack of advance warning has long hindered them from taking appropriate action before floods arrive. In 2004, the neighbourhood was flooded and a few days later, filmmakers produced a video showing the situation and suggesting links to climate variability and change. Local inhabitants reported that they never knew in advance when the floods were coming even though there was official information regarding precipitation, tides and water levels. The video was used to generate awareness among the community and at different decision-making levels within government agencies, while a community early warning system was developed: a telephone line was installed so that port authorities could call a resident and a system of whistles was set up to alert neighbours.⁽³⁹⁾

There are examples of low-income populations who lack the knowledge to cope with risk. For example, in Brazil, new migrant populations from the arid northeast, with no personal experience of mudslides, arrive in Rio de Janeiro and settle on the hillsides. As they clear these areas for their homes, they remove the protective vegetation cover despite government efforts to protect these areas. The lack of personal knowledge of local risk and of appropriate building techniques hinders safer practices – although many other factors also contribute, including the prevalence of crime and violence that inhibit social cohesion. Over the last 15 years, there have been large public programmes to improve conditions in the *favelas*, including investment in basic infrastructure, health and education for half a million poor residents.⁽⁴⁰⁾

Whose homes and neighbourhoods face greatest risks when impacts occur?

In informal settlements, houses are usually built incrementally over a number of years, with materials of diverse origin and quality, and not always following accepted techniques. These houses rarely comply with official safety standards and there are no controls in place. Most buildings are used intensively – with high levels of overcrowding and a mix of living and working spaces. This is often combined with a lack of maintenance and with environmental conditions (e.g. humidity from proximity to river edges and coastal areas) that cause rapid deterioration. Houses are not as solid or as insulated as they should be and are often built on inadequate foundations (many on landfill or unstable land). In the suburbs of Buenos Aires, in low-lying lands, each resident contracts trucks to bring solid waste to their piece of land and later compact it as best they can. There is no coordination between neighbours, so plots end up on different levels; when it rains, some are flooded more than others. The natural drainage of the larger site has been totally modified without incorporating the needed drainage infrastructure. Families often end up with water in their houses for up to a day when heavy (but not exceptional) rains occur. Houses built on stilts are rare in Buenos Aires – although there are examples, mostly in traditional low-income coastal areas (for example, La Boca–Barracas, Isla Maciel and some neighbourhoods in Avellaneda, south of Buenos Aires, or Tigre, in northern Buenos Aires). Most relatively new low-income settlements have not incorporated such measures, although building two-storey houses would allow valuable assets to be moved to the higher floor. However, this cannot always be done because of the costs and skills necessary to build two-storey houses.

39. See Simms, Andrew and Hannah Reid (2006), "Up in smoke? Latin America and the Caribbean. The threat from climate change to the environment and human development", Third Report from the working group on climate change and development, New Economic Foundation, page 15.

40. See reference 13.

Most low-income groups live in housing without air-conditioning or adequate insulation, and during heat waves, the very young, the elderly and people in poor health are particularly at risk.⁽⁴¹⁾ In northern Mexico, heat waves have been correlated with increases in mortality rates; in Buenos Aires, 10 per cent of summer deaths are associated with heat strain; and records show increases in the incidence of diarrhoea in Peru.⁽⁴²⁾ Cold spells are also becoming more frequent, and without proper heating and housing insulation they are also difficult to cope with. In July 2007, it snowed in Buenos Aires for the first time in almost 100 years. There are no available data, however, on death tolls and health impacts related to unusual and extreme temperatures.

The expansion of dengue, malaria and other infectious diseases is related to changes in temperature and precipitation. No studies that we know of specifically associate disease risks and vulnerability to climate change. However, we can assume that low-income groups and, in particular, vulnerable age groups will be more at risk, as they live and work in homes and neighbourhoods where public health measures to eliminate disease vectors are absent or ineffective. They also have to rely on overtaxed and often ineffective health care systems, and lose school and work days to health problems that should have been prevented. Most work in the informal economy and thus lack insurance to cover lost workdays.

Who is least able to cope with impacts?

The most vulnerable groups (low-income groups in general, women, children and the elderly) seldom have an influential voice with regard to disaster preparedness or responses. This applies in particular to those living in informal settlements where government agencies refuse to work. The needs of infants, children and the elderly often get little attention. The same is generally true for women, who also have less scope to take action. In the case of the Santa Fe floods, although no precise data relate vulnerability to disaster, it has been recorded that in general, those most affected live in flood-prone areas that also lack drainage infrastructure. Data from 2002 estimate that 63.7 per cent of the population of the city of Santa Fe were below the poverty line and there was an unemployment rate of 23 per cent. Certain indicators point to people's potential (or lack thereof) for coping with floods – in 2003, 46 per cent of Santa Fe's population were under the age of 18 and 93.8 per cent of those under 18 were poor; 41 per cent of the households had a female head; 80 per cent of the labour force worked within the informal economy; 41 per cent lived in informal settlements; and 60 per cent had no health insurance other than the public health system.⁽⁴³⁾

A considerable proportion of the urban poor in Latin America are refugees, fleeing wars and conflicts (including guerrillas and drug warfare), disasters and environmental degradation. Even if many of these situations are unrelated to climate events, they highlight who is most affected. These people move to urban areas, leaving behind homes, social networks, family ties and assets. It takes a long time to insert themselves into local communities and build ties and participate in community organizations that can push for changes and negotiate with government and utilities for neighbourhood improvements. Recent floods in the city of Tabasco in Mexico generated between 60,000 and 100,000 refugees, who moved to Playa del Carmen and Cancun in search of jobs and a place to live.⁽⁴⁴⁾ It is

41. Bartlett, Sheridan (2008), "Climate change and urban children: implications for adaptation in low- and middle-income countries", Human Settlements Discussion Paper Series, Climate Change and Cities 2, IIED, London.

42. See reference 26.

43. CEPAL (2003), cited in Natenzon (2006), see reference 15.

44. See <http://www.migrantesenlinea.org/enlinea.php?c=1689>.

impossible to know where these people will ultimately settle but none of these cities were prepared to absorb so many migrants. Cancun, for example, was transformed over a period of 30 years from a fishing town of 500 inhabitants to the biggest tourist centre in Mexico, with 458,477 inhabitants. The city has a wealthy hotel area on a sand barrier, which is totally at risk from storm surges and hurricanes but which has appropriate services and resources for protection and recovery. The proper city, where most of the people serving the hotels or tourist trade live, is also at risk from hurricanes but many neighbourhoods are impoverished and marginal, lacking services and adequate housing.⁽⁴⁵⁾

In Colombia, between 1995 and 2005, 3 million people were displaced, mostly by paramilitary and guerrilla activity. According to CODHES (Consultoría para los Derechos Humanos y el Desplazamiento Forzado) women, children, Afro-American and native communities have been the most affected. The majority of the displaced move to nearby small urban centres or to mid-sized or large capital cities, but they usually lack the education and job skills suitable for urban life and labour markets cannot absorb so many. Unemployment and low salaries are common. On average, in 2005, a displaced family earned 40 per cent of the minimum salary – evidence of the vulnerability of the displaced (who lose their land, assets, social and cultural networks) and the disruption of families in the process. Along with social and political unrest, much of Colombia is prone to flooding, landslides, tropical storms, droughts and seismic activity. Many of the displaced, already socially and economically vulnerable, move into marginal city areas (prone to flooding and landslides, near waste dumps) and are even more vulnerable than existing low-income city dwellers.

Migrants also take measures to address their vulnerability. In the suburbs of Buenos Aires, migrants from Peru organize savings groups that are used, among other things, for housing and household appliances. These savings groups are based on trust between friends and family. Migrants who have moved abroad often send remittances home – and remittance flows are greatly increased if family members at home are hit by a disaster. These funds are an important economic support for recovery.

Who is least able to adapt to avoid impacts?

Although Latin America has an abundance of freshwater resources, many cities depend on local rivers, underground water, lakes and glaciers that may be affected by climate change. Considering city growth, environmental deterioration and possible climate change impacts, these sources might not be enough to meet demand. Cities such as Guadalajara in Mexico⁽⁴⁶⁾ and many Andean cities may face increasing water stress, and low-income groups who still lack adequate access to water will be even less likely to obtain it unless there is strong political commitment.

Cities located in semi-arid regions are particularly vulnerable. Glacier shrinkage reduces the storage of large quantities of water that are later released to river networks during the dry season. Many cities in the Andes will face water shortages during the dry season as a result of glacier retreat over the last decades. Examples include Ushuaia in Tierra del Fuego, which obtains water from the Martial glacier, and Mendoza and San Juan in the Cuyo region in Argentina, where 2 million people live distributed in eight oases. A study from the central Andes of Peru indicates that the largest city in the region, Huancayo, with approximately 325,000 inhabitants, is

45. Domínguez Aguilar, Mauricio and Ana García de Fuentes (2007), "Barriers to achieving the water and sanitation-related Millennium Development Goals in Cancún, Mexico at the beginning of the twenty-first century", *Environment and Urbanization* Vol 19, No 1, April, pages 243–260.

46. See Von Bertrab, Etienne and Philippus Wester (2005), "Gobernabilidad del agua en Méjico: la crisis de agua en Guadalajara y el destino del lago Chapala", *Medio Ambiente y Urbanización* Vol 21, No 62/63, pages 143–160, IIED–AL, Buenos Aires.

already experiencing water shortages. Retaining walls and small dams have been constructed on nearby lagoons but now these interventions are being called into question as they may have contributed to water shortages, along with the increased demands that come with population growth, land use changes and deforestation. The situation is likely to become more acute with climate change. Structural measures have not provided expected outcomes, as they have been implemented within a framework of institutional weakness, overlapping functions between offices, corruption, political opportunism, weakened democracy and no stakeholder participation.⁽⁴⁷⁾

Quito is another city that will face water shortages as a result of glacier retreat. According to official studies, climate change is affecting mountain glaciers and water availability through a reduction in surface and underground water, the sedimentation of waterways, land use modification, the emergence of conflicts around water use, and increases in water use due to increased temperatures (see below for a discussion of how the local government is preparing an adaptation plan).⁽⁴⁸⁾

The flooding in Santa Fe is also relevant to the issue of who is least able to adapt to avoid impacts. In this city, knowledge about the risks and about what needs to be done does not result in needed actions. The director of a local foundation in Santa Fe noted after the floods that “...*there have always been heavy rains in the city of Santa Fe*”; he also noted that the contingency plan for flooding was only on paper and that no one really knew what they were supposed to do. There was no alert and evacuation system in place although everybody knew that more than 100,000 *santafesinos* were at risk and experts from INA had anticipated the weather conditions. No studies have monitored the actions taken in Santa Fe after the 2003 floods; but it seems that structural measures were proposed (although not necessarily implemented) and public resources were used with political aims.⁽⁴⁹⁾ Civil society groups (including groups of evacuees) have been unable to press government to implement the needed programmes and actions for overall city improvement and risk reduction. Floods in 2007 once again exposed the lack of official action. Recently, the municipality and UNDP invited local organizations to the presentation of a programme for the reconstruction of the city. The main proposal is the relocation of those most affected by the floods and the construction of social housing (1,500 units) on vacant land in four different areas of the city near transportation networks, with services and infrastructure. However, who participates, who is relocated and which house prototypes are used are all decided by the city authorities. Selection criteria will be based on a family's vulnerability. The way the programme is implemented will result in new neighbourhoods with families from different places who will probably lose family support and social networks.⁽⁵⁰⁾

An ambitious plan to address flooding in Buenos Aires is underway with support from the World Bank, which includes the modelling of drainage systems, the design of infrastructure works (structural measures) and the development of city norms (non-structural measures) and procedures (management system). The plan is based on historical climate records, with a 50-year horizon, and has not taken into account climate change variables. The reason given is that there is insufficient information to allow this, although the study recognizes that the floods have worsened over recent decades.⁽⁵¹⁾ Meanwhile, an internal report from IDRC suggests that the population at risk from flooding on coastal and estuary lands of the

47. Martinez, Alejandra et al. (2006), “Vulnerability and adaptation to climate change in central Peruvian Andes cities: report of a pilot study”, Proceedings of the 8th International Conference on Southern Hemisphere Meteorology and Oceanography, 24–28 April, Foz de Iguaçu, Brazil.

48. Neira Carrasco, Juan A (2007), “Medidas asumidas por el municipio del distrito de Quito para afrontar los efectos del cambio climático”, accessible at www.comunidadandina.org/desarrollo/cl_JuanNeira.pdf.

49. See reference 15.

50. See reference 17.

51. See reference 19, Rebagliati (2003).

La Plata River could be 1.7 million by 2070, three times the current figure. The property and infrastructure losses for 2050 to 2100 could range from US\$ 5 billion to US\$ 15 billion. Meanwhile, low-income neighbourhoods and upper middle-income gated communities continue to settle on low-lying lands.⁽⁵²⁾

In most Latin American cities, upper middle- and high-income neighbourhoods also settle in risk areas near rivers or coastal areas or on slopes, but they have a choice and the assets (capital, contacts, power etc.) to reinforce their house structures, get protective infrastructure, and lobby for policies and actions that protect their homes and neighbourhoods; their homes and possessions are also protected by insurance.

III. POSSIBLE WAYS FORWARD

A large and diverse body of promising experiences demonstrates how community-based actions in low-income settlements (sometimes supported by international agencies, local and national NGOs, state or national government bodies and charities) can address the risks described above. Even though many of these experiences are in response to risks that do not originate from the impacts of global warming, they show how local governments, communities and other social actors can work in collaboration or independently to reduce risks from extreme weather and other likely impacts of climate change.

a. Regional or national networks and risk management programmes

Central America is within the hurricane belt and has a long history of trying to cope with the effects. In 1998, Hurricane Mitch affected more than 1.2 million people, and conservative estimates suggest US\$ 8,500 million worth of losses, more than the annual GDPs of Honduras and Nicaragua combined. This set development back for more than a decade. More recently, the unprecedented hurricane season of 2005 shows how climate change may increase the intensity and frequency of these natural events.

A range of programmes and networks has been set up in the region to better prepare for disasters. In 1993, Costa Rica, El Salvador, Guatemala, Honduras, Nicaragua and Panama created the Centro de Coordinación para la Prevención de los Desastres en América Latina – CEPREDENAC. This centre coordinates development cooperation, information exchange and advice – seeking to contribute to the improvement of decision-making in the region regarding risk prevention and mitigation. In each country, a commission or national system for risk management and disaster prevention was set up.

In 2000, the government of Nicaragua created the Sistema Nacional para la Prevención, Mitigación y Atención de Desastres (SNPMAD), which integrates different government levels, social actors and municipal and regional committees for risk prevention and mitigation, with a clear focus on risk management. Nicaragua is the second poorest country in the region and 60 per cent of its labour force earn less than the amount needed to cover basic needs. Economic and political crises add to international context, droughts, floods and hurricanes. Estimates of economic losses

52. Burone, Federico (2007), "Vulnerable communities worldwide. Adaptation to climate change", United Nations Climate Change Conference, 3–14 December, Nusa Dua, Bali, Indonesia.

between 1978 and 2000 are around US\$ 4 billion. The system aims to articulate with municipal committees the work at the local level, strengthening networks and horizontal relations. A national fund has also been created to support the work.⁽⁵³⁾

After Hurricane Mitch, El Salvador developed an early warning system and prepared the communities for emergencies. At the same time, it created an office for risk management.⁽⁵⁴⁾

The Andean region is also working on disaster preparedness; although this is not specifically related to climate change, it may improve the potential to share knowledge and capacities, allowing countries to adapt more easily to climate change. Capital cities in the region⁽⁵⁵⁾ are taking part in a project to strengthen local capacities for risk management. In the last three decades, the Andean region urbanized rapidly, with the urban population rising from 30 to 75 per cent. Most low-income settlements are located on steep slopes. The Proyecto Regional de Reducción de Riesgos en Capitales Andinas (RLA/51467) is funded by UNDP and DIPECHO.⁽⁵⁶⁾ It aims to establish alliances between local mayors and produce information exchange, tools and local norms and regulations that include risk management within local development plans.⁽⁵⁷⁾

In terms of risk management, particularly after Hurricane Mitch and later Stan, Central American countries have recognized that disaster management is not the exclusive concern of civil defence institutions or a single organization but, rather, an integral part of policies and actions at different government levels, involving different sectors and offices.⁽⁵⁸⁾ However, these programmes and networks have usually been set up at the national level, without sufficient coordination and implementation at the local level and with weak links to key sectors and institutions such as the housing and urban planning. The emergency aspects of disaster remain deeply rooted within the institutions of the region.⁽⁵⁹⁾ Risk reduction is not really being addressed and many governments and international aid organizations continue to favour structural measures over non-structural, even though they have shown their limitations.

b. City level risk management programmes or implementation of some of its components

Some of the cities that are best prepared for disasters are those affected periodically by seismic movements and hurricanes. In recent years, they have made improvements to include risk management within their local development plans and have set up warning systems.

Several municipalities (*alcaldías*) that are part of the metropolitan district of Caracas are undertaking actions to reduce risk within a broader framework of habitat improvement. The municipality of Chacao has developed an early warning system that aims to monitor gorges and alert dwellers about potential landslides, thus reducing damage and loss of life. The municipality of Bolivariano Libertador, where the Anauco neighbourhood is located (one of the areas that was most affected by 1999 landslides), is implementing a project of social and physical rehabilitation and a community warning system. Another municipality, El Hatillo, is working on community capacity, building in risk protection and prevention.⁽⁶⁰⁾

Some cities are addressing problems of freshwater resources. In the cities of Jauja and Concepción, the implementation of such non-structural

53. Zilbert Soto, Linda (2001), "Material de apoyo para la capacitación en gestión local del riesgo", within the framework of the Formación de Recursos Humanos para la Integración de Sistemas Nacionales de Prevención, Mitigación y Atención de Desastres implemented by Secretaría Ejecutiva del Sistema Nacional (SE-SNPMAD) and UNDP-Nicaragua with funds from Oficina para Ayuda Humanitaria de la Agencia Suiza para el Desarrollo y Cooperación (COSUDE), LA RED.

54. Lopez, Ana Deisy (2004), "Sistema de alerta temprana por inundaciones. Experiencia en El Salvador", accessible at hispagua.cedex.es/documentacion/documentos/cong_valencia2004/PRESENTACIONES/SAT%20EI%20Salvador.PDF.

55. La Paz, Lima, Quito, Caracas and Bogotá.

56. DIPECHO stands for Disaster Preparedness-ECHO, where ECHO is the European Commission's Humanitarian Aid Department.

57. See <http://content.undp.org/go/newsroom/2007/june/pnud-comprometido-con-la-reduccion-de-riesgos-en-la-regin.es?lang=es>.

58. Gavidia, Jorge (2006), "Priority goals in Central America. The development of sustainable mechanisms for participation in local risk management", *Milenio Ambiental* No 4, pages 56-59, Journal of the Urban Environment Programme (UPE) of the International Development Research Centre (IDRC), Montevideo.

59. See reference 58.

60. See reference 28.

61. See reference 47.

62. Marulanda, Liliana M (2000), "El Biomanizales: política ambiental local. Documentación de la experiencia de gestión ambiental urbana de Manizales, Colombia", Instituto de Estudios de Vivienda y Desarrollo Urbano (IHS) dentro del marco de implementación del proyecto Apoyo para la Implementación de Planes Nacionales de Acción del Habitat II (SINPA), Mimeo; also Velasquez, Luz Stella (1998), "Agenda 21; a form of joint environmental management in Manizales, Colombia", *Environment and Urbanization* Vol 10, No 2, October, pages 9–36.

63. UNDP (2004), *Global Report. Reducing Disaster Risk: A Challenge for Development*, UNDP, Bureau for Crisis Prevention and Recovery, New York.

64. Even prior to Hurricane Mitch, La Masica had an early warning system in place that helped save lives during the hurricane. See Lavell, Allan (2000), "Desastres urbanos: una vision global", Seminario on El Impacto de los Desastres Naturales en Areas Urbanas y en la Salud Publica Urbana en Centro America y el Caribe", ASIES, Guatemala, January.

65. Bollin, Christina and Friedegund Mascher (2005), "Honduras: community-based disaster risk management and inter-municipal cooperation", a review of experience gathered by the special inter-municipal association MAMUCA, GTZ, Eschborn.

measures as incentives for proper land use and water resource use, taking advantage of the knowledge of the population, have shown good results for the rational management of water resources and other environmental concerns that together reduce risk.⁽⁶¹⁾

The city of Manizales in Colombia is well known for its ambitious environmental improvement process, which includes Biomanizales (the city's environmental policy operating since 1995 and integrated into the city's development plan) and the Bioplan (the city's action plan to facilitate policy implementation). Perhaps the main achievement is the programme's integration of local and regional government, the private sector, universities and representatives of community organizations in a participative process that seeks to reconcile different priorities and interests. The programme includes a pilot project, Biocomuna Olivares, which was selected because of the area's vulnerable physical and social conditions. One of the activities involved relocating families living on steep slopes and at risk of landslides and flooding. However, a report mentions funding-related difficulties.⁽⁶²⁾ Since the 1980s, the local government has implemented a municipal disaster prevention system in line with its environmental action, with risk management as an integral part of local policies. A system of community preparedness and education, institutional coordination and research are in place. In addition, tax reduction is given to those who implement measures to reduce housing vulnerability. A system of collective voluntary insurance has also been implemented for lower-income groups.⁽⁶³⁾

In response to Hurricane Mitch's impacts, the municipalities of La Masica,⁽⁶⁴⁾ Arizona, Esparta, San Francisco and El Porvenir in Honduras founded a inter-municipal association, Mancomunidad de los Municipios del Centro de Atlántida (MAMUCA), to create a platform for dialogue and cooperation in preparation for extreme natural events and to coordinate local responses. There are around 80,000 inhabitants in the MAMUCA region, about 20,000 in each municipality. The process involved participatory diagnosis and planning (taking stock of disaster risk management capacities and identifying relevant actors), awareness raising, prioritization of strategic reconstruction activities, participation in local decision-making through *cabildos abiertos* (public meetings of citizens) and involving MAMUCA in the national disaster risk management system (COPECO – Regional and National Permanent Commission for Contingencies). One of the main outcomes is a significant improvement in evacuation action during rainstorms through community-based disaster reduction practices, and the possibility of sustaining a system of local emergency committees (CODELS) integrated into municipal emergency committees (CODEMs) and COPECO. The CODEM is chaired by the mayor and involves the participation of representatives of the local council and local institutions (health care, police, fire department, Red Cross, etc.).⁽⁶⁵⁾

c. Community organizations

In response to the rains and floods affecting the city of Viacha in Bolivia and the lack of government support, neighbours organized themselves. Each affected area (13 *barrios*) elected two representatives, from which seven were elected with different responsibilities, creating the "association of those who suffered losses" (Asociación de Damnificados de Viacha-ADV).

This organization coordinates actions with the local government for resource distribution, housing reconstruction and upgrading. However, the work with some of the neighbourhood associations proved difficult as they ended up being indifferent to neighbours' claims.⁽⁶⁶⁾

Floods in 1992 affected seven provinces in northeast Argentina and 123,000 people had to be evacuated. The national government received an emergency loan from the World Bank. A rehabilitation programme involved beneficiaries building their own houses in six provinces and a related flood protection programme included structural and non-structural measures. After 10 years, more than 10,000 units had been built with services, on sites safe from flooding and constructed by the same community members who had been affected by the floods. One of the main assets was the transparency with which beneficiaries were selected and the funds managed. Overall, the process led to improvements in relations between different government levels and between government and community; it helped regularize urban areas and created a sense of ownership, and it integrated those displaced by floods into the urban fabric through a participatory process.⁽⁶⁷⁾

In the Barrio Parque Paso del Rey in the municipality of Moreno, Argentina, a local community organization with a strong leader has organized a soup kitchen that acts as an evacuation centre during floods caused by intense rains. The centre is becoming more and more organized, staffed with beds, mattresses, food and clothing. Evacuees have learned to read local conditions and know when to move to the evacuation centre. The occupation of marshlands and lagoons, coupled with individual practices such as elevating plots or building small walls to keep water out, has increased general flood risk in the *barrio* in successive years. Other localities in Moreno, such as Mariló, also have evacuation places managed by the community and an informal system for keeping track of river and stream water levels. When the situation overwhelms community action, demands are made on local government for mattresses, zinc sheets for roof replacement, etc.⁽⁶⁸⁾

There are many examples outside the risk management sphere that involve neighbourhood organizations and local NGOs negotiating for water and sanitation, land regularization and environmental improvement. These are examples of how communities can organize and achieve a common goal.

d. Adaptation to climate variability and change

México and Cuba are implementing a regional three-year pilot project on climate change adaptation aiming to set up strategies, policies and adaptation measures. It is being implemented by the Centro del Agua del Trópico Húmedo para América Latina y el Caribe (CATHALAC) and coordinated by UNDP. This initiative aims to identify priorities at the local, regional and national level, evaluating vulnerability and adaptation options.

The government of the city of Quito is putting in place several measures to prepare for the impacts of climate change. The plan, promoted by the mayor and set within the framework of the 2005–2009 government plan, includes emission controls, the creation of a legal framework for pollution control, a plant for methane catchment and treatment on the city's landfill and a metropolitan system for risk management implemented by

66. See reference 29.

67. Programa de Protección contra las Inundaciones (PPI), Subprograma de Vivienda por Autoconstrucción, Esfuerzo Propio y Ayuda Mutua (2003), "La experiencia en el programa de protección contra inundaciones", Ministerio de Planificación Federal, Inversión Pública y Servicios, IIED-AL, Buenos Aires.

68. Hardoy, J and G Pandiella (2008), "Consulta sobre los efectos del cambio climático en comunidades vulnerables. El caso del municipio de Moreno", Pcia. de Buenos Aires, Argentina, prepared for Consulta Regional para Evaluar las Prioridades Regionales, Capacidades y Vacíos de Investigación en Cambio Climático y Reducción de la Pobreza en América Latina y el Caribe, Consulta Subregión Cono Sur, IDRC and DFID.

an emergency operation committee. They are also aware of the need to analyze vulnerability and adaptation in the face of climate change and develop the institutional capacities needed to conduct these actions. One area is climate change and water services. The government is planning actions and projects to compensate for less freshwater availability, such as: the reduction of water losses along the network; creating a culture of rational use of the resource; infrastructure works (dams); use of underground water sources; and the development of mechanisms to reduce conflicts generated around water use.⁽⁶⁹⁾ Despite being one of the few cities in the region that is taking climate change seriously and proactively, none of the actions suggested seem to integrate community participation into planning and implementation or into an analysis of the root causes of vulnerability – who, historically, has and has not had access to water, whether they will be better off with new government plans, etc.

An initiative fostered by the Spanish government aims to set up a regional network – Red Iberoamericana de Oficinas de Cambio Climático (RIOCC) (Ibero-American Network for Climate Change Offices) – to generate links and information exchange among the Spanish-speaking Latin American countries. This is intended to support the development of responses to climate change problems and facilitate consensus on responses.⁽⁷⁰⁾

e. Relations between stakeholders

Although important advances have been made, the relationships between local communities, government and the private sector still need to mature. Since the 1980s, with the return to democracy of many Latin American countries, the election of national, provincial and local governments came with a wave of decentralization and municipalization although not necessarily accompanied by decentralization of resources, capacities and control mechanisms. Local governments have had to assume increasingly diversified responsibilities while being confronted with new urban residents (mostly poor) each year. For municipal authorities, relations with different levels of government have proved complicated and time consuming, especially if they come from different political parties. In most Latin American nations, local government budgets depend heavily on national and provincial/state budgets and allocations.

Few would say that governments are truly representative. It is common for presidents to concentrate power and control of resource allocations and for there to be difficulties in keeping the executive, legislative and judicial bodies operating independently.⁽⁷¹⁾ In Argentina, for example, the electoral system is based on lists prepared by political parties in rather closed internal meetings, and citizens vote for a list, not an individual.

Municipal authorities' relations with their constituencies have also been complicated. Many local governments, with a mix of arrogance and practicality, find it easier to maintain tight control over what takes place within their boundaries in case demand overwhelms them. Neighbourhood leaders affiliated to political parties play an important role in the local community. Many manage social programmes and networks operating in the territory but rarely with any accountability to the residents, and they may coerce citizens for support. It is difficult to overcome the jealousy and mistrust that often accompany this lack of accountability and transparency.

69. See reference 48.

70. See reference 26.

71. This is drawn from comments by Hermes Binner, governor of the province of Santa Fe, in *La Nación*, 26 June 2008, page 6, political section.

Another problem is the difficulty in integrating information, resources and capacities between offices of the same government level and between different government levels. In most cities, it is very difficult to put articulated and integrated programmes into practice.

IV. THE NEED FOR ADAPTATION+DEVELOPMENT

Adaptive capacity in Latin America is low.⁽⁷²⁾ A background paper on impacts, vulnerability and adaptation to climate change in Latin America notes the difficulties in ensuring that adaptation assessment and planning move on to the implementation of concrete actions.⁽⁷³⁾ In part, this is due to the lack of certainty regarding likely impacts, especially local impacts; in part, it is because of a lack of resources and institutional capacities to address multiple and combined stresses and processes. Other reasons are the slow rate at which national policies have included climate change variables⁽⁷⁴⁾ and the difficulties in tackling root problems when decision makers lack the training and access to information⁽⁷⁵⁾ (at different scales) in the context of fiscal constraints and conflicts between different levels of government. The difficulties in assessing vulnerability and adaptation options are also important.

Most of the attention and funding by national governments relating to climate change has been dedicated to preparing the national communications required by the United Nations Framework Convention on Climate Change (UNFCCC) and developing climate change mitigation options, mostly associated with greenhouse gas inventories and emissions reduction programmes. These also complement the governments' international negotiation strategies.⁽⁷⁶⁾ Much less research and action has concentrated on urban adaptation and resilience.

The Global Report on Reducing Disaster Risks⁽⁷⁷⁾ notes that the lack of capacity within governments to manage risks associated with past and present climate variability may also mean a lack of capacity to deal with the direct impacts of climate change. Taking advantage of lessons learned from climate variability and applying them to climate change adaptation could also avoid duplication of efforts. In practice, governments still tend to concentrate on emergency response and recovery and have been slow to adopt an integrated disaster prevention and preparedness approach, which needs an understanding of vulnerability and risk accumulation processes and a capacity and willingness to work with those who are vulnerable. So much of what has been learnt about disaster prevention and preparedness has direct relevance for climate change adaptation.

Risk management – whether or not related to climate change and variability – should be an integral part of development policies. Most of the risks associated with likely climate change in the next few decades are not new – they are already evident although becoming more intense or frequent.⁽⁷⁸⁾ It may also be the case, however, that climate change and urban development can act to trigger new hazards in the region.⁽⁷⁹⁾

Although Latin America contributes only a small proportion of total anthropogenic greenhouse gas emissions (between 4 and 5 per cent), by 2050 the region's share may grow to 9 per cent of global emissions.⁽⁸⁰⁾ This suggests a need to include some consideration of mitigation even if much more attention needs to be given to adaptation.

72. Magrin, Graciela and Carlos G García with David Cruz Choque, Juan Carlos Jiménez, Ana Rosa Moreno, Gustavo J Nagy, Carlos Nobre and Alicia Villamizar (2007), "Chapter 13: Latin America", in Martin Parry, Osvaldo Canziani, Jean Palutikof, Paul van der Linden and Clair Hanson (editors), *Climate Change 2007: Impacts, Adaptation and Vulnerability*, Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press, Cambridge and New York, 976 pages.

73. See reference 26.

74. See reference 1.

75. See reference 4.

76. See reference 26.

77. See reference 63.

78. Satterthwaite, David, Saleemul Huq, Hannah Reid, Mark Pelling and Patricia Romero Lankao (2007), "Adapting to climate change in urban areas; the possibilities and constraints in low- and middle-income nations", Human Settlements Discussion Paper Series, Climate Change and Cities 1, IIED, London.

79. See reference 32.

80. See reference 39; also see reference 26; and see reference 3.

Actions that integrate an understanding of the links between environmental problems (including climate change and variability) and development have the greatest potential to generate multiple benefits and provide the kind of measures most needed in Latin America. Most of the best adaptation options are those that would be taken even in the absence of climate change because of their contribution to risk reduction and sustainable development.⁽⁸¹⁾ Although in recent years there has been a change in the discourse of academics, technicians and policy makers on this, few practical cases exist of an integrated approach to risk reduction. The norm is that research and risk management and development planning follow parallel tracks. The way disaster management is implemented in Argentina is a clear example of the difficulty of translating discourse into action, even though the Second National Communication emphasizes the need to address multiple stresses together.⁽⁸²⁾

Addressing the root causes of vulnerability to climate change is a challenge not many in government are willing to face: "The political costs of redirecting priorities from visible development projects to addressing abstract long-term threats are great. It is hard to gain votes by pointing out that a disaster did not happen."⁽⁸³⁾

However, there is a promising body of diverse experiences that show ways in which local governments, communities and other social actors can work in collaboration or independently to achieve improvements at city or neighbourhood level. They demonstrate that community-based actions in low-income settlements (sometimes supported by international agencies, local and national NGOs, state or national government bodies and charities) have made great strides in recent years.⁽⁸⁴⁾ Funds can be channelled effectively and efficiently to relatively inexpensive community-based initiatives – using a wide variety of schemes, from small loans or grants to small groups, to upgrading schemes, the installation of water supply and sanitation projects and even to full community development projects, including plans to manage risk related to water resources and water basins at local and city level. The guiding principles should be that they foster long-term solutions that respond to local needs, that they tackle more than one goal at a time, and that measures are undertaken within a broad risk management programme tied into long-term development goals.

81. See reference 1.

82. See reference 32.

83. Christoplos, Ian, John Mitchell and Anna Liljelund (2001), "Re-framing risk: the changing context of disaster mitigation and preparedness", *Disasters* Vol 25, No 3, pages 185–198, <http://dx.doi.org/10.1111/1467-7717.00171>.

84. See reference 10.

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