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Towards Pro-Poor Adaptation to Climate Change in the Urban Centres of Low- and Middle- Income Countries

Global Urban Research Centre Working Paper #1

By Caroline Moser and David Satterthwaite

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1 Executive summary

This paper outlines a framework for adaptation to climate change for urban areas in low- and middle-income nations that is pro-poor and that enhances the capacity of low-income households and community organizations to contribute to such adaptation. It begins by describing how urban centres in low- and middle-income countries concentrate a large proportion of those most at risk from the effects of climate change – as people‘s lives, assets, environmental quality and future prosperity are threatened by the increasing risk of storms, flooding, landslides, heatwaves and drought that climate change is likely to bring. It also points to the weaknesses in the local institutions with responsibility for addressing this and the very large deficiencies in the infrastructure and services needed for protection. It also discusses the lack of attention given to supporting adaptation in urban areas by scientists, governments and international agencies, and considers why this is so.

To improve understanding of the problems and to contribute to identifying solutions, the paper introduces an asset-based framework focused on households and community organizations. As a conceptual approach this helps to identify the asset vulnerability to climate change of low-income communities, households and individuals within urban areas. It also considers the role of assets in increasing adaptive capacity. The asset-based framework provides an operational tool, an asset-adaptation framework, which serves to highlight the measures needed to address four aspects of risk and vulnerability. These four aspects are illustrated in relation to extreme weather events. The first consists of the measures needed to protect those most at risk from extreme weather: safer sites, protective infrastructure and better-quality buildings – to prevent extreme weather events from causing disasters. The second, third and fourth aspects focus on limiting the impact of extreme weather events for low-income or otherwise vulnerable groups through household and community actions for pre-disaster damage limitation, immediate post-disaster response, and longer-term rebuilding. This highlights the many synergies between poverty reduction and resilience to climate change, and clarifies how vulnerability and risk are influenced by income level, age and gender.

The paper then highlights three reasons why strengthening, protecting and adapting the assets and capabilities of individuals, households and communities is far more important in low- and middle-income countries than in high-income countries. The first is the limitations in urban governments’ adaptive capacity, especially in providing needed protective infrastructure and services to low-income populations. The second reason is the unwillingness of many city or municipal governments to work with low-income groups, especially those living in informal settlements (which usually include most of those most at risk from floods and storms). The third reason is the key role of assets in helping households and communities to cope with disasters.

This focus on strengthening the asset base of households and communities is also a key means of building more competent, accountable local governments. The paper discusses how a substantial part of adaptive capacity relates to the ability of households and community organizations to make demands on local governments and, wherever possible, to work in partnership with them. Case studies illustrate the effectiveness of such partnerships in some nations. The paper concludes by discussing the roles for local and national governments and international agencies in supporting adaptive capacity at all levels.

2 Introduction

To date, the need to begin addressing climate-change risk in the urban areas of low- and middle-income countries is not fully appreciated by most governments and the majority of development and disaster specialists. Low- and middle-income countries not only have close to three-quarters of the world's urban population (United Nations, 2008), they also have most of the urban population at greatest risk from the increased intensity and/or frequency of storms, flooding, landslides and heatwaves and constraints on fresh water that climate change is bringing or will bring (Wilbanks, Romero-Lankao et al. 2007; Satterthwaite et al. 2007). Since 1950, there has been a sevenfold increase in their urban population. This has also brought an increased concentration of people and economic activities in low-lying coastal zones at risk from sea-level rise and extreme weather events (McGranahan, Balk and Anderson 2007). A very high proportion of global deaths from disasters related to extreme weather occur in these countries, with a large and growing proportion of such deaths in urban areas (UN-Habitat 2007).

Low- and middle-income countries also have a far greater deficit in adaptive capacity than do high-income countries, because of the backlogs in protective infrastructure and services and the limitations in urban government. To this is added the unwillingness of many city or municipal governments to work with those who live in informal settlements, even though these often house a third or more of the population and include those most at risk from climate change. This has led to increasing recognition of the need to support initiatives to build resilience at household and community levels, to adapt assets and capabilities to climate change.

Thus, addressing the social-development dimensions of climate change adaptation in urban areas requires consideration of the roles of not only different levels of government but also individuals, households and civil society organizations. To address this, this paper introduces a framework of pro-poor asset adaptation for climate change. This seeks to provide a conceptual approach to identifying the asset vulnerability of low-income individuals, households and communities to climate change and to consider how assets can support adaptation. The asset-based framework outlined here is also an operational tool that identifies the asset-adaptation interventions that help low-income households and communities to strengthen, protect and, where needed, rebuild their asset base.

Such an approach also recognizes that strengthening the asset base of low-income households and communities can also contribute to building more competent, accountable local governments. A substantial part of adaptive capacity relates to the ability of local communities to make demands on local governments and, wherever possible, to work in partnership with them. The paper therefore addresses the implications of climate change for urban institutions at the levels of national government, local government and donors.

As both governments and international agencies give more attention to climate change, the relevance of this paper is that it seeks to set out an adaptation agenda oriented to social development, and complementing rather than competing with the agendas of other research and policy-focused communities. It is unusual in concentrating on urban areas; most of the adaptation literature covers ecological changes or focuses on agriculture. In addition, this paper focuses on those aspects of climate change for which there is high confidence within the Intergovernmental Panel on Climate Change (IPCC) that they are occurring, or will occur, in the next few decades. It does not discuss the very serious social, political and environmental issues that are likely to arise further into the future, if no effective international agreement is reached soon on stabilization and reduction of greenhouse-gas emissions. It also follows the IPCC's lead in being cautious in

ascribing climate change as a significant causal factor in conflicts, whether social, economic or political in nature. In this way it argues that the extent to which climate change will produce or catalyze serious conflict in urban areas in the next few decades depends heavily on the effectiveness of adaptation measures and measures to reduce greenhouse gas emissions (mitigation). This contrasts with a more certain vision, increasingly popular though as yet unsubstantiated, linking climate change with increased levels of conflict.

The paper is divided into seven sections. Following this introduction, Section 2, by way of contextual background, explains why climate change is such an urgent urban problem. Section 3 introduces a conceptual framework for the asset vulnerability experienced by the poor, and an associated asset-based adaptation framework that seeks to provide community- and household-level solutions. Section 4 discusses the vulnerability of the urban poor to climate change impacts, including those related to inadequate responses after disasters. Section 5 outlines current local government frameworks for adaptation, highlighting some of their limitations from a social-development perspective. Section 6 describes four aspects of an asset-based adaptation framework to storms and floods: protection (or disaster avoidance), pre-disaster damage limitation, immediate post-disaster responses, and finally rebuilding. Drawing on empirical examples, this illustrates the asset-based actions with their associated institutions and social actors. Section 7 focuses on the institutional implications of this framework in relation to municipal and national government and international donors.

3 Background: The urgency of climate change in urban contexts

Table 1 summarizes the main manifestations and likely impacts of climate change in Africa, Asia and Latin America and the Caribbean, as identified by the IPCC. These include increased frequency and/or intensity of extreme weather events including heatwaves, heavy precipitation events and intense tropical cyclones. These events have long been among the most common causes of disasters, independent of climate change. But there is a clear upward trend in the frequency of disasters from 1950 to 2005, and especially from 1980 (UN-Habitat 2007), and most of this upward trend is due to extreme-weather-related events (Hoeppe and Gurenko 2007). Of any year on record, 2007 is likely to have had the largest number of disasters and, up to October 2007, most were extreme-weather-related (Borger 2007). Between 1996 and 2005, disasters classified as floods and windstorms were the two most frequent of all disasters; they also affected most people (over 1.6 billion people) and did most economic damage (UN-Habitat 2007). In terms of mortality, they were second and third to earthquakes and tsunamis; during this decade over 150,000 people were killed by disasters caused by floods and windstorms (ibid.). It is also well established that the international statistics on disasters considerably understate their number and thus their total impact (UN-Habitat 2007).

A review of flooding in urban areas in sub-Saharan Africa documented how changing rainfall patterns and increasing storm frequency are aggravating the problem of flooding. In most cities, settlement layout restricts where floodwaters can go, with large parts of the ground covered with roofs, roads and pavements, with natural channels obstructed. This results in increased local runoff and higher flood frequency, magnitude and duration, aggravated by the occupation of floodplains, usually by informal settlements, as well as the lack of attention to household waste collection and the construction and maintenance of drainage channels. Now, even quite modest storms produce high flows in rivers or drains, and floods (Douglas and Alam 2006; Douglas et al. 2008).

The growing number of extreme-weather-related disasters is consistent with predictions from the IPCC of what climate change will bring. It is not 'proof of climate change' (which is difficult to ascertain) but proof of the vulnerability of cities and smaller settlements to extreme weather events whose frequency and intensity climate change is likely to increase.

Agriculture is included in Table 1 not only because of its influence on the price and availability of food, fuel and many industrial inputs for urban areas, but also because of the importance of rural-based (producer and consumer) demand for goods and services for many urban economies. In addition, there are important rural–urban linkages for adaptation and mitigation, such as the protection of key natural defences within and around urban centres and watershed management linked to flood control and water-supply protection.

Table 1: Some likely impacts of climate change

Change	Impact on natural systems, agriculture, water	Impact on urban areas	Impact on health and household coping	Implications for children
Warm spells and heatwaves frequency up on most land areas	Reduced crop yields in warmer regions, wildfire risk up, wider range for disease vectors	Heat islands with higher temperatures (up to 7˚C higher); often large concentrations of vulnerable people; air pollution worsened	Increased risk of heat-related mortality and morbidity; more vector-borne disease; impacts for those doing strenuous labour; increased respiratory disease where air pollution worsens; food shortages	Greatest vulnerability to heat stress for young children; high vulnerability to respiratory diseases, vector-borne diseases, highest vulnerability to malnutrition with long-term implications
Heavy precipitation events, frequency up over most areas	Damage to crops, soil erosion, water-logging, water-quality problems	Floods and landslide risks up; disruption to livelihoods and city economies, damage to homes, possessions, businesses and to transport and infra-structure; loss of income and assets; often large displacements of population, with risks to social networks and assets	Deaths, injuries, increased food and both water-borne and water-washed diseases; more malaria from standing water; decreased mobility with implications for livelihoods; dis-locations; food shortages; risks to mental health, especially associated with displacement	Higher risk of death and injury than adults; more vulnerable to water-borne/washed illness, and to malaria; risk of acute malnutrition; reduced options for play and social interaction; likelihood of being removed from school/ put into work as income is lost; higher risk of neglect, abuse and maltreatment associated with household stress and/or displacement, long-term risks for development and future prospects
Intense tropical cyclone activity increases	Damage to crops, trees and coral reefs, disruption to water supplies			

Source: Drawing on Table SPM.1 in IPCC (2007) with the column on the implications for children drawn from Bartlett (2008)

Urban centres in low- and middle-income countries concentrate a high proportion of those most at risk from the effects of climate change. As the fourth assessment of the IPCC notes, "Climate change can threaten lives, property, environmental quality and future prosperity by increasing the risk of storms, flooding, landslides, heatwaves and drought and by overloading water, drainage and energy supply systems" (Wilbanks, Romero Lankao et al. 2007, page 382). Many urban centres will also be affected by less dramatic stresses, including reductions in freshwater availability and stresses on local crop production.

More and more case studies of specific cities highlight the risks arising from extreme weather events and, for many, sea-level rise (see for instance El-Raey (1997) for Alexandria; Alam and Golam Rabbani (2007) for Dhaka; Abam, Ofoegbu, Osadebe and Gobo (2000) for Port Harcourt; de Sherbinin, Schiller and Pulsipher (2007) for Mumbai, Shanghai and Rio de Janeiro; Dossou and Glehouenou-Dossou (2007) for Cotonou; Awuor, Orindi and Adwerah for Mombasa). It is difficult to generalize about likely risks of climate change: the scale and nature of risk varies greatly between urban centres and also within them, between different population groups or locations. Nevertheless urban centres can be grouped according to certain shared physical characteristics that relate to climate-change risk, such as:

- already facing serious impacts from heavy rainstorms and cyclones (including hurricanes and typhoons) and heatwaves
- coastal location, and so impacted by sea-level rise
- location by a river that may flood more frequently
- location dependent on freshwater sources whose supply may diminish or whose quality may be compromised.

The extent to which extreme weather events and other likely climate-change impacts pose problems, however, relates not only to settlement location but also to the quality and level of infrastructure and service provision. A high proportion of deaths, serious injuries and loss of property from storms, floods and landslides are the result of deficiencies in such provision, and because settlements have developed on dangerous land sites. This also means that there are large variations in the relative importance of climate-change-related risks compared to other pressing environmental hazards. Where a large proportion of the population lacks infrastructure such as water, sanitation and drainage, it is difficult to claim the problem is primarily one of climate change. In addition, the very large variations in the number of people killed or injured by extreme weather events is much influenced by the quality and extent of disaster preparedness. Wealthy cities (and nations) can afford levels of investment in protective infrastructure that are far beyond those possible in low- and middle-income nations – for instance, the very expensive flood defences in the Netherlands, or the Thames Barrier and other flood defences to protect London.

Thus, within most cities and towns in low- and middle-income nations, risks fall disproportionately on the population living on particular high-risk sites and with the least adequate provision for protective infrastructure and services. The principal driver of increasing loss of life as well as social and economic vulnerability is poverty (limiting individual, household and community investments) and exclusion (limiting public investments and services). Climate change not only exacerbates existing risks but also reveals new hidden vulnerabilities as more locations are exposed to more intense floods and storms.

To date, there has been relatively little consideration of what adaptation will be needed in urban areas in low- and middle-income countries. In part, this is because so much of the IPCC's attention has been focused on persuading governments to accept the scientific evidence for human-induced climate change, and the pressing need for mitigation. Currently it is natural scientists who have produced most of the evidence for human-induced climate change, and who are most strongly represented in government and international-agency discussions or actions on climate change. This has also meant a greater scientific knowledge of likely climate-change impacts on agriculture, forestry and ecosystems than on the built environment. The National Adaptation Programmes of Action on climate change developed by governments within the least developed countries were developed primarily by ministries of the environment – not ministries of housing or public works or local government (all of whom will have key roles in adaptation).

In addition, mitigation can be driven as a national agenda, promoted by international agreement, whereas effective adaptation needs to be locally driven, in part because adaptation measures must be rooted in the particulars of each local economic, social, political and ecological context. Further, as discussed in this paper, for urban areas, most measures will have to be implemented or supported by different departments of local government. This will require local governments prepared to work with the groups most at risk – including large sections of the population with low incomes living in informal or illegal settlements and working in the informal economy. One final reason for the lack of attention to urban areas is the longstanding antipathy within most bilateral aid agencies and much of the development community to any focus on urban areas.

4 A conceptual framework: From asset vulnerability to asset adaptation

A social development perspective on urban climate-change adaptation focuses on both the risks and the impacts of such changes on the poor, excluded and marginal populations living in urban areas. Recognition that poor populations are particularly vulnerable to climate change in terms of individual lives, but also in relation to their household and community assets, makes it useful to draw on earlier conceptual and operational frameworks on poverty, vulnerability and assets (Moser 1998; 2007; 2008), and to modify these to address the particular problems associated with climate change.

4.1 Asset vulnerability

Analysis of the risks arising from climate change to low-income urban households and communities is grounded in the concept of vulnerability. This draws on an important development literature that recognizes poverty as more than income- or consumption poverty and that captures the multidimensional aspects of changing socioeconomic wellbeing.1 Moser (1998) in an urban study defines vulnerability as insecurity in the wellbeing of individuals, households and communities, including sensitivity to change. Vulnerability can be understood in terms of a lack of resilience to changes that threaten welfare; these can be environmental, economic, social and political, and they can take the form of sudden shocks, long-term trends, or seasonal cycles. Such changes usually bring increasing risk and uncertainty. Although the concept of vulnerability has focused mainly on its social and economic components, in applying it to climate change, vulnerability to physical hazards becomes more important.

Also of operational relevance to climate-change-related vulnerability is the distinction between vulnerability and capacity/capability which is linked to resilience. The emergency relief literature has shown that people are not ‘helpless victims’ but have many resources even at times of emergency, and that these should form the basis for responses (Longhurst 1994; ACHR 2005); there is also widespread recognition of the resources that grassroots organizations can bring to adaptation (Satterthwaite et al. 2007; Huq and Reid 2007). When sudden shocks or disasters occur, the capabilities of individuals and households are deeply influenced by factors ranging from the damage or destruction of their homes/assets to constraints on prospects of earning a living, to the social and psychological effects of deprivation and exclusion including the socially generated sense of helplessness that often accompanies crisis.

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1 Sen’s (1981) work on famines and entitlements, assets and capabilities, as well as that of Chambers (1992; 1994) and others on risk and vulnerability influenced an extensive debate that defined concepts such as capabilities and endowments, and distinguished between poverty as a static concept, and vulnerability as a dynamic one that better captures change processes as ‘people move in and out of poverty’ (Lipton and Maxwell 1992, 10).

The fact that vulnerability can be applied to a range of hazards, stresses and shocks offers a particular advantage to the analysis of climate-change-related risks in urban contexts. Urban poor populations generally have to live with multiple risks and have to manage the costs and benefits of overlapping hazards from a range of environmental sources while also facing economic, political and social constraints. Climate change brings a futures dimension to understanding vulnerability. It highlights the uncertainty of future risk and with this an uncertainty concerning the bundle of assets that will enable adaptation and greater resilience, or lead to increased vulnerability. An asset-based vulnerability approach that incorporates social, economic, political, physical, human and environmental resources allows for flexibility in analysis and in planning interventions that is harder to maintain within a hazard-specific approach. It also highlights how many assets serve to reduce vulnerability to a range of hazards.

Box 1: Definition of the most important capital assets for individuals, households and communities

- Physical capital: the stock of plant, equipment, infrastructure and other productive resources owned by individuals, the business sector or the country itself.
- Financial capital: the financial resources available to people (savings, supplies of credit).
- Human capital: investments in education, health and nutrition of individuals. Labour is linked to investments in human capital; health status influences people's capacity to work, and skill and education determine the returns from their labour.
- Social capital: an intangible asset, defined as the rules, norms, obligations, reciprocity and trust embedded in social relations, social structures, and societies' institutional arrangements. It is embedded at the micro-institutional level (communities and households) as well as in the rules and regulations governing formalized institutions in the marketplace, political system and civil society.
- Natural capital: the stock of environmentally provided assets such as soil, atmosphere, forests, minerals, water and wetlands. In rural communities land is a critical productive asset for the poor; in urban areas, land for shelter is also a critical productive asset.

Sources: Bebbington (1999); Carney (1998); Moser (1998); Narayan (1997); Portes (1998); Putnam (1993)

Vulnerability is closely linked to a lack of assets. The more assets people have, the less vulnerable they generally are; the greater the erosion of people's assets, the greater their insecurity. As a starting point, it is useful to identify how assets are defined, as well as those of particular importance in the context of climate change. Generally, an asset is identified as a "stock of financial, human, natural or social resources that can be acquired, developed, improved and transferred across generations. It generates flows or consumption, as well as additional stock" (Ford Foundation 2004, page 9). In the current poverty-related development debates, the concept of assets or capital endowments includes both tangible and intangible assets, with the assets of the poor commonly identified as natural, physical, social, financial and human capital (Box 1).2 In impact assessments after disasters, assets are shown to be both a significant factor in self-recovery and to be influenced by the response and reconstruction process. Where survivors participate in

2 In addition to these five assets, which are already grounded in empirically measured research (see Grootaert and van Bastelaer 2002), more 'nuanced' asset categories have been identified. These include the aspirational (Appadurai 2004), psychological (Alsop, Bertelsen and Holland 2006), productive and political assets, increasingly associated with human rights (Ferguson, Moser and Norton 2007; Moser, Sparr and Pickett 2007). These examples illustrate the growing importance of moving beyond well-established categories of capital assets.

decision-making, psychological recovery strengthens the recovery of livelihoods and wellbeing. Reconstruction is a period in which either entitlements can be re-negotiated to improve the capacity and wellbeing of the poor, or poverty and inequality can be entrenched through the corresponding reconstruction of vulnerability.

4.2 Asset-based adaptation

Asset-based approaches to development are not new and, as with poverty, definitions are rooted in the 1990s debates on international poverty. Assets are closely linked to the concept of capabilities. Thus assets "are not simply resources that people use to build livelihoods: they give them the capability to be and act" (Bebbington 1999, page 2029). As such, assets are identified as the basis of agents' power to act to reproduce, challenge or change the rules that govern the control, use and transformation of resources (Sen 1997). Moser (2007) distinguishes between an asset-index conceptual framework as a diagnostic tool for understanding asset dynamics and mobility, and an asset-accumulation policy as an operational approach for designing and implementing sustainable asset-accumulation interventions

To get beyond vulnerability and focus on strategies and solutions, this paper introduces an asset-based framework of adaptation to climate change that identifies the role of assets in increasing the adaptive capacity of low-income households and communities to climate change. Asset-based frameworks include a concern for long-term accumulation strategies (see Moser 2007; Carter 2007). Clearly the asset-portfolios of individuals, households and communities are a key determinant of their adaptive capacity both to reduce risk and to cope with and adapt to increased risk levels. As discussed below, they also influence capacity to make demands on, and work with, local governments.

An asset-based adaptation strategy in the context of climate change includes three basic principles.

1. The process by which the assets held by individuals and households are protected or adapted does not take place in a vacuum. External factors such as government policy, political institutions, and nongovernmental organizations all play important roles (discussed in Section 5). However, institutions can also include the laws, norms and regulatory and legal frameworks that either block or enable access, or indeed positively facilitate asset adaptation, in a variety of ways.
2. The formal and informal context within which actors operate can provide an enabling environment for protecting or adapting assets. Entry points for strengthening strategies for asset adaptation are contextually specific but may be institutional or opportunity-related in focus. The adaptation of one asset often affects other assets that are highly interrelated; similarly, insecurity and erosion in one can also affect other assets.
3. Household asset portfolios change over time, sometimes rapidly, for example following marriage or the death or incapacity of an income earner. Thus households can quickly move into security/vulnerability through internal changes linked to life cycle as well as in response to external economic, political and institutional variability.

The key to the development of an asset-based adaptation framework therefore is, first and foremost, the identification and analysis of the connection between vulnerability and the erosion of assets, which is discussed below. Section 6 below then goes further and introduces an asset-based adaptation framework that seeks to identify asset adaptation or protection strategies as

households and communities exploit opportunities to develop resilience and resist, or recover from, the negative effects of climate change.[3]

5 Urban poverty, asset vulnerability and climate change

5.1 Types of vulnerability and groups particularly affected

Hazards created or magnified by climate change combine with vulnerabilities to produce impacts on the urban poor's human capital (health) and physical capital (housing and capital goods) and their capacity to generate financial and productive assets. Some impacts are direct, such as more frequent and more intense floods. Those that are less direct include reduced availability of freshwater supplies. Finally, others that are indirect for urban populations include constraints on agriculture and thus on food supplies and increased prices that are likely in many places.

There is also considerable variation in levels of vulnerability to climate change within low-income populations, in terms of both the hazards to which they are exposed and their capacity to cope and adapt. Variations exist among settlements in terms of the quality of physical capital and homes, the provision for infrastructure (much of which should reduce risks), and the risks from flooding or landslides. In addition, a local population's interest in risk-reduction through building improvements will vary depending on ownership status, with tenants often less interested, especially if their stay is temporary, for example as seasonal migrants (Andreasen 1989).

In identifying the vulnerability of poor urban populations to climate-change impacts, there are also differences in people's knowledge and capacity to act. These include issues such as gender, with differences between women's and men's exposure to hazards, and their capacities to avoid, cope with or adapt to them. Age is also important, with children facing greater risks and having reduced coping capacities for some impacts, and very young children and older groups facing particular risks from some impacts. Individual health status is also crucial, regardless of age and gender (Bartlett 2008).

It is useful to identify different aspects or types of vulnerability to climate change in terms of four broad questions, each of which is particularly, though not entirely, associated with an aspect of asset adaptation.

1. Protection: Who lives or works in the locations most at risk from the direct or indirect impacts of climate change and/or lacking the infrastructure necessary to reduce risk?
2. Pre-disaster damage limitation: Who lacks knowledge and capacity to take immediate short-term measures to limit impact?
3. Immediate post-disaster responses: Who and whose homes/neighbourhoods face greatest risks when impact occurs and are least able to cope with impacts?
4. Rebuilding: Who is least able to adapt?

[3] Research results on longitudinal asset accumulation in Guayaquil, Ecuador, showed that asset accumulation policies were not static but changed over time, with a useful distinction made between first- and second-generation policies (Moser 2007). While first-generation asset-accumulation policy generally provides social and economic infrastructure essential for assets such as human, physical capital and financial capital, second-generation asset-accumulation policy in contrast is designed to strengthen accumulated assets, to ensure their further consolidation and to prevent erosion. Such strategies go beyond issues of welfare and poverty reduction to address a range of concerns relating to citizen rights and security, governance and the accountability of institutions. While this distinction may also be relevant for an adaptation framework, it will require further redefinition – a policy issue that goes beyond this paper.

At the outset it is important to note that many components of poverty-reduction strategies also build resilience against a range of hazards, and thus complement actions targeted at particular groups' exposure to specific hazards. For instance, better-quality housing, infrastructure and services greatly reduce a range of hazards – including exposure to many disease-causing agents (pathogens), while an effective healthcare system reduces the impact of illnesses and injuries.

1. Protection: Among the groups most at risk in cities are lower-income groups living in environmentally hazardous areas, lacking protective infrastructure. For instance, large concentrations of illegal settlements can be seen on hills prone to landslides (in Rio de Janeiro, La Paz, Caracas and Bamenda), in deep ravines (Guatemala City) or on land prone to flooding (Guayaquil, Recife, Monrovia, Lagos, Port Harcourt, Port Moresby, Delhi, Bangkok, Jakarta, Buenos Aires, Resistencia, Santa Fe, Mumbai, Accra, Kumasi, Mombasa) (Hardoy, Mitlin and Satterthwaite 2001). Most major cities were founded on 'safe' sites, but have grown to sizes never envisaged by their founders.4 Increased exposure to extreme-weather hazards is partly related to expansion onto hazardous sites, such as the settlement expansion of Caracas and Rio de Janeiro onto steep, unstable slopes, or Guayaquil's expansion onto the low-land mangrove swamps of the suburbios. Risks faced in such sites have often been exacerbated by damage to natural systems including the loss of mangrove stands, or hillside vegetation and deforestation – yet areas constantly exposed to flooding still attract low-income groups because of cheaper land and housing costs.

Extreme-weather impacts frequently relate more to the lack of protective infrastructure and services than to the hazards inherent to urban sites. For instance, it is generally cities with the largest inadequacies in protective infrastructure that have experienced the highest number of flood-related deaths and injuries over the last 25 years. The lack of protective infrastructure is partly linked to the constrained investment capacity of city and municipal governments. But in some cities, it is associated more with the problematic relationships between local governments and urban poor groups living in high-risk informal settlements. High proportions of these cities' populations occupy land illegally, build structures that contravene building regulations and work in the informal economy outside official rules and regulations. Infrastructure and service-provision agencies may not work in such informal settlements because of the 'anti-poor' attitudes of government officials and politicians.5 Within such settlements most loss or damage to buildings in extreme weather is the result of inadequate infrastructure (for instance for storm drainage) and poor building quality (often linked to the lack of application of effective, locally relevant building codes). The greater intensity and shifting geography of windstorms that climate change is likely to bring may mean that settlements with relatively good-quality housing and protective infrastructure are also at risk.

The lack of attention to protection (and thus disaster-prevention) may simply be the result more of government inertia than of any policy. Hardoy and Pandiella (2009) describe the case of the city of Santa Fe in Argentina which suffered serious floods in 2003, which displaced a third of the city's population and caused major damage to production and infrastructure. But more floods in 2006/07 caught the government unprepared; there were several deaths, tens of thousands of people had to evacuate, highways and roads flooded, and bridges came down. Again, a third of

4 Some major cities were built on high-risk sites, either because the founders did not know of these risks (for instance, high risk of earthquakes) or because the site had commercial or strategic advantages that outweighed the risk.

5 Misconceptions include the assumption that informal settlements' residents are unemployed (when in reality they work long hours), that they are recent migrants (rather than city-born or long-term residents), or that migrants would have been better off if they had not migrated (despite the fact that migration studies show that this is a logical response to changing economic opportunity).

the city was turned into shallow lake in the same area hit by the 2003 flood. City authorities recognized that in the last 50 years there has been no official urban land policy and people settled in areas near to work or social networks. But as some NGOs have commented, the lack of policies is also a way of doing politics.6

Addressing this issue is usually technically relatively simple but politically difficult. Most of the sites at high risk from extreme weather can have these risks much reduced if building quality is improved and infrastructure and services provided. But this means that government agencies must agree to this and reach agreements with the residents over the transfer of land tenure. In most cities, there are also land sites to which those on land that cannot be protected can be moved with their approval – but even elected, accountable city governments have difficulties in addressing this because low-income groups that are to be relocated need locations close to income-earning opportunities. They will not want to move if the sites offered to them are too peripheral. Meanwhile, non-poor groups will generally object to the resettlement of low-income groups close to them. There is also the larger issue of who is displaced as cities invest in needed infrastructure. Cities in low-income nations and many in middle-income nations have large deficits in infrastructure – from roads and rail transit to piped water supplies, sewers and drains to flood defences. Addressing these deficiencies usually involves clearing settlements. Again, the issue is the quality of the alternatives offered to those who are displaced; it is common for most of those displaced to be from low-income groups (middle- and upper-income groups have the political power to protect their residential areas) and for them to receive very inadequate or no compensation (Hasan 1999; du Plessis 2005).

As is the case in any forced relocation, conflicts can develop when governments clear poor groups off land-sites deemed to be vulnerable, for instance to floods. This can result in standoffs, physical resistance and even personal injury to those trying to defend informal property and associated livelihoods. This is exacerbated when alternative sites are inadequate or not provided at all.

2. Pre-disaster damage limitation: Generally high-income groups and formal businesses with good-quality buildings and safe, protected sites do not require ‘emergency preparedness’ measures in response to forecasts for storms and high tides. For groups living in less resilient buildings, and more dangerous sites, risks to health and assets can be reduced by appropriate actions in response to warnings. However, to be effective, reliable information needs to reach those most at risk in advance, to be considered credible, and to contain supportive measures that allow them to take risk-reducing actions. This includes the identification of known safer locations, and provision of transport to assist them to move.

A case study from Santa Fe (Argentina) showed that although flood-risk information was widely available, many people failed to move. The reasons why included a lack of confidence in the reliability of the information, a lack of knowledge of what to do, residents’ concern about post-flooding looting, and the worry that the government would not allow them to return to their settlement (Hardoy and Pandiella 2009). Risks faced by low-income households can be exacerbated by economic concerns. For instance in San Salvador, many roofs were blown off during storms because households had not fastened them securely – because they wanted to keep the roofs intact and unmarked so they could be sold in a crisis (Wamsler 2007).

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6 Asociación Civil Canoa (http://www.canoa.org.ar/PrPe-Recons.html).

Climate change is likely to make the timing and intensity of heavy rainfall less predictable, which in turn makes long-established coping mechanisms less effective. The experience of the international NGO, ActionAid illustrates this. The agency held discussions on flooding problems with residents of poor communities in cities including Accra, Kampala, Lagos, Maputo and Nairobi. Residents in each city reported that flooding had become more frequent and less predictable. In all cases, resident responses were ad hoc, individual and short-term. These included sleeping on furniture in order to be above the flood waters, moving families to safer sites and measures to protect property which ranged from barriers to water entry at the door to trenches to steer water away, and outlets at the house rear so water could quickly flow out. Organized community action to limit impacts, such as clearing drainage channels in anticipation of flooding, was relatively rare, while there was also no evidence of coordinated action to develop emergency shelter in any of these cities (Douglas et al. 2008). Effective community-based pre-disaster measures to limit damage require levels of trust and cohesion – community social capital – that are often not present. These depend on a complex set of factors including length of time in the settlement, pattern of occupation (including tenure) and state infrastructure-delivery mechanisms (see Moser and Felton 2007).

There are also differences in knowledge and the capacity to act to limit risk based on age, gender and health status. This includes differentials as simple as the capacity to run or to swim, with speed variations relating to different groups; infants, younger children, adults caring for them, the disabled and older people all move more slowly when responding to impending risks. It is common for mortality among children to be higher than among adults (Bartlett 2008). In societies where women are constrained by social norms from leaving the home, they may move less rapidly to avoid floodwater, as may women who take responsibility for young children. Although the Indian Ocean tsunami was not related to climate change, its impacts illustrate differentials in vulnerability; in India, Indonesia and Sri Lanka, the mortality of women was between three and four times that of men (Renton and Palmer 2005).

3. Immediate post-disaster responses: This concerns groups less able to cope with impacts. Disasters often separate communities, inhibiting responses by established community organizations. Particular groups, differentiated by age, gender, health status, and other forms of exclusion such as ethnicity or religion, face particular difficulties in coping with the immediate effects of extreme-weather-related disasters. Infants, young children and older age groups are at greater risk from the disruption they bring to, for instance, supplies of safe water and food. Children from low-income households may be removed from school and put into work as income is lost. Disaster events often endanger the personal safety of girls and women, with higher risk of gender-based violence, abuse and maltreatment associated with displacement and/or household stress (Bartlett 2008). While little is known about the psychological impact of urban disasters, it is clear that different forms of trauma unfold over time, from acute shock lasting a few days, to longer-term impacts such as recurrent stress-related illnesses and reduced quality of life (Bartlett 2008).

4. Rebuilding: Poorer groups not only get hit hardest by the combination of greater exposure to hazards and a lack of hazard-removing infrastructure, but also have less capacity to adapt after disaster; they also generally receive less support from the state and very rarely have insurance protection. Post-disaster reconstruction processes rarely allow the poorest groups and those most affected to take central roles in determining locations and forms of reconstruction. In many instances, poorest groups fail to get back the land from which they were displaced, as this is acquired by commercial developers (ACHR 2005).

As Enarson (2004) describes, within poorer groups, again some have particular problems. When populations are forced to move, gender inequalities that exist prior to a disaster can manifest themselves in many ways afterwards – not only in differential impacts but also in the resources and services available to support recovery and reconstruction. Women's needs and priorities are rarely addressed in resettlement accommodation, with particular problems faced by women-headed households and widows (Enarson and others 2003, Enarson 2004). Women generally assume most child-rearing and domestic responsibilities, and these often become more onerous and time consuming post-disaster, with greater difficulties getting food, fuel and water, among other domestic responsibilities. At the same time they "struggle in the fast-closing post-disaster 'window of opportunity' for personal security, land rights, secure housing, employment, job training, decision-making power, mobility, autonomy, and a voice in the reconstruction process" (Enarson and Meyreles 2004, page 69). Equally problematic is the failure to recognize women's individual and collective capacities for recovery and reconstruction as community leaders, neighbourhood networkers, producers, gardeners, rainwater harvesters, and monitors of flood-prone rivers. This means that their resources, capacities, assets and hard-won knowledge about how to make life safer for their families and live with risk are all ignored. Examples show that supporting women's involvement in reconstruction and in rebuilding their livelihoods benefits not only women but also their communities (Enarson and others 2003, Enarson and Meyreles 2004).

Bartlett (2008) describes in detail how children are also generally affected in more extreme ways, compared to the population as a whole, both by extreme events and by longer-term climate change. This relates to their greater physiological and psychosocial vulnerability to a range of associated stresses, as well as the long-term developmental implications of these vulnerabilities. Disruptions to water supplies and sanitation systems for instance, are far more likely to result in diarrhoeal illness for infants and young children than for other age groups, and repeated episodes can have long-term implications for physical growth and even cognitive functioning. Almost all of the disproportionate implications for children are exacerbated by poverty and by the difficult choices that must be made by low-income households as they adapt to more challenging conditions. Thus, many of the well-documented pathways between poverty and poor developmental outcomes for children are intensified by the added pressures of climate change (ibid.).

6 Current governmental operational frameworks for action

6.1 Local government roles

The quality of government, both at national level and, as crucially, at local (district or municipal) level, influences the levels of risk from climate change, especially for those with limited incomes and assets.

Risk levels will be much influenced by:

- the quality of provision for infrastructure for all areas (that limit risks of flooding for the whole city area, not just the wealthier areas) and land-use management (to limit or make more resilient buildings and settlements in high-risk areas);
- good disaster-preparedness (including warnings, measures taken to limit damage and, if needed, provision to help people move to safer areas quickly);
- quality of planning for and coordination of disaster-response (for instance rescue services and appropriate emergency and healthcare services) and reconstruction (to help those who have lost their homes and livelihoods);
- extent to which poorer groups can buy, build or rent 'safe' housing in 'safe' sites;

- degree to which local government creates an enabling environment for household and local civil-society action to contribute towards addressing the above.

Adapting to climate change needs climate-change risk assessments, to identify both areas and population groups that are particularly vulnerable. For cities with effective city development plans or strategies, it is then easy to formulate and implement climate adaptation plans, or strategies, identifying key intervention points. Although most city plans prioritize economic growth and the necessary associated infrastructure, their development constitutes a process engaging powerful stakeholders, into which adaptation issues can be introduced. This is simplest in cities where local governments already prioritize pro-poor development, environmental issues and/or disaster preparedness. In most instances the key is competent, accountable urban governments that understand how to incorporate, or mainstream, adaptation measures into the work of all relevant sectors and departments. But these are rare; for most cities and smaller urban centres, there is a need to address the limitations of local government capacity and accountability both for development and for a local capacity to integrate into this adaptation.

Important intervention points include adjusting local planning, regulatory and financial frameworks to encourage and support adaptation by households, community organizations, NGOs and the private sector, and also local government responses to bottom-up pressures for risk reduction. Many needed measures may seem to be quite minor adjustments to current practices, such as adjusting building codes, land sub-division regulations, land-use management and infrastructure standards, that in sum over time can build greater resilience without high costs. Theoretically land-use planning should plan hazard exposure out of a city's expansion although this is rarely done. To do all this requires cross-departmental collaboration and agreement on responsibility for the different measures undertaken individually or jointly – which in turn means careful, locally rooted risk assessments and widespread consultation.

At first sight, adaptation frameworks seem primarily a municipal government responsibility with limited roles for households, community organizations and other civil society organizations. City and municipal governments are in charge of planning, implementing and managing most measures that can diminish climate-change risks, including those that address the high vulnerability of particular groups to known hazards, such as floods, heatwaves or increased constraints on freshwater supplies. Their responsibilities also include factoring climate-change-related risks into new development plans and investment programmes, and adapting infrastructure standards and building codes as appropriate. If this were the case, there would be limited relevance for adaptation strategies focusing on the assets and capabilities of low-income households and their grassroots organizations, except to ensure that local government is responsive to their protection priorities.

Experience in high-income countries shows that local government is the key locus for action on adaptation. Households in London or Washington D.C., for instance, do not expect to have to make major investments in adaptation, or to work with community-based organizations to do so. If there is serious flooding, this is seen as the responsibility of government, even where households chose to live in new developments in floodplains. Urban populations in high-income nations take for granted that a web of institutions, infrastructure, services and regulations protects them from extreme weather/floods, and keep adapting to continue protecting them. Many of the measures to protect against extreme weather supply everyday needs: healthcare services integrated with emergency services, and sewer and drainage systems both serve daily requirements but can also cope with storms. The police, armed services, health services and fire services, if or when needed, provide early warning systems to ensure rapid emergency responses. Consequently, extreme weather events rarely cause large loss of life or serious injury in high-

income nations. Although such events occasionally cause serious property damage, the economic cost is reduced for most property owners by property and possessions insurance.

This adaptive capacity is also underpinned by most buildings conforming to building regulations and health and safety regulations, and being served by piped water, sewers, all-weather roads, electricity and drains 24 hours a day. The institutions responsible for such services are expected to make these resilient to extreme-weather events. Consequently infrastructure and services, paid for as service charges or taxes, represent a small proportion of citizen income. While private companies or non-profit institutions may provide some of the key services, the framework for provision and quality control is supplied by local government or local offices of provincial or national government. In addition, it is assumed that city planning and land-use regulation will be adjusted to any new or heightened risk that climate change may bring, encouraged and supported by changes in private-sector investments (over time shifting from high-risk areas) and changes in insurance premiums and coverage. At least for the next few decades, as the IPCC's Fourth Assessment stressed, this 'adaptive capacity' can deal with most likely impacts from climate change in the majority of urban centres in high-income countries.7

For the most part, households and community organizations in high-income countries engage very little with the institutions that ensure their protection other than through complaint channels such as local politicians, lawyers, ombudsmen, consumer groups and watchdogs. While some groups are ill-served or excluded, a high proportion of the urban population is well served and protected.

Table 2: Different local contexts through which national governments and international agencies can pursue 'good governance' for adaptation

Resources available to local government	**The quality of local government/governance**	
	From democratic and accountable local government structures…	**…to undemocratic, unaccountable and often clientelist local government**
From relatively well-resourced, local government institutions with the needed technical competence…	Local government can be well served by external funding to support adaptation by households and private enterprises as well as for infrastructure and support services (provided by community organizations, NGOs, private enterprises or government agencies)	Long-term support needed for governance reforms at all levels of government; support needed for local private and community provision, to improve conditions and build local capacity to pressure government for better governance
...to poorly resourced local governments lacking funding, a strong local revenue base and technical capacity	Support to building local-government adaptive capacity; support for its partnerships with civil society, with local private-sector infrastructure and with service providers (including informal providers) and for disaster preparedness	As above but with strong support for local private providers and community provision within a long-term goal of supporting more competent, accountable and transparent local government

7 Some locations cannot be defended, while the potential for adaptation to keep down risks depends on effective mitigation. The weakest governance point in richer societies is reconstruction, where the investment potential both to enhance the life chances and wellbeing of the urban poor and to lead in local economic regeneration is consistently missed. Government responses to recent flooding in Hull, UK and New Orleans, USA have shown little sign of catalysing progressive reconstruction and have been undermined by slow administrative systems compounded by insurance services in the case of Hull, and competition for reconstruction funds between business interests and survivors in the case of New Orleans; see Independent Review Body (2007) Final report of the June 2007 floods in Hull (http://www.coulthard.org.uk/downloads/floodsinhull3.pdf) and Koepp (2007) for New Orleans.

Very few urban centres in low- and middle-income nations have the web of institutions, infrastructure, services and regulations that is taken for granted in high-income nations – although the extent of the deficiencies in these varies greatly. Table 2 highlights contrasts in the resources available to local governments, and the quality of local governance and level of accountability to citizens. In the thousands of cities and smaller urban centres where most of the population lives in illegal and informal settlements, not only is the public provision of infrastructure and services inadequate, but also there are few mechanisms by which low-income citizens can hold their local governments to account. At the same time many such local governments are anti-poor, regarding informal-settlement populations as 'the problem' rather than as key parts of the urban economy.

At the other extreme are cities and towns in low- and middle-income nations where deficiencies in provision of infrastructure and services affect a much smaller proportion of the population. This often reflects local governments that are more accountable to the citizens in their jurisdiction, with national government structures that have strengthened and supported this level of government. This is often associated with stronger local democracies. For instance, in many urban centres in Latin America, the quality and coverage of provision for water, sanitation and drainage has improved very considerably over the last two decades, while others already have close to 100 per cent coverage (UN-Habitat 2006; Heller 2006). Several countries have implemented constitutional or legal changes to increase city and municipal government revenues and to strengthen local democracies (Velasquez 1998; Campbell 2003; Fernandes 2007; Cabannes 2004). There are also an increasing number of local governments that have developed successful partnerships with low-income groups and their community organizations that demonstrate cheaper, more effective ways in which they can meet their responsibilities for infrastructure and services (D'Cruz and Satterthwaite 2005; Hasan 2006; Boonyabancha 2005).

To date, there is little evidence of state institutions in low- and middle-income countries acting on adaptation in urban areas. For instance, in India, Chile, Argentina and Mexico, central government is starting to be concerned about adaptation but this has yet to engage the interest of the larger, more powerful national ministries, agencies or city and municipal governments (Satterthwaite, Huq, Pelling et al. 2007).8 Local government politicians and civil servants are often confused about how to respond to climate change.9 This is not surprising. Even in the cities of high-income countries where there is the greatest awareness of climate change – and that have made substantial efforts to reduce emissions – there has been no move on adaptation (Ligeti, Penney and Wieditz 2007). It is also difficult to get local governments or local populations engaged in adaptation when there is little or no locally relevant data on the likely direct and indirect impacts of climate change in each urban area.

8 This paper drew on unpublished background papers by Jorgelina Hardoy and Gustavo Pandiella (Argentina), Karina Martínez, E. Claro and Hernando Blanco (Chile), Aromar Revi (India) and Patricia Romero Lankao (Latin America) that looked in more detail at this.

9 The authors have participated in many climate-change conferences with mayors or technical staff from urban governments in low- and middle-income countries; their presentations suggested considerable confusion between adaptation and mitigation, and between conventional urban environmental policies and climate change (for instance an assumption that controlling air pollution necessarily lowers greenhouse-gas emissions). There may also be more knowledge of mitigation than of adaptation.

7 Community responses to climate change: A pro-poor asset-based adaptation framework for storms and floods

The responses of individuals, households and communities to the increased risks that climate change brings to urban areas (and rural areas) have greater importance in low- and middle-income nations than in high-income nations. In part, this is because, in many locations in low- and middle-income nations, risks are higher. But more importantly, in most instances, the web of institutions, infrastructure and regulations provided by government that is the core of protection and adaptation capacity in high-income nations is absent or only partially present in other nations.

If most city or municipal governments have proved unable or unwilling to provide the infrastructure, services, institutions and regulations to reduce risks from extreme weather events for much of their populations, they are unlikely to develop the capacity necessary to adapt to climate change. Adaptation frameworks need to be developed to support household- and community-based responses. This might be considered as support for adaptation that is independent of government10 but, as stressed above, this support for household and community adaptation should also be supporting citizen capacity to negotiate and work with government wherever possible – and if needed to contest government. This section outlines such an adaptation framework, focusing on one set of likely climate-change impacts: the increased intensity and/or frequency of floods and storms. There are also some important synergies between this and household- and community-led poverty reduction.

Section 4 distinguished between four closely related aspects of adaptation: protection; pre-disaster damage limitation; immediate post-disaster response; and rebuilding. This section discusses each of these in relation to roles of different actors and within different levels of government. For each of these, asset-based actions and associated institutions or social actors at household, community and government level are identified (Table 3). Obviously, the greater the success in protection, the less is the need for intervention in the second, third and fourth aspects; similarly, good pre-disaster damage limitation can greatly reduce the impacts (especially deaths and injuries) and reduce the scale of the required post-disaster response and rebuilding. This is a critical point with implications for human wellbeing (including lives saved and injuries and asset losses avoided) and economic costs. Promoting protection to politicians and civil servants is hampered by the difficulty of estimating the lives it will save and the injuries it will avoid. However, some idea of this can be seen in the differences in mortality between different cities hit by cyclones of comparable strength. There has been more analysis of the economic savings from disaster prevention compared to the costs of reconstruction, which highlights the very large cost advantages of disaster prevention.[11]

10 This might be considered as ‘autonomous adaptation’ as it is adaptation independent of government, but the term autonomous adaptation is usually given a different meaning in the climate change literature, referring to adaptation that is not planned.

11 The World Bank and US Geological Survey calculated that economic losses worldwide from disasters during the 1990s could have been reduced by US$280 billion if US$40 billion had been invested in risk reduction. In China, flood-control investments of US$3.15 billion over 40 years are thought to have averted losses of US$12 billion. Studies in Jamaica and Dominica have put the ratio of costs for reconstruction against prevention at between 2:1 and 4:1 (DFID 2004), although some sources suggest that it can be up to 10:1 (Simms and Reid 2006).

Table 3: Synthesis of asset-based adaptation framework to floods and storms

Areas for intervention	Protection	Pre-disaster damage limitation	Immediate post-disaster response	Rebuilding
Actions and institutions	Asset-based actions and institutions/actors			
Levels	Household and neighbourhood			
	Municipal or city			
	Regional and national			

7.1 Asset-based adaptation for protection

In most instances, the most effective adaptation in terms of avoiding disasters is establishing the infrastructure and institutions that prevent storms or floods becoming disasters. But for most urban centres in low- and middle-income nations, this is also the most difficult to implement, mostly because of the lack of funding and government capacity and the large deficits in infrastructure provision that need to be remedied. This also relates to how higher levels of government have retained the power, resources and fundraising capacities that urban governments need.

When considering adaptation for households, it is important to recognize that most low-income urban groups already have a range of measures by which they adapt to risk and to changing circumstances, whether these are economic opportunities or shocks, political circumstances or housing risks. At the same time their survival needs and economic priorities often conflict with risk reduction. A case study in Indore, for instance, showed how the inhabitants of a low-income settlement at high risk of flooding had developed their own local temporary and permanent adaptations measures; they were unwilling to move to safer sites because these were not well located in terms of income-earning opportunities (Stephens, Patnaik and Lewin 1996).

Table 4: Asset-based adaptation framework for protection from floods and storms

Asset-based actions	Institutions/actors
Household and neighbourhood level	
Households choose to move to safer sites (perhaps resulting in erosion of financial and social capital)	Households, housing finance agencies
Households improve housing (providing better protection against hazards); risk reduction through community space management to reduce local hazards (e.g. install drains, keep drains clear)	Households, CBOs, NGOs
Households protect productive assets	Households
Households get insurance (property and possessions) with implications for financial capital	Insurance companies, NGOs, community based micro-insurance
Community-based disaster-response and preparedness training including early-warning systems, safe sites and routes to them identified as preventative measures for human capital and family first aid	NGOs; CBOs
Municipal or city level	
Local government provide or upgrade protective infrastructure and adjust official standards for building and land use	In partnership with CBOs and NGOs
Local/city government support for household and neighbourhood action to improve dwellings and infrastructure (including slum and squatter upgrading)	Government agencies and households, CBOs, NGOs…
City/municipal hazard mapping and vulnerability analysis as basis for identifying adaptation strategy. Also land-use planning so settlements do not end up in the most risky sites, and, where needed, wetlands and floodplains are retained and can fulfil their natural protective functions	Government agencies working with NGOs and CBOs
At regional and national level	
Risk-reduction investments and actions that are needed beyond city boundaries (e.g. upstream or within watershed)	Local and extra-local government
State framework to support the above	Regional and national government

Low-income households that have built their own homes are more likely to opt for housing improvements and risk reduction rather than relocation. As Hardoy and Pandiella (2009) identify in the case of Latin American cities, when legal land for housing is scarce and/or unaffordable for low-income groups, households face choices between different types of tenure for land (with the more secure, informal 'owner occupation' options generally being the most expensive), accessibility (especially to income-earning opportunities), and possibilities of infrastructure and service provision and regularization. Once settled, the inhabitants generally struggle for services and regularization; in cases where they face environmental hazards, they also start demanding solutions from government (Moser 1998). Many of the sites on which they have developed their homes face high risks and high costs for reducing these risks (see, for instance, the risks faced by

most favela dwellers in Rio de Janeiro described in de Sherbinin, Schiller and Pulsipher, 2007).

Although there is often scope for community-level action to build more resilience to extreme-weather events, this is difficult to manage without representative, inclusive community-based organizations. In Buenos Aires, for example, in some predominantly low-income peripheral districts, each household contracts trucks to bring debris to elevate their plot of land to reduce flood risks, and later compact it as best they can. There is no agreement or coordination between neighbours so each plot ends up at a different level. When it rains, some plots therefore get more floodwaters than others. Thus the site's natural drainage has been modified without incorporating the necessary drainage infrastructure. This individualistic rather than collective response again belies the idealized picture of harmonious community social capital, pervasive in the development literature on participation (Hardoy and Pandiella 2008).

A case study of 15 disaster-prone 'slum' communities in El Salvador (Wamsler 2007) also shows the difficulties of achieving appropriate risk reduction at neighbourhood level. Households recognized that flooding and landslides were the most serious risks, although earthquakes and windstorms, lack of job opportunities and water provision, and insecurity due to violent juvenile crimes were also highlighted. Households on average spent 9 per cent of their incomes investing in risk reduction. Measures taken to lower risk included diversifying livelihoods or investing in assets that were easily sold if disaster occurred. Remittances from family members working abroad were important for many households, especially as support for post-disaster recovery (Wamsler 2007). However, a complex range of issues limited the effectiveness of community-wide measures to reduce risk. These included the individualistic nature of households' investments, the lack of representative community organizations through which to design and implement settlement-wide measures 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. Meanwhile, most of the institutions that supported social housing and housing-finance initiatives, such as local and international NGOs, and government agencies, did not consider risk reduction. Although their programmes usually supported safer houses, they took no actions to support insurance, or to enhance family or community capacity for recovery. Wamsler (2007) also highlights the need for initiatives to strengthen community capacity to work collectively, so household efforts can better contribute to community-wide risk reduction.

There is also the issue of what community organizations cannot address, however well organized and representative they are. Much of the needed protection in cities is for large-scale, expensive infrastructure that is part of city-wide systems – for instance storm and surface drains (and measures to keep them free of silt and solid waste) and all the components of an effective piped water system which includes getting the bulk water for distribution and its treatment. The scale and range of what community-based organizations can achieve in developing protective infrastructure is much increased where they can work in partnership with government agencies (see for instance Hasan 2006). Pelling (2003) shows successful partnerships between community actors, local NGOs, international donors and municipal government that have reduced vulnerability to flood and hurricane risk in Santo Domingo, the Dominican Republic. Partnership works best when low-income groups have representative organizations and where municipal agencies are responsive and accountable to local actors. Achieving this is one of the biggest challenges facing not just adaptation, but also progressive, pro-poor urban development more generally.

There are examples in many nations of low-income households getting safer, legal land sites for their housing, as a result of the active engagement of these households in organizations or federations of 'slum' or shack dwellers. For instance, a relocation programme in Mumbai in

response to transport rather than climate hazards (with tens of thousands of households living each side of the railway track) demonstrated methods for designing and implementing relocations (and choosing relocation sites) in which those who moved had far more control (Burra, Patel and Kerr 2003). The large-scale upgrading and secure-tenure programme of the Community Organizations Development Institute in Thailand has included city-wide strategies in which poorer groups were fully involved in finding safe sites when they had to move, although the priority was for upgrading in situ (Boonyabancha 2005). The city of Windhoek worked with the Namibian Homeless People's Federation to reduce minimum lot sizes and allow incremental development of infrastructure which made official legal housing plots with basic infrastructure affordable for a larger section of low-income households (Mitlin and Muller 2004). Other examples of organizations and federations of slum/shack dwellers successfully negotiating for legal land sites for housing include cases in South Africa (Bolnick 1996; Sisulu 2006), Malawi (Manda 2007) and Kenya (Weru 2004).

While these examples were not driven by climate-change adaptation, they demonstrate how relocation agreements were reached between very low-income households and governments, in a relocation methodology that involved poorer groups, thus avoiding many or all of the disadvantages and impoverishment that often accompanies such processes. When urban poor groups are engaged in the design and management of relocation, measures are taken to retain or strengthen the social networks of organizations involved in the allocation of plots and relocation. In the Mumbai case study, it was savings groups formed by those living along the railways that participated in the design and management of the relocation programme, both during and after the move (Burra, Patel and Kerr 2003). National federations of slum/shack dwellers are now active in 15 countries in seeking to work with local governments in improving housing, infrastructure and services, and this includes finding ways to get land at prices and locations that serve low-income groups. Such federations also have exchange programmes through which they learn from one another as well as from local governments that work with them.12 These are obviously important examples of representative organizations formed by the urban poor (in which women have central roles) that offer government agencies partnerships both in upgrading existing settlements and in developing new residential settlements. This also allows the incorporation of measures to reduce risks from floods and storms, whether by working together on moving to safer sites or by installing necessary infrastructure and supporting house improvements.

The relocation of existing houses and settlements away from areas which cannot be protected from floods and storms, coupled with land-use management strategies to prevent new settlements in such areas, is an important component of an asset-based strategy. But homeowners and renters alike will often resist relocation, because it can result in a decline in financial capital and social networks, as well as the loss of the physical asset itself, the housing. For poor urban households, housing is the first and most important asset they seek to acquire (see Moser and Felton 2007). Climate change will often decrease the availability of safe, residential sites as it increase the sites at risk of subsidence, mud-slides, wind-damage, flooding and (for coastal cities) sea-level rise.

There are some examples from Latin America of municipal governments taking the lead in developing safe, legal land sites that low-income households can afford (see Follageti 1998; Díaz Palacios and Miranda 2005 for the example of this in Ilo, Peru). Other municipal governments have worked with the inhabitants of settlements at high risk of landslides to relocate them and manage the high-risk sites through community management (see Velasquez 1998, for an example of this in Manizales, Colombia).

12 see www.sdinet.org; also d'Cruz and Satterthwaite (2005).

Insurance of homes and possessions is one of the main means by which middle- and upper-income groups protect their asset base from extreme weather events. But it is difficult to see this being effective and affordable for low-income groups living in poor-quality housing at high risk from such events or other impacts of climate change. Insurance premiums can be brought down only if risks are reduced but this depends on low-income groups being able to find good-quality housing in safe sites served by infrastructure and services. Any financial service for low-income groups, including micro-insurance or microcredit for businesses or house improvement can be effective only if risks are reduced, and repayments do not draw from needed consumption (see ProVention 2007).

7.2 Asset-based adaptation for pre-disaster damage limitation

Table 5: Asset-based framework for pre-disaster damage limitation

Asset-based actions	**Institutions/actors**
At household and neighbourhood level	
Social assets in place to facilitate the dissemination of early warning and knowledge of how to respond	CBOs, NGOs, coordination with state agencies for early warning and responses, including where needed identification of safe sites and routes to them
Households temporarily move away from high-risk sites or settlements	State provides transport to safe sites to those without access to private transport. Police and civil defence prepare to protect assets left behind after the disaster has passed (e.g. from looting)
Households prepare property to withstand event (protecting physical capital)	Households, CBOs, NGOs
Households protect or move productive assets	Households, CBOs
Community-based disaster-response and preparedness training including early-warning systems, safe sites and routes to them identified as preventative measure for human capital and family first aid	CBOs, NGOs
At municipal or city level	
Preparation of safe spaces with services to which people can move temporarily	Government, NGOs, CBOs. Oversight in early warning to ensure communication between state agencies and local focal points
Organizing corridors for mass evacuation	Police and civil defence clear main routes to enable fast evacuation and also to prepare for the distribution of relief aid
At regional and national level	
Flood management upstream	Private and state-owned flood-management infrastructure
Disaster early-warning system	State at national and regional level

Most urban centres in low- and middle-income countries at high risk from extreme weather events lack the capacity to invest in measures that provide complete protection. In such circumstances, well-conceived interventions taken in the period just prior to the extreme event can greatly reduce loss of life, serious injury and loss of possessions, while also having the potential to moderate damage to homes. As noted above, households and communities may have well-developed measures to cope with storms and flooding, based on past experience with these events and their timing, but in many locations climate change will alter the timing and often the intensity.

One of the foundations of pre-disaster damage limitation is an early warning system that not only identifies the risk but also communicates the information to all neighbourhoods at risk. This is not something that low-income communities can provide for themselves, but depends on government institutions. Many low-income countries do not have an adequate weather-monitoring system, although the importance of this is now more widely recognized. Awuor, Orindi and Adwerah (2008) describe the efforts of the Kenyan government, through the local administration and Kenya Meteorological Department, to gather climate information and send it to residents and businesses in the expected impact areas, especially strategic holiday and business areas. This includes a radio-based information system for vulnerable coastal communities that will monitor sea-level rises and help detect extreme events such as tsunamis, storm surges, coastal flooding and tropical cyclones

However, a warning system does not in itself necessarily generate the required response. For instance, in El Zanjon, Buenos Aires, a low-income community at risk of flooding, the lack of timely information hindered households from taking appropriate actions prior to the arrival of floods in 2004. After the floods, local inhabitants explained how they never knew when the floods were coming, despite the government having the information regarding precipitation, tides and water levels. A film made after the flooding was used to generate community awareness, and a community early-warning system was developed. A telephone line was installed to enable port authorities to call one household, with a system of whistles set up to alert neighbours (Simms and Reid 2006).

In Latin America, there are examples of government provision of early warning and support for immediate pre-disaster action that allowed individuals, households and communities to take appropriate action for damage limitation. Cuba, for instance, is well known for the speed and efficiency of its disaster preparation. In 2004, hundreds of thousands of people were evacuated as Hurricane Charley approached, and international press reports suggest that although over $1 billion worth of damage was caused, including 70,000 houses damaged, only four or five people died.13 Various measures have been taken in Central America, partly in response to the devastation caused by Hurricane Mitch in 1998 which affected over 1.2 million people. For instance, in Nicaragua, in 2000 the government created the Sistema Nacional para la prevención, mitigación y atención de desastres (SNPMAD) that integrates different government levels, social actors and municipal and regional committees for risk prevention and mitigation, with a clear focus on risk management.

The system aims to work with municipal committees at the local level, strengthening networks

13 See Reuters, August 27th, 2004 http://www.planetark.com/dailynewsstory.cfm/newsid/26793/newsDate/27-Aug-2004/story.htm; also Messina (2004).

and horizontal relations. A national fund has also been created to accompany the work.14 One key driver of these changes in Latin America is the redefinition of the causes of disasters, with extreme-weather disasters now identified as a failure of development, rather than simply as natural events, with associated policy shifts in avoidance and impact-reduction measures.15 Even though this redefinition was not actually climate-change driven, it has relevance for adaptation. This requires a change in focus from hazard-prone areas and associated engineering solutions, to improved identification and changes in the complex urban processes that increase risks.

7.3 Asset-based adaptation for immediate post-disaster response

After any disaster, two separate intervention points are the immediate response and then the longer-term follow up. The two are separated largely because responsibility for them is generally divided between different institutions, both within low- and middle-income countries and within international agencies.

14 See Zilbert Soto (2001).
15 See, for instance, the work of La Red in Latin America, and Peri-Peri and AURAN in Africa (Bull-Kamanga et al. 2003) and the work of Allan Lavell, Ben Wisner, Terry Cannon, and Mark Pelling (Lavell 1999 and Pelling 2003).

Table 6: Asset-adaptation framework for immediate post-disaster response

Asset-based actions	Institutions/actors
At household and neighbourhood level	
Reducing risks in affected areas (e.g. draining flooded areas, clearing roads); recovering assets	Government (mainly agencies responsible for disaster response), perhaps international agencies
Adopt cash-based social protection measures	Donors, NGOs
Help restore infrastructure and services	Utilities, disaster-response agencies
Support for households to restore livelihoods with gender- disaggregated analysis	Local governments? NGOs?
Planning and implementing repairs	Households, insurance companies, local contractors
At municipal or city level	
Rapid repairs to key infrastructure and services such as healthcare, safe water provision	Government and utilities
Human capital social protection of displaced especially for elderly and children	Government ministries of health/education/welfare, NGOs
Protection of physical capital to prevent looting and further erosion of assets	Police and security services
Support for community-action	Local government, NGOs
At regional and national level	Funding and institutional support for the above

One of the main influences on low-income groups' capacity to address their post-disaster needs is the effectiveness of their pre-disaster efforts to protect their assets. Savings and savings groups can help prevent post-disaster dependency and provide a basis for re-energizing the local economy. Support for such savings groups can be an important component of community-led post-disaster response. In rural development, microcredit and micro-insurance have become commonplace but both are rare in urban contexts. The NGO Development for Humane Action (DHA) combines microbanking with skills training and social networking to build social capital and generate business opportunities for poor women. In 2006 it worked in 5604 slum and village communities across six states in India, including those affected by the tsunami. This funding supported diversification away from fishing-based livelihoods and provided an economic boost even after disaster (Chakrabarti and Bhatt 2006).

The tsunami that struck several Asian-Pacific countries in 2004 provided important lessons about relative merits of an asset-based approach. Because of the sheer volume of money donated by governments and individuals, and the pressure on international NGOs to distribute funds quickly, direct cash transfers to individuals and families were used in preference to gifts of food or other commodities. People quickly used the cash to acquire assets they wanted and needed, which allowed them to rebuild their livelihoods faster than would have been possible using traditional methods of disaster relief. Agency personnel also reported that cash transfers appeared to enable

people to retain their dignity and take control of their lives and communities more quickly (Moser, Sparr and Pickett 2007).
An awareness of the assets and capabilities of women, men, youth and children affected by a disaster, and their importance in immediate post-disaster response, brings changing approaches. Maternal and child healthcare and nutritional supplementation are among the first supports set up in the immediate aftermath of disaster. To address the needs of human capital, health interventions beyond the availability of health services and provision for personal safety and environmental health in post-disaster situations is often very inadequate, especially for children and girls/women. Awareness of the heightened potential for injury is also critical after an extreme event, especially where children are concerned. A careful assessment of the post-disaster area can identify measures that result in the avoidance of cuts, falls, electric shocks and other injuries from unfamiliar hazards (Bartlett 2008).

Among the key guidelines for responses are the following.[16]

- People should have access to an ongoing, reliable flow of credible information on disaster and associated relief efforts.
- Keep the emergency response short, and shift to cash transfers and microfinance projects rather than direct supply of goods and services as soon as possible. Principles related to community involvement and integrating a gender analysis and women in all 'solutions' need to be operational immediately after disasters.
- Normal cultural and religious events should be maintained or re-established (including grieving rituals conducted by relevant religious practitioners, and people able to conduct funeral ceremonies).
- As soon as resources permit, children and adolescents should have access to formal or informal schooling and to normal recreational activities.
- Adults and adolescents should be able to participate in concrete, purposeful, common-interest activities, such as emergency relief activities.
- Isolated persons, such as separated or orphaned children, child combatants, widows and widowers, older people or others without their families, should have access to activities that facilitate inclusion in social networks.
- When necessary, a tracing service should be established to reunite people and families.
- Where people are displaced, shelter should be organized with the aim of keeping family members and communities together.
- The community should be consulted regarding decisions on where to locate religious places, schools, water points and sanitation facilities. The design of settlements for displaced people should include recreational and cultural space.
- Where ethnic or other excluded groups are affected by disaster, they should be included in all post-disaster responses.

Many of the problems experienced after disasters are related to how emergency and transitional assistance is delivered, with people frequently feeling that they have little or no control of their lives. Not only do survivors generally have no role in decisions that affect them, but also they often do not even know what decisions have been made. The resources, skills and social capital within local communities are often overlooked in the rush to assess risks and needs. An example of an alternative approach comes from an emergency camp in Thailand, set up by the Community Organizations Development Institute (CODI). From the day after the tsunami, when the camp was opened, residents were encouraged to organize themselves by alley, with each alley providing a

16 These are drawn from Batniji, van Ommeren and Saraceno (2006) and Sphere Project (2004), quoted in Bartlett 2008.

representative to a resident committee that served as the gatekeeper for all NGOs coming to provide services. Camp residents negotiated with them to determine how best to use the assistance available. Although residents waited many months for final relocation, the mood was very different from that of conventional 'post-disaster' settlements, and people had taken a constructive role in improving and maintaining the camp (Bartlett 2008).

Despite the rhetoric on the value of genuine involvement of adults or children affected in the aftermath of a disaster, this is surprisingly rare. In part this relates to the pressure on international agencies to accomplish a great deal in a short time, and the sense that involving people will undermine efficiency. But as the CODI example illustrates, efficiency can be enhanced when people are engaged in practical ways. However, participation is too often perceived by organizations as an additional project to burden staff in an already overwhelming situation, rather than a means of getting things done. When superficial consultation occurs it usually has more to do with donor requirements for participation, than with actually sharing control with the community, drawing on its knowledge and strengths. In defence of over-burdened organizations, it must also be acknowledged that facilitating and supporting truly constructive community engagement, especially with communities that may have little experience of joint decision making, can take skill and experience, as well as genuine commitment. In many cases, those working in the field in this setting, hired suddenly in the aftermath of disaster, may have little or no understanding, let alone experience, of this approach (ibid.).

Approaches that encourage active engagement, community control and rebuilding social capital in the aftermath of disaster have very significant implications for children. The Thailand example, described above, showed the differences for children not only in terms of their health and safety, but also in terms of the level of reassurance and stability provided by the presence of adults who were engaged and in charge. In the aftermath of disasters, an important response is to get schools and early childhood centres operating as soon as possible. The benefits of community-level supportive institutions for children have been well documented. Early childhood programmes, for instance, can help to reduce parental stress as well as providing young children with a safe, structured daily routine and valuable contact with other children (Williams, Hyder and Nicolai 2005). Schools provide the same routine, sanctuary and interest for older children (Nicolai and Triplehorn 2003).

7.4 Asset-based adaptation for rebuilding

Although the reconstruction process should be an opportunity to address both short- and longer-term development issues, it often just replaces old problems with new ones. There tends to be very little understanding of how reconstruction can be turned to better advantage to rebuild social as well as physical assets and thereby also contribute to poverty reduction. Table 7 outlines the key asset-based actions for rebuilding after a disaster. Obviously, one of the most pressing issues for many low-income households is whether they can get back their previous home or its site on which to rebuild – and this is often prevented by a lack of land title or by government decisions that prevent rebuilding in the affected areas.

Table 7: Asset-adaptation framework for rebuilding after a disaster

Asset-based actions	Institutions/actors
At household and neighbourhood level	
Displaced households seeking land rights and titles associated with political capital; rebuilding physical capital	Households and government agencies, NGOs
Building/rebuilding homes and physical capital undertaken with community involvement that also rebuilds trust and collaboration relating to social capital	Households, NGOs, CBOs, government
Households rebuild productive capital relating to income-generating activities	Relatives sending remittances Financial service institutions
Building/rebuilding houses and neighbourhood infrastructure such as transport links, and water and sanitation infrastructure	Households, CBOs and government
Securing provision of infrastructure to enhance wellbeing for affected and host populations where relocation has been necessary	Affected and host households, local government, NGOs
Recovering the household and local economy	Households, CBOs, NGOs, municipal and national governments
At municipal or city level	
Building/rebuilding infrastructure (to more resilient standards)	Government agencies working with CBOs, NGOs
Rebuilding of systems of safety and security in communities to ensure accumulation of assets	Police and security systems
Building/rebuilding livelihoods and productive capital	Government working with households
At regional or national level	
Rebuilding productive capital of region	Financial services and banks
Regional reconstruction of natural and physical capital – such as water systems	Contributions of state/provincial governments and national governments to this reconstruction

The tsunami experience also showed why solid gender analysis should be included in rebuilding. After the tsunami, many women joined self-help groups to obtain microcredit, which they used to boost their assets and increase their productive activities. This reliance on self-help groups was caused partly by the gender-blind nature of disaster relief that focused on men's lost fishing boats, not on the assets managed or controlled by women. Another tsunami lesson underscored the need to focus on rebuilding communal assets rather than individual ones. Often, individual reconstruction did not work well, while community-led development worked better. Some communities had enough power to throw out corrupt engineers or suspend them. The collective focus broke the 'beneficiary' mentality, with leaders emerging who took on public roles. This also showed how community-led reconstruction can reduce costs. Money is not wasted on unneeded infrastructure and outside professionals when the community itself has the skills to perform the necessary tasks (Moser et al. 2007).

The location of rebuilt settlements has obvious implications for livelihoods as well as for access to such amenities as schools, markets and health facilities. In Tamil Nadu after the tsunami, many large resettlement areas remained empty after they were completed, in part because there were too far from jobs and other supports, even though this meant people staying in hot, crowded, run-down emergency barracks. Genuine consultation in advance of such major decisions, and throughout the rebuilding process, far from being a factor that slows down the process, is the only approach likely to ensure its practicality and efficiency.

Housing in new settlements is often placed in a grid pattern on land that has been levelled and stripped of vegetation – an arrangement that is efficient for engineers, but that fails to make optimal use of space from a social perspective. It means, for one thing, that through-streets occupy most of the open space, with negative implications for social interaction and children's play and safety. Conversely, housing that is clustered to reflect and support social ties is more likely to result in local interaction (Bartlett 2008).

Recovering the household and local economy is also a cornerstone of progressive adaptation post-disaster. Without this, recovery and reconstruction can easily reproduce or even exaggerate the social inequality and asset poverty that led to disaster in the first place (UNDP 2004). Two core principles are required for pro-poor recovery.
Where possible promote local sourcing of materials and skills, to prevent monetary resources aimed at reconstruction from leaking, and rapidly leaving the local economy.
Use emergency response and reconstruction interventions as a vehicle for enhancing local skills and empowerment, by transferring decision-making power to survivors, or sharing it with them. This moves beyond the simple employment of survivors to provide income or reduce reconstruction costs.

The recovery of the local economy and local landownership are interdependent. Loss of rights over land and forced resettlement during reconstruction, often under the guise of 'adaptation' or 'risk reduction', serves to transfer land rights from the poor to the rich while at the same time dislocating survivors from the identity of place and informal safety nets offered by social support networks.

8 Institutional implications

Previous sections have emphasized the need for household- and community-based initiatives for adaptation to climate change, illustrated with a discussion of asset-based adaptation strategies for floods and storms. They also noted the critical interventions for climate-change adaptation that go beyond the scope, capability and financial budgets of households and communities, and discussed how the effectiveness of community-based and local-government-directed adaptation measures are often much enhanced if they work together. This section considers the potential role of local and national governments and international agencies in supporting household- and community-based adaptation.

8.1 Implications for urban government

Section 5 discussed the important roles that city and municipal governments should have in adaptation, and highlighted examples of the kinds of local governance reforms that allow this level of government to support household- and community-based adaptation. Section 6 included several examples of city governments that have worked closely with low-income groups and their organizations and federations in reducing environmental risks. Obviously, effective adaptation

strategies for urban areas depend on more competent, better-resourced, accountable urban governments that are willing and able to work with poorer groups (and other groups particularly at risk). This also raises questions about whether urban governments receive the needed support from national governments and international agencies – as discussed below.

At present climate-change models can predict likely changes only at a continental or regional level but not for particular localities,[17] so it is not possible to predict with precision the changes that global warming will bring for each urban centre. This makes it difficult to convince local governments of any need to take action (see Roberts 2008). However, a strong information base can be gathered on the past impact of extreme weather and other disasters and this helps to show who is most at risk from extreme-weather events whose frequency and/or intensity climate change is likely to increase. This needs to include as many 'disaster events' as possible – including those that do not get included in international disaster databases.[18] This can draw on the DesInventar methodology, developed in Latin America and now widely applied elsewhere. This encourages the collection of data on deaths, injuries and other impacts from 'small disasters' (for instance, events with one or two deaths or serious injuries, or even events in which there were no deaths or serious injuries but other serious impacts on particular neighbourhoods).

17 The city of Durban, unusual for having developed a detailed climate-change adaptation programme, is working with the Tyndall Centre to see how climate-change models can provide the level of detail needed about likely impacts at local level – see Roberts (2008).

18 The Centre for Research on the Epidemiology of Disasters (CRED), which holds the only publicly accessible global disaster database, defines disaster as "a situation or event, which overwhelms local capacity, necessitating a request to national or international level for external assistance". To be entered into the EM-DAT database, at least one of the following criteria has to be fulfilled: 10 or more people reported killed; 100 people reported affected; a call for international assistance; and/or declaration of a state of emergency (CRED EM-DAT; see http://www.em-dat.net/; see also International Federation of Red Cross and Red Crescent Societies 2002).

Table 8: Climate-related disasters typology, trends and impacts in Mombasa

Disaster type	When it was or is experienced	Established incidence rate or return period	Impact profile (who/ what was most affected and quantity/extent of damage)	Impact on assets	Remarks
El-Nino	1947, 1961 and 1997	Approximately 5 years	-Houses destroyed -Property lost -Livestock and crops lost -Human lives lost -Increased disease incidence (cholera, typhoid cases)	Physical capital eroded Productive assets eroded Human capital killed or eroded through ill health	Most affected areas are estates located near the ocean and lacking or with poor drainage structures or systems
Floods	Frequently (almost annually)	Unpredictable	-Houses destroyed -Property lost -Livestock (all types) lost -Human lives lost -Increased disease incidence (cholera, typhoid cases)	Physical capital eroded Productive assets eroded Human capital killed or eroded through ill health	Most affected areas are estates lacking or with poor drainage structures or systems
Tsunami	2006	Unpredictable	-Several fishing boats reported destroyed	Productive capital eroded	1 human life reported lost
Drought	2005/6	Every 4 or 5 years	-All agricultural activities affected -Women spend more time looking for water	Productive capital eroded Women's productive capital eroded	Time spent looking for water detracts from time available for other activities Droughts also cause famine

Source: Adapted from Awuor, Orindi and Adwera (2008); column on 'Impacts on assets' added by Moser

Table 8 illustrates this by summarizing recent disasters experienced in Mombasa, Kenya, and shows the erosion of multiple assets that predictably has included physical, productive and human capital. It also highlights the relationship between the collapse of physical capital associated with infrastructure, and its health impacts on human capital. During the flooding in Mombasa in 2006, the Ministry of Health issued a cholera alert, 94 suspected cases of cholera were reported, 13 cases were found to be positive and at least 2 deaths were reported. In addition, water sources got contaminated, several drainage systems collapsed, and water pipes washed away. The Kenya Red Cross estimated that some 60,000 people were affected by the floods on the coast, and a high proportion of these were in Mombasa, the coast's main population concentration (Awuor, Orindi and Adwera, 2008).

This analysis of the impacts of past extreme weather (and other disasters) can form the first step in understanding adaptation needs and in considering how to mainstream these into conventional

planning, infrastructure investment and other development programmes. This contributes to an information base on risks and vulnerabilities. To this should be added an information base on current provision for infrastructure and services to each building, and details of environmental hazards – which in turn allows a preliminary identification of those households and areas most at risk. This contributes to a much more detailed and location-specific information base on risk/vulnerability including risk-assessment maps at city and district level. Such assessments and maps detail what is located within hazardous zones, identify settlements, infrastructure, populations, or even gender- or age-differentiated groups, most at risk as well as activities that may be at high risk (such as water treatment plants unprotected against flooding). From this, choices can be made relating to investments and support programmes for households and communities in high-risk sites. There is also a considerable body of experience in community-based mapping of housing, infrastructure, services and site characteristics undertaken in informal settlements by urban poor organizations and federations (Hasan 2006; Weru 2004; Burra, Patel and Kerr 2003). These allow the risk/vulnerability assessments to cover the areas of the city for which where there are little or no official data, and which often include homes and neighbourhoods most at risk.

A pro-poor adaptation policy starts by identifying the measures to be introduced for protection for those identified as vulnerable. Reducing risk and increasing the resilience of physical capital that has already accumulated in cities can be done in three ways:
reducing hazards in sites already occupied through installing protective infrastructure and complementary risk-reduction measures (which may need modifications outside the area at risk – for instance watershed management upstream);
supporting better-quality buildings – for instance through technical support and appropriate finance systems (this may also require land tenure regularization);
assisting those who live in the most dangerous sites to move to safer sites, as well as taking measures to increase the supply and reduce the cost of land for housing on safe, serviced sites.

One key issue in this is whether capable, committed individuals are attracted to work in local governments – as civil servants and politicians. Although this is difficult to measure, in many South American countries there have been significant changes in this in the last two to three decades for a number of reasons:
a return to democratic governments and reforms that made local governments more democratic;
key institutional changes that gave more power and resources to urban governments while also increasing their accountability (see, for instance, Fernandez 2007 and Cabannes 2004 for Brazil., Velasquez 1998 for Colombia);
the concentration of population and new investment in urban areas (more than four-fifths of the region's population lives in urban areas);
the introduction of elected mayors, encouraging people from outside the long-established political systems to enter local politics, which in many instances brought mayors more committed to pro-poor agendas and social agendas (see for instance Campbell 2003; Cabannes 2004; Hordijk 2005; Fernandes 2007; Almansi 2009; Davila 2009).

This process has also been driven by national networks that have encouraged and supported inter-municipal learning – for instance through national associations of local authorities or of particular professionals (e.g. architects, sanitary engineers). Thirty years ago, it was difficult to find evidence of socially or environmentally progressive urban governments in Latin America; today this is not the case. Thus, one key issue for national governments and international agencies is to support those local, innovating governments, as well as designing initiatives to learn from them.

8.2 Implications for national government

The potential for urban (metropolitan, city, municipal) governments to be good 'climate-change adaptors' depends heavily on the extent to which higher government levels provide the legislative, financial and institutional basis to allow and encourage them to do so, while not overwhelming local governments with adaptation responsibilities that cannot be fulfilled. Also important are the conditions set for urban governments applying for funding from higher levels, such as requirements for local development plans to involve all key interest groups and incorporate risk and vulnerability assessments. National funds, on which innovative urban governments can draw, are important. These need to support locally developed responses that will vary depending on the range and relative importance of climate-change-related hazards in different urban centres.

Central government institutions generally have important roles in helping local governments to reduce disaster risk from climate change and to develop asset-based adaptation strategies. Countries that already have such strategies in place need to review these in light of the increased or new risks that climate change is likely to bring. For countries where extreme weather events are already causing disasters, there is need for a national fund that supports locally developed disaster-risk reduction but also supports rapid responses when disasters occur, as well as helping households, civil society and local governments in rebuilding processes.

Some obvious tasks and responsibilities for urban adaptation fall to higher government levels, such as weather information systems that support local assessments and early warning systems. A clear articulation of the planning and implementation roles, before and after extreme weather events, is also needed. This concerns local governments, higher government levels (including provincial/state and national), government agencies that have key roles in disaster response (such as the army and the police) and civil society organizations (including NGOs and grassroots organizations). Higher government levels also have responsibility to identify which urban areas need priority action, and the forms of external support required.

8.3 The role of international donors

The role of bilateral aid agencies and of multilateral development banks in supporting governments in the development of adaptive capacity within urban areas can be usefully identified in terms of three entry points. The first is an examination of funding flows to identify whether sectoral priorities are appropriate, with sufficient support allocated to urban infrastructure and services that enhance climate-resilience and appropriate disaster avoidance and response. The second is identification of the role of international donors in increasing national adaptive capacity for urban areas, such as supporting the development of national or state/provincial-level financial and regulatory capacity to assist urban governments developing adaptive capacity. The third is direct support to local adaptive capacity, working with city and municipal governments keen to innovate, committed to reducing risks to other climate-related hazards, and able and willing to work with lower-income groups. Here, the focus is on linking local asset-based adaptation with good local development and environmental governance, with support for local adaptive capacity not simply following national policies but helping to lead and inform such national policies (see Roberts 2008).

The bottom line for donors is the urgent need for a large increase in international funding and international agency competence to address the backlog in urban infrastructure, as part of climate-change adaptation. It is obvious that programmes to make infrastructure more resilient to climate

change cannot be implemented if there is no infrastructure to adjust. At the same time, increased adaptation funding flows will not achieve much unless local governments have the necessary capacity to use the resources appropriately, and to work with the groups most at risk. For the majority of low-income countries, and many middle-income ones, this may present more difficulties for official development assistance agencies than the actual funding itself. Such agencies are not set up to support the long-term local engagement necessary to ensure the development of local adaptive capacity – especially the local engagement that includes support for the asset-based adaptation frameworks so important for low-income groups and their own organizations.

Development assistance agencies therefore need to recognize the importance of long-term commitment to national (and provincial) systems that builds adaptive capacity by local governments. This assumes that budgets associated with disaster response and reconstruction include works that strengthen long-term local capital assets. This may require restructuring loan or grant conditions that are often constrained by tight spending deadlines, making participatory approaches difficult to achieve. Disaster reconstruction budgets are often funded by moving funds from development pools, which links reconstruction funds more closely to developmental outcomes. Certainly for most low- and middle-income countries, building resilience to climate change requires substantial increases in funding for 'risk-reducing' infrastructure, as well as support for the needed (national and local) governance processes to ensure it is used well.

To date, development assistance has failed to support cities that have already faced serious climate-related disasters by investing in the infrastructure and services necessary to reduce future risks. The most appropriate funding channel may be a substantial municipal infrastructure fund within nations on which local governments and civil society groups can draw. To make this fund only for 'adaptation to climate change' would be a mistake: in part because it is not possible to specify how much climate change is contributing to, for instance, extreme weather events; and in part because of the very large deficiencies in protection against other environmental hazards. But a climate-change adaptation lens should be applied to ensure that all infrastructure and other urban development funding takes account of climate change. Such a fund should also be proactive in helping to identify cities or smaller urban centres most at risk and in helping to develop appropriate local responses. The extent to which this type of financial support for 'local development plus adaptation' requires external funding, and the terms under which this should be provided, will obviously vary a lot. As Table 2 emphasized, what is possible and what should be prioritized in any country depends on the competence, capacity and accountability of local governments.

An important part of building local adaptive capacity is supporting adaptation that serves low-income groups. Here there are good 'slum and squatter upgrading' experiences on which to draw, in which, as described above, local governments worked with informal settlements' inhabitants to provide infrastructure and services and improve housing quality. Equally useful are the many examples of new housing developments undertaken by federations formed by 'slum' or 'shack' dwellers themselves. Often these have proved to be more effective and less costly than those supported by international agencies. And, where government support has been received, they have demonstrated considerable capacity to 'go to scale' (as in India, South Africa, Thailand and Malawi). Some bilateral agencies have developed ways to support both the grassroots-led initiatives and the local government support for them, including DFID and Sida; so too have some international foundations (Mitlin and Satterthwaite 2007). Thus assistance for adaptation to climate change needs to think through the financial systems and mechanisms that will allow support for a multiplicity of city or municipal innovations by local governments, and by households and community organizations, that reinforces and works with 'good local

development' and 'good local governance'.

New international funding sources for adaptation are being developed, over and above what development assistance agencies are doing – especially through the United Nations Framework Convention on Climate Change. But at present, the scale of funding available falls far short of what is needed, and what little has been supported gives very little attention to urban areas (Satterthwaite, Huq, Pelling et al. 2007; Ayers 2009). There has been some support for the least developed nations to develop National Adaptation Programmes of Action (NAPAs) and for community-based adaptation but, again, little attention has been given to urban areas. In addition, such a focus leaves out the key role of local government (although some community-based adaptation has involved local governments). Local Adaptation Programmes of Action (LAPAs) and City Adaptation Programmes of Action (CAPAs) are needed to underpin and drive innovations in NAPAs (Satterthwaite, Huq, Pelling et al. 2007). It is also important to stress that, in almost all instances, there must be 'development plus adaptation'. Even competent and accountable national and local (city and municipal) governments will not engage with adaptation to climate change unless this is seen as supporting and enhancing the achievement of development goals.

In addition, many international donors are concerned to see how urban adaptation can also contribute to reducing greenhouse-gas emissions (mitigation), and here there are some complementarities between the two. But care needs to be taken, especially in assuming that measures to reduce greenhouse-gas emissions necessarily serve adaptation or development. Because mitigation in high-income countries focuses so strongly on increasing energy efficiency and reducing use of fossil fuels, there is an assumption that the measures used to achieve this should be transferred to low- and middle-income countries, even when those countries have just 1 or 2 per cent of the carbon emissions per person of those in high-income countries. In most urban centres in low- and middle-income countries, asset-based adaptation priorities of the poor need to focus on the expansion and improvement of protective infrastructure and services, not on energy efficiency. At the same time, is important for large infrastructure or relocation projects, and in-situ disaster reconstruction, to make contributions to mitigation through material recycling, careful resource sourcing and integrated transport planning to minimize carbon costs in construction and use.

Finally, there is also a critical need to draw on the 'disaster-preparedness' community of scholars and activists who have transformed our understanding of what causes disasters and the extent to which 'natural' disasters are preventable. It is surprising that to date they have not had a more central role in asset-based adaptation, given how much they can contribute to understanding the possibilities and constraints of adaptation that reduces risks from disasters and allows for progressive reconstruction.

Conclusion: The linkages between social development and climate change and cities

This paper identifies the ways in which climate-change adaptation provides the rationale for far stronger linkages between social development and the urban sector. It shows how climate-change adaptation will affect 'traditional' urban physical infrastructure concerns such as housing, water, sanitation, roads and drainage. At the same time it identifies the crucial roles and responsibilities that individuals, households and communities adopt in their own adaptation processes, independent of government. Supporting such communities, and their contestation and collaboration with local institutions such as municipal governments, will be essential if climate-

change adaptation is to move beyond its identification as a ‘technical’ domain, towards recognition of the essential importance of its social dimensions. An asset-adaptation framework, which assists in mapping asset vulnerability, as well as identifying interventions to strengthen, protect and rebuild the assets and capabilities of local households and communities, is an important operational tool for ensuring that the social consequences of climate change are recognized and addressed.

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